Understanding your sports annual health report

Guidebook

Version 1.0

October 2021

AIS

Understanding the numbers in your annual health report

This summary of key messages is based on the guidebook "Understanding your sports Annual Health Report" and the definitions and use of the injury record within the Athlete Management System: Data Dictionary Version 2.1. Together, these resources intend to support the data entry and data reports produced from the Athlete Management System.

Entering and checking data in the AMS

DATE & STATUS
- Date of injury occurence
- Injury status accurate (no training, modified training, full training)
- Treatment status accurate (open or closed)
- Date of injury closure

TIME LOSS
- The number of time loss days (no training + modified training) is recorded
- The total number of days spent injured is recorded

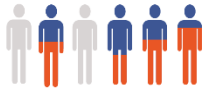
DIAGNOSIS
- The diagnosis under the injury section (body chart) is accurate and up to date
- Side of injury entered is accurate (left, right, central)

INJURY RECORD
- Each record has data for one body site only, different site = different record
- There are no duplicate records, one injury = one record

Reviewing data reports from the AMS

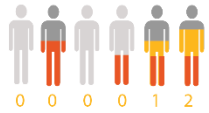
TOTAL NUMBER OF ATHLETES (POPULATION)
population = 6

NUMBER OF INJURED ATHLETES
injured athletes = 4
period prevalence for all injury = 66.7%



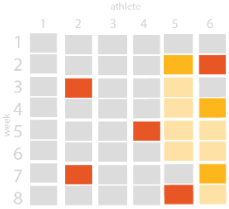
TOTAL NUMBER OF INJURIES
number of injuries = 8

0 2 0 1 2 3



SPORTS INCAPACITY (TIME LOSS INJURY)
sports incapacity injury = 3
period prevalence for sports incapacity injury = 33.3%

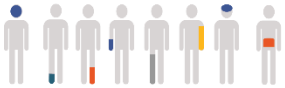
0 0 0 0 1 2



TIME LOSS
total weeks = 8 per player, 8 weeks x 7 days = 56 athlete days each
56 athlete days x 6 athletes = 336 athlete days potential exposure
10 weeks (70 days) missed (sports incapacity) = 266 athlete days

INJURY INCIDENCE RATE

$\frac{8}{266} \times 1.1.0$ injuries per 365 athlete-days



INJURY DIAGNOSIS
Check the injured body region and body site, as well as the injury nature. A broad and specific diagnosis is provided.

Broad = shoulder joint sprain; Specific = Anteroinferior shoulder subluxation

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Welcome

As high-performance staff your role is to maximise the performance health, training and competition availability, and ultimately contribute to the performance of athletes. Understanding factors that contribute to suboptimal health, decreased availability and impaired performance enable you to design proactive strategies that best address problems when they arise. Determining what factors impact athlete availability rates (positively or negatively) can often be found within the data of the Athlete Management System (AMS). An annual report of population injury data can be provided to you through the automated injury reporting system, or you may generate one yourself. The interpretation of this data is best led by you and your team as no one knows the athletes, their training, and competitions, as well as you.

This guidebook is designed to help you through the interpretation of the data in your annual health report. We provide several examples of red flags to look out for and how to identify features in your data. We have also included a checklist of items that should be reviewed before you make conclusions from your data or report. This final step of reviewing is important to ensure your conclusions are accurate and relevant and so that subsequent decisions are of most value to your athletes and team. Blank spaces have been included throughout the document to provide space for you to make notes that make sense for you and your sport.

This document is intended for use by professionals, including but not limited to physiotherapists, medical doctors, dieticians, psychologists, sports scientists, and strength and conditioning coaches. It may also be used to assist other members in your high-performance team to understand the data and reports you provide to them.

The information described here is designed to complement data reports produced from the AMS and should be read in conjunction with *The definitions and use of the injury record within the Athlete Management System: Data Dictionary Version 2.1*, which provides details and rationale for the definitions adopted for injury in Australian sport. It is highly recommended that you are familiar with the AMS Data Dictionary prior to reading this guidebook as the detail contained within it will be assumed knowledge.

Need more help? Please reach out to the team by email: ams@ausport.gov.au.

The definitions and use of the injury record within the Athlete Management System: Data Dictionary Version 2.1, can be accessed by clicking on the link below or via the AIS website:

https://www.ais.gov.au/__data/assets/pdf_file/0004/756148/The-defintions-and-use-of-the-AMS-injury-record_Data-dictionary_Approved-final-version.pdf

Summary

The first table in your report presents the main summary data in one place, including different measures of how many athletes were injured in the period investigated. These tables are most useful to compare overall team/squad health over regular time periods, i.e., comparing year-to-year. Where there is a difference in information between reports that you think is clinically relevant, this should be looked at in more detail. **The information presented in this table is explained in detail through the guidebook.**

Table 1. Overview of summary statistics

Measure reported	2019	95% confidence interval	refer to page
Athletes (population)	209	-	*page 7*
Medical Attention Injury Period Prevalence (%)	74.2	68.3 to 80.1	*page 15*
Time Loss Injury Period Prevalence (%)	55.6	48.8 to 62.2	*page 16*
Incidence Rate (per 365 days)	2.1	1.9 to 2.3	*page 18*
Burden Rate (per 365 days)	43.7	39.8 to 48.0	*page 26*
Median Athlete Availability (%)	98.1	96.2 to 100.0	*page 28*
Team (Whole Squad) Availability (%)	78.9	73.4 to 84.4	*page 26*
Total Medical Attention Injuries	434	-	*page 7*
Total Exacerabtions	15	-	*page 7*
Total Time Loss Injuries	213	-	*page 7*
New Injury Time Loss (days)	16912	-	*page 25*
Pre-Existing Injury Time Loss (days)	13085	-	*page 25*

Injury definitions and frequency statistics

Population

The population is defined as all athletes that are in the team or scholarship program for that season. Table 1 shows there are 209 athletes in the population. For the examples in the following pages, there will be 10 athletes in the population, representing a mixed indoor soccer team.

Figure 1. Example of population (athletes)

POPULATION = 10 ATHLETES

Injury

It is important to define 'injury' as this will be what you are aiming to quantify in the report. There are a few definitions of sports injury, each with its own use, benefits, and limitations. Below are the definitions published by the IOC and adopted by the Australian HP system who use the AMS. Refer to Figure 2 for an illustrative example.

Athlete self-report injury

"A sensation of pain, discomfort, or loss of functioning associated, by an athlete, related to exposure to sports training or competition having an intensity and quality that leads to the sensation being interpreted by the athlete as discordant with normal body functioning."

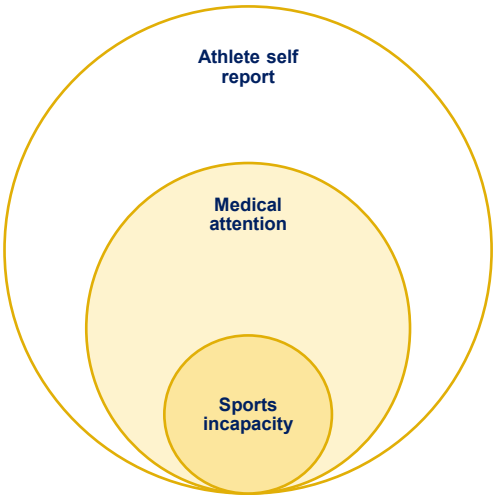
Medical attention injury

"Tissue damage or other derangement of normal physical function due to participation in sports, resulting from rapid or repetitive transfer of kinetic energy that results in an athlete receiving medical attention."

Sports-incapacity (time-loss) injury

"Tissue damage or other derangement of normal physical function due to participation in sports, resulting from rapid or repetitive transfer of kinetic energy that results in an athlete being unable to complete the current or future training session or competition."

Figure 2. **Illustrative example of injury definitions**



Your annual report focuses on injuries defined within the shaded circles:

- medical attention
- sport incapacity

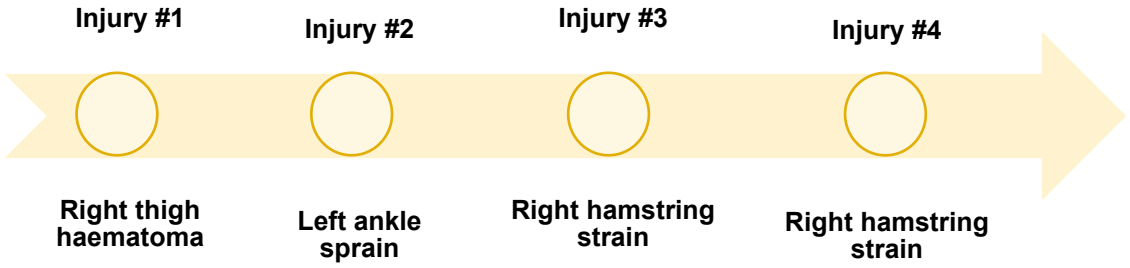
Subsequent injury

"An injury that occurs following the occurrence of a previous (index) injury, irrespective of the type of injury."

Recurrent injury

"An injury that occurs after an index injury that is of the same type and to the same body site, following a player's return to full participation from the index injury."

Figure 3. **Illustrative example of subsequent/recurrent injury definitions**



Injury #1 is an index injury. Injuries #2, #3 and #4 are all SUBSEQUENT to injury #1

Injury #2 is SUBSEQUENT to injury #1,

Injury #3 is SUBSEQUENT to injury #1 and injury #2

Injury #4 is SUBSEQUENT to injuries #1, #2 and #3

Injury #4 is also a RECURRENT injury - same site and type as injury #3.

Exacerbation

"The worsening of a current/active injury whereby the injury status transitions from being in full training and competition to either the modified training/compteition or no training/competition status. This relates to the same site, same nature, same side, and same structure as the initial injury occurrence."

Injury distribution

Frequency statistics may seem basic, but they are crucial to understanding the impact of injury in your squad/sport.

Consider the team of ten indoor soccer athletes. In their sport season, the team records a total of 13 injuries. Although unlikely, it is possible that nine athletes are injury free, and one athlete has sustained all 13 injuries. You would manage the one injury-prone player differently than you would a team with one or two injuries per athlete.

An injury distribution table (Table 2) provides a useful overview of how many athletes sustain different numbers of injuries.

Table 2 should be checked for:

- First data row: how many athletes are injury free (0 injuries)
- Second data row: how many athletes had 1 injury
- Third row: how many athletes sustained multiple (2 or more) injuries

Table 2. Injury distribution summary

Number of injuries	Number of athletes	Proportion of athletes
0 injuries	3 athletes	30%
1 injury	3 athletes	30%
≥2 injuries	4 athletes	40%
Total injuries	**13 injuries**	-
Total athletes	**10 athletes**	-

NOTE

3 athletes did not get injured

3 athletes had one injury

4 athletes sustained multiple injuries

(in this case 2 athletes had 2 injuries each and 2 athletes had 3 injuries each)

Describing distributions

REFRESHER - WHAT DO ALL OF THESE MEASURES MEAN?

Below is a quick reminder of measures to describe distribution.

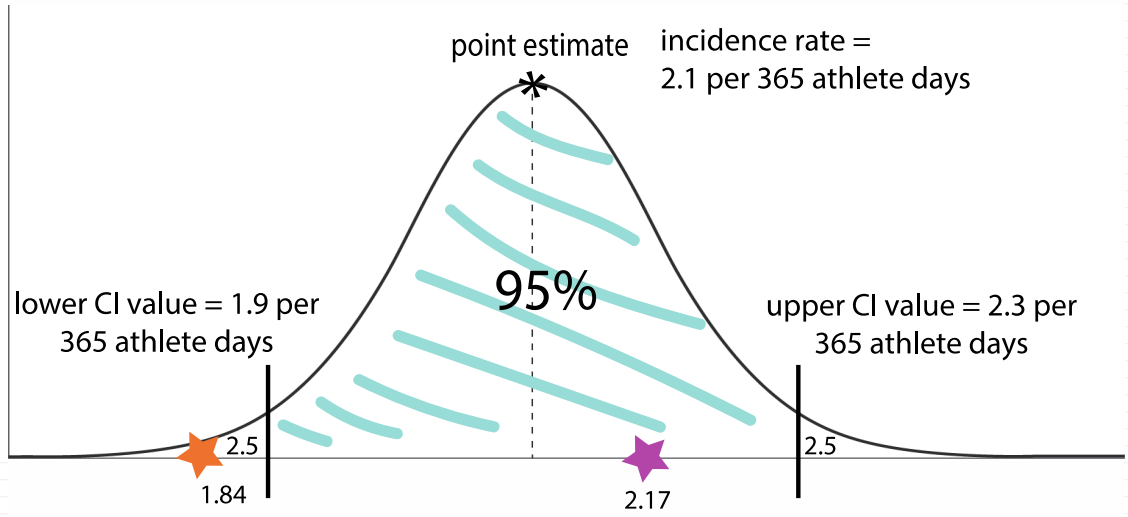
Mean is an average. As an example, the mean for injuries is calculated as the sum of all injuries in the data set and dividing by the number of athletes.

Median is the middle value. This value is obtained by putting all the values in order (e.g. the number of injuries per athlete) and finding the middle result.

Mode is the number that occurs most often in a data set. For example, zero injuries can often be the value that is most common for athletes, in this case the mode would be zero.

Confidence interval (CI) represents the range for which an estimate (the finding or result) is most likely to actually fall. The confidence interval considers that you are working with a sample that will have variance from the actual population.

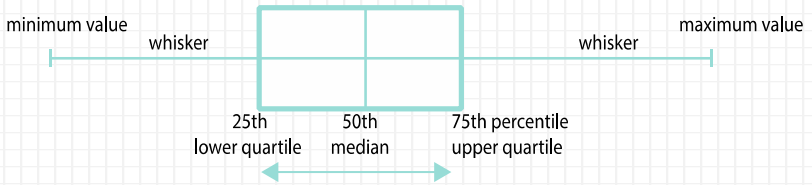
The sketch below shows the point estimate (in this case injury incidence rate) of 2.1 per 365 athlete days, with confidence interval of 1.9 – 2.3 (assuming a normal distribution with 95% confidence interval).

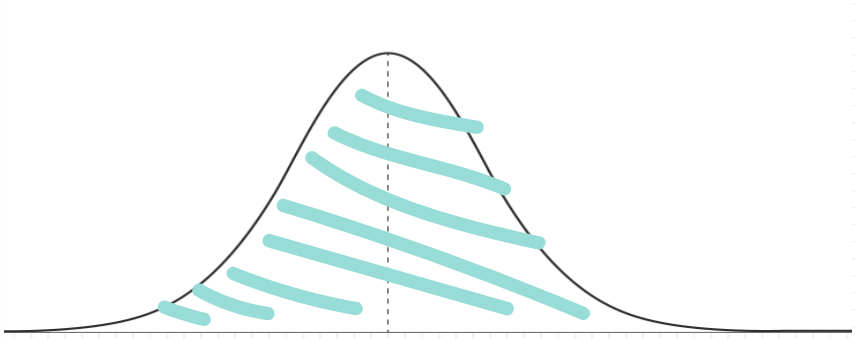


A simple interpretation is to look if your estimate lies within the 95% confidence interval from the previous reporting period. Refer to the purple star indicating 2.17 injuries per 365 athlete days. In this case, you can be comfortable that the finding is consistent with previous years. However, if your estimate is outside of the 95% confidence interval of the previous report, as indicated by the orange star at 1.84 injuries per 365 athlete days, this would be an indication that something might be different from before and warrants a detailed review.

Data are spread out in different patterns. A familiar pattern is the normal distribution (shape below = bell shaped curve). In this distribution, data are symmetrically spaced around a central value. The median number of injuries is equal to the mean number of injuries and the mode.

Interquartile range is a measure that shows the spread (dispersion) of the middle 50% of values in the sample, with the median as the central value.



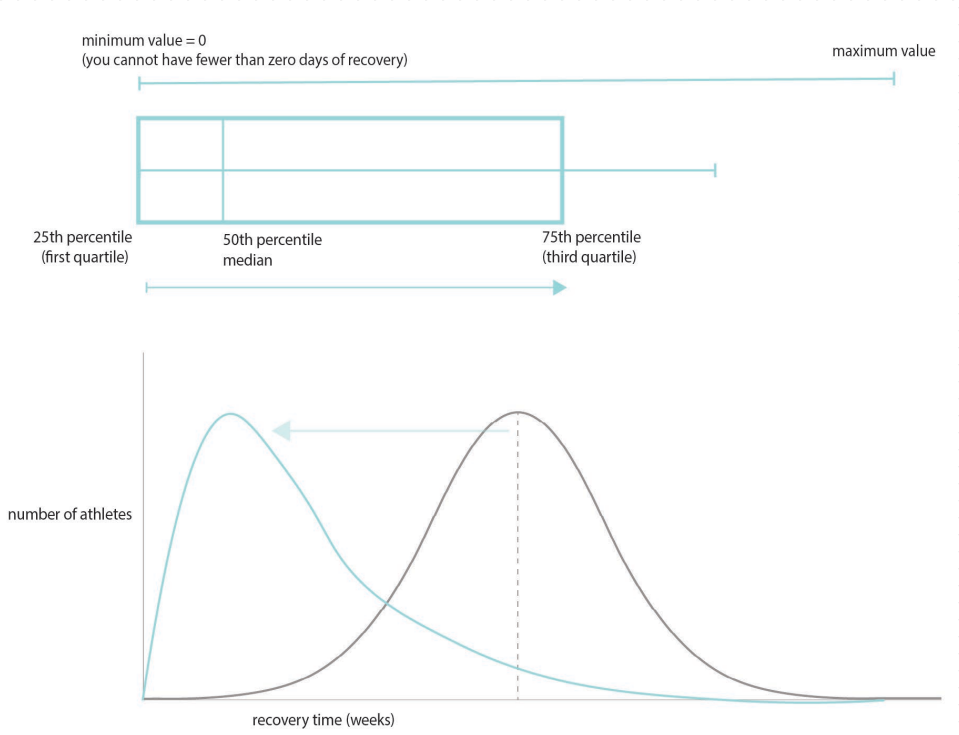


Often, when looking at sports injury data the distribution will not be normal (bell curve shape) because there will be many athletes with 0 injuries, and only a few athletes with a relative high number of injuries. This distribution is described as positively skewed (or skewed to the right). In this case, the mode will be zero (representing many athletes with 0 injuries) and the median will be less than the mean.

The sketch below presents an example to think about skewed distribution. The blue curve represents time to injury recovery. Many injuries will take just a few days to resolve (i.e. 0-7 days), some athletes will take longer (8-28 days), and a few outliers on the right hand tail will take many months. The median will be somewhere in the 0-28 days. The mode will be less than 28 days. The mean can be much larger, if there are a few athletes with a long time for recovery, as they increase the average time.

Over different seasons, the shape of this curve can change - the peak will move across to the right if there is an increase in more severe (more days of recovery) injuries.

While the number of athletes with these outlying high counts of injuries is small, they are important to be aware of because the overall mean value will increase. This is one reason why you will notice that many of the summary statistics in your annual injury report use the median and interquartile ranges rather than mean values.



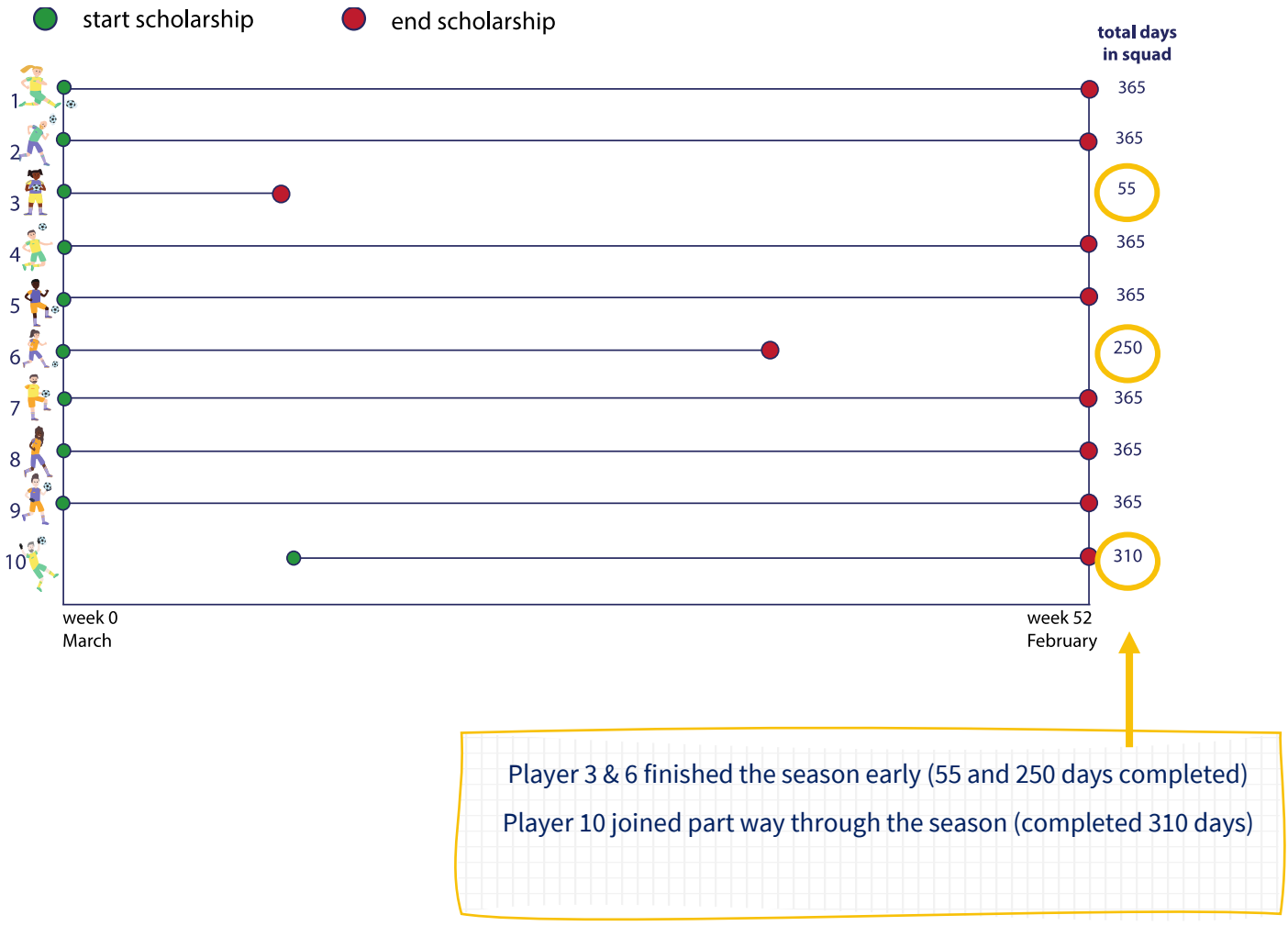
Measures of injury quantification

Exposure (time at risk)

When reporting injury rates, we need to understand 'exposure' as this will form the basis for calculating the injury incidence rate. Exposure is a way to measure the amount of time an athlete is considered 'at risk' and is imperative when comparing across seasons, between squads and/or sports. In simple terms, exposure represents the number of days that an athlete is in your squad or on scholarship. For most players, this will be 365 days or the length of the scholarship period. Players who are removed from scholarship (e.g. retire) or join the squad during the year will have fewer days.

The total time for each athlete is summed [*(365 x 7 athletes) + 55 + 250 + 310 = 3170*] and reported as 'athlete-days.' In the example below (Figure 4), we have 3170 athlete-days.

Figure 4. **Illustrative example of exposure for a fictional population of 10 athletes**



Prevalence

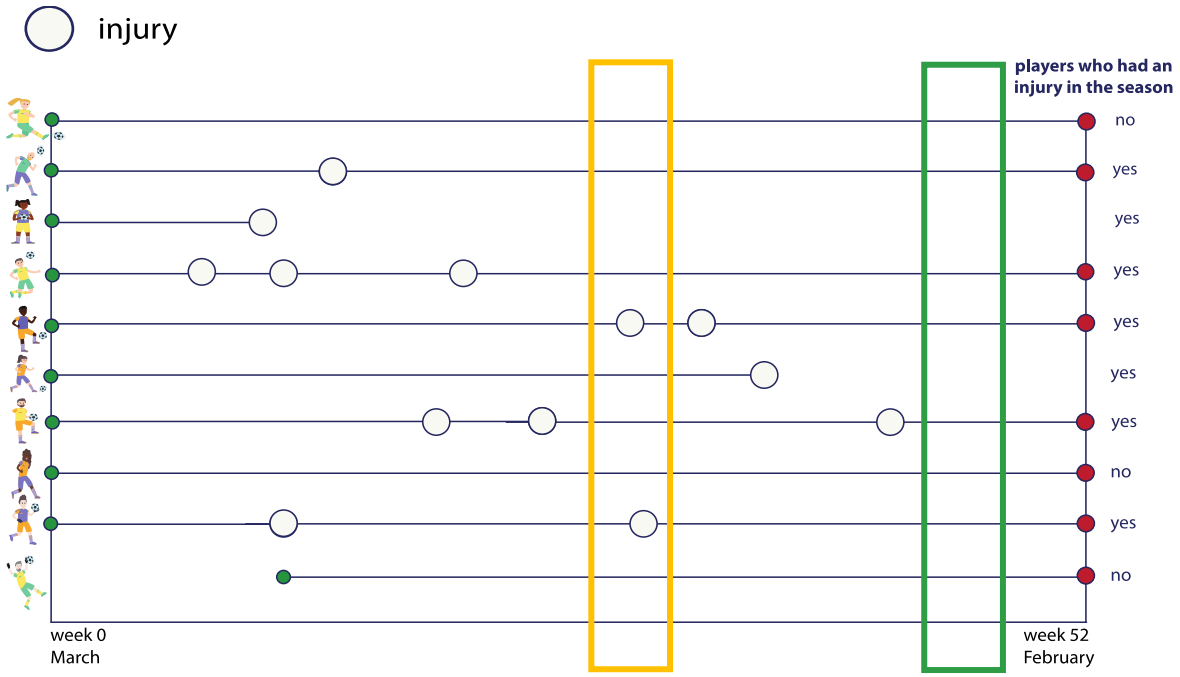
Prevalence is a measure of the proportion of the population that have a condition within a given time period. The time periods may be on a specified date (point prevalence), within a short period (period prevalence) or even across their whole life (lifetime prevalence). Below we share how these can be measured in sport.

Point prevalence

Point prevalence = number of athletes available for competition / the total number of athletes with a scholarship.

Imagine there is an upcoming competition, and you need to know how many athletes are available for selection. We can work this out by determining the total number of athletes on scholarship and then finding out how many are healthy (or available) on competition day. With this information, we can now work out point prevalence for the competition week (Figure 5).

Figure 5. Illustrative example of injury point prevalence for a fictional team of 10 athletes



In the week indicated by the yellow box, 2 players are unavailable. Point prevalence for unavailable is 2/9 = 22%

In the week indicated by the green box, all players are available. Point prevalence for unavailable = 0/8 = 0%

The point prevalence only considers the number of athletes who are currently included in the population on the given date of interest.

Period prevalence

The period prevalence represents the proportion of your population that sustained an injury at any stage during a defined period of time (e.g. the entire season or pre-season). Figure 6 shows that there were seven players *(number of players with a white circle)* that experienced at least one injury, resulting in an injury period prevalence of 70%.

You can compute period prevalence from the data in Table 2, which shows that seven of the ten players had an injury.

The period prevalence is also useful to report specific types of injury, for example, injury with a sports incapacity definition (demonstrated in Figure 7).

Figure 6. Illustrative example of period prevalence for all injury

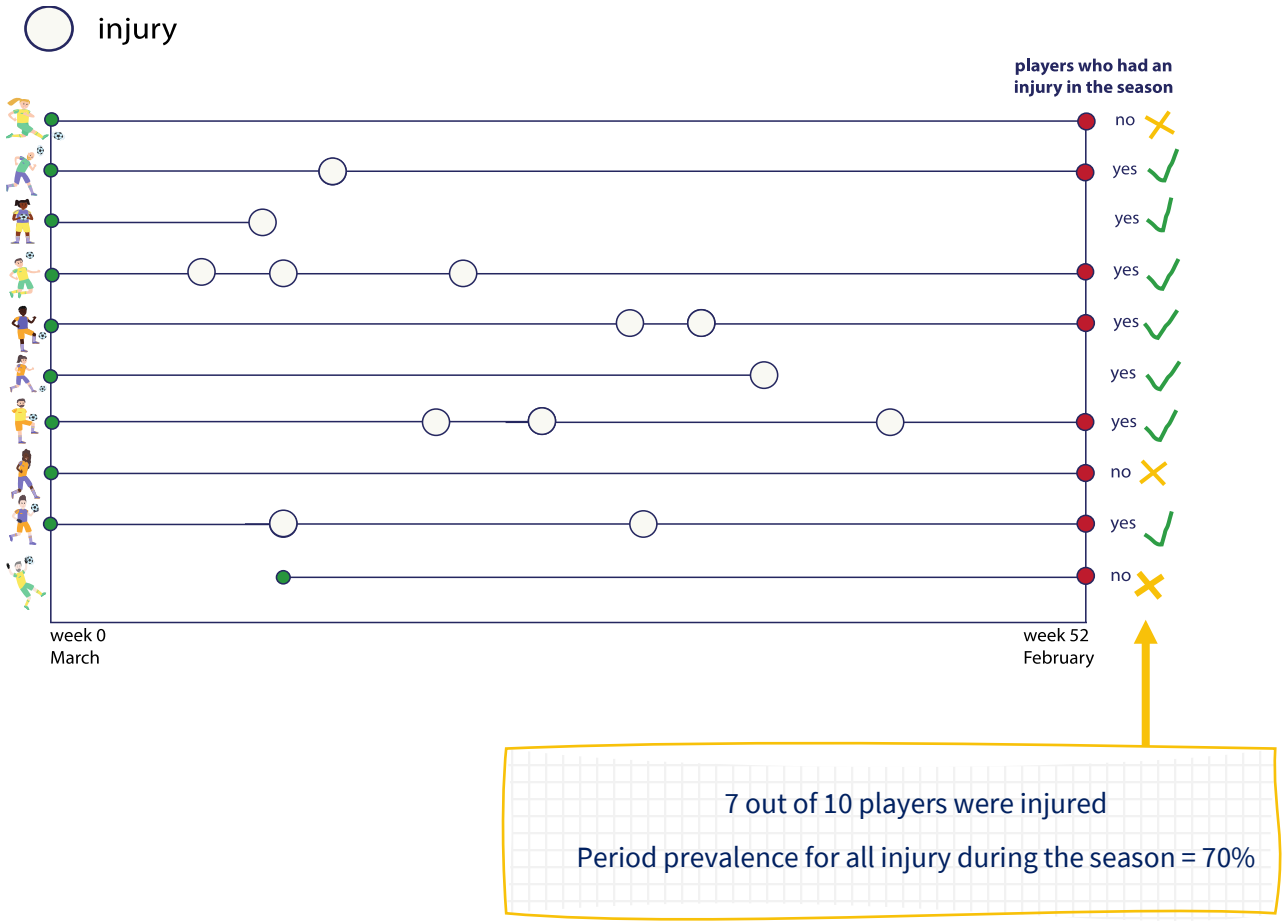
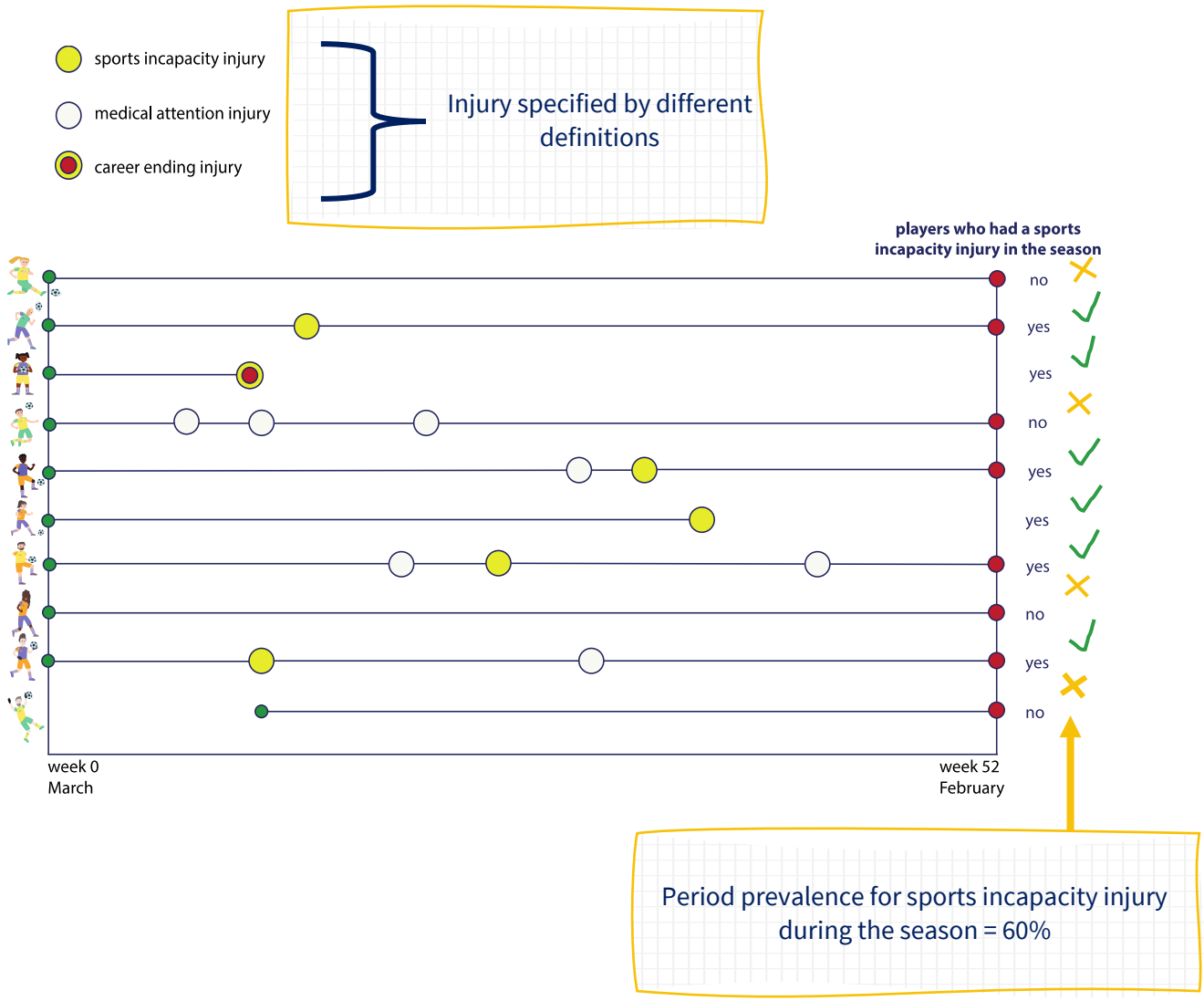


Figure 7. Illustrative example of period prevalence for sports incapacity (time loss) injury

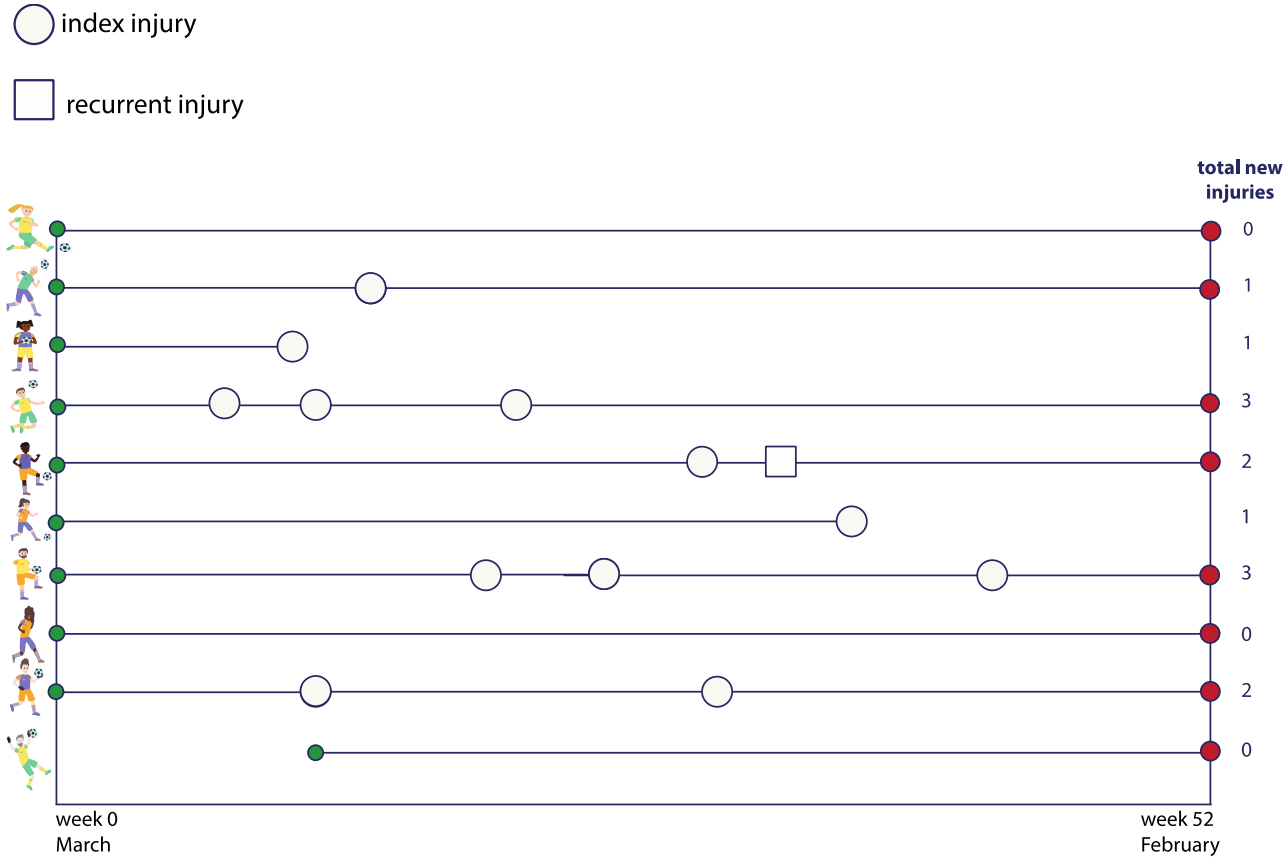


Injury incidence (new injuries)

Injury incidence is the total number of all new injuries that occur during the season – this is simply a count of each injury independent of who gets injured. In the example (Figure 8), injuries are represented by white circles. The injury represented by a square is a recurrent injury.

There are 13 shapes (circles + squares), which means there were 13 new injuries.

Figure 8. Illustrative example of new injuries sustained over one season



0 + 1 + 1 + 3 + 2 + 1 + 3 + 0 + 2 + 0

= 13 injuries

Injury incidence rate

The injury incidence rate considers the frequency at which new injuries occur. An injury incidence rate requires a numerator for the number of new injuries (in our example, new injuries = 13) and a denominator for the exposure time (from our previous example, we have 3170 athlete-days).

Equation 1

The injury incidence rate is calculated as

$$injury\ incidence\ rate = \frac{new\ injuries}{days\ at\ risk} \times 365 = \frac{13}{3170} \times 365 = 1.5$$

There are 1.5 new injuries every 365 athlete-days.

Therefore, for every 365 athlete-days (or each athlete-year in scholarship), 1.5 injuries occurred. This means, in a team with 10 players, you can expect 15 injuries in the season.

Equation 2

The injury incidence rate is *higher* if there are more injuries during the same period of exposure. For example, if there had been 63 injuries sustained by our population, the rate would be:

$$injury\ incidence\ rate = \frac{63}{3170} \times 365 = 7.3$$

In this second example, there are 7.3 new injuries every 365 athlete-days.

Equation 3

The injury incidence rate is *lower* if there are the same number of injuries, but sustained over a longer time period (e.g. either more players or a longer season). For example, if there had been 63 injuries sustained by our population, but our population had 15 players for 365 days (total of 5475 athlete-days), the rate would be:

$$injury\ incidence\ rate = \frac{63}{5475} \times 365 = 4.2$$

In this third example, there are 4.2 new injuries every 365 athlete-days. As above, for every 365 athlete-days, our team of 15 players can expect 63 injuries for the year.

Equation 4

Injury incidence rate can also be presented per 1000 athlete-hours (as an alternative to athlete-days). The exposure hours are estimated in the annual report as 1.5 hours* x 365 days x 209 athletes = 114428 hours. The time estimate of 1.5 hours per day can of course be adjusted by sport (sports that have clear records of training and match times might use an exact measure of time through detailed records of participation).

For our indoor soccer example, the injury incidence rate per 1000 hours is calculated as:

hours at risk = [(1.5 x 365 x 7 athletes = 3832.5) + (1.5 x 55 x 1 athlete) + (1.5 x 250 x 1) + (1.5 x 310 x 1) = 4755]

$$injury\ incidence\ rate = \frac{new\ injuries}{hours\ at\ risk} \times 1000 = \frac{13}{4755} \times 1000 = 2.7$$

The result for the final example is 2.7 injuries per 1000-athlete hours.

**Note: 1.5 hours is an estimate used for this example*

NOTES ON INJURY INCIDENCE RATE

- A higher injury incidence rate indicates injuries occurring more often, for example: 2.5 or 3.0 injuries per 365 athlete-days.
- Injury incidence rate is a useful measure to compare injuries across seasons because it accounts for the number of players and time at risk. This is particularly important if team numbers change seasonally.
- It is important not to confuse injury incidence rate with the frequency (count) of injuries. When referring to the frequency of injuries you should avoid the phrase “the incidence of injuries was 13”. Instead, you can simply say “the number of new injuries was 13” or “the total number of injuries was 13”.
- Injury incidence includes only new injuries (not injuries that were sustained in the previous recording period that may have carried over into the current season).

Take away messages – prevalence and incidence

Your annual report will include the information in Table 3. These measures have all been presented to this point - total athletes (Figure 1), new injury count (Figure 7), total exposure days (Figure 4) and total exposure hours (Equation 4) and injury incidence rate (Equation 1).

You now also have the basic knowledge needed to interpret and understand the first rows of ***Table 1 – summary statistics*** in your annual health report (refer to Table 4 for examples of what you could say/write).

Table 3. Annual injury incidence rate

Year	2019
Total athletes	209
New injury count	434
Total exposure (days)	76285
Incidence rate (per 365 athlete days)	2.1 per 365 athlete-days
Total exposure (hours) (1.5 hours per athlete-day)	114428
Injury incidence rate (per 1000 hours)	3.8 injuries per 1000 athlete-hours

Table 4. Interpretation of first rows of summary statistics (updated from Table 1)

Summary Statistic	2019	95% CI	*Example commentary*
Athletes (population)	209	-	*There were 209 athletes in the squad throughout the year.*
Medical Attention Injury Period Prevalence (%)	74.2	68.3 to 80.1	*Almost three quarters of athletes sustained at least one injury through the year.*
Time Loss Injury Period Prevalence (%)	55.6	48.8 to 62.2	*More than half (56%) of athletes sustained an injury that resulted in time loss through the year.*
Incidence Rate (per 365 athlete-days)	2.1	1.9 to 2.3	*There were 2.1 injuries sustained every 365 athlete-days.*

Player availability and burden of injury

In every team situation, some players leave the squad, some players retire, and of course, some players will be unavailable due to a health problem (e.g. sports incapacity (time loss) injury). Figure 4 showed that not all players are available for equal amounts of time and in Figure 9, we show a real-world situation of how different players are in different health states each week.

Sport incapacity injuries are a focus of the annual health report because they result in players being unavailable for training and competition. These time loss injuries are considered more impactful than injuries which do not result in time loss. Note - time loss as a measure of impact or severity is an imperfect measure, with impact/severity not limited to time loss and other influences also having a role in player availability. However, time loss is recognised and accepted as an objective and practical way to compare outcomes over different years.

In our cohort of 10 indoor soccer players, six players had a sports incapacity injury, including one which forced the athlete to retire.

Figure 9 provides an illustrative example from our indoor soccer population of the definitions of player availability. Before we do this, we will revise the AMS health status definitions from with *The definitions and use of the injury record within the Athlete Management System: Data Dictionary Version 2.1* as this will help you understand your report and the example below.

Full availability (full training and competition)

'Unrestricted participation in the primary mode of training or competition at an equivalent level to pre-injury when at full capacity, as planned by coaching staff if the athlete was uninjured/healthy.'

Full availability is represented in Figure 9 by the solid green line.

Modified training or competition

'Any reduction from pre-injury full capacity or restriction to an athlete's participation in training or competition, as planned by coaching staff that is based on medical restriction and relates only to the primary mode of training.'

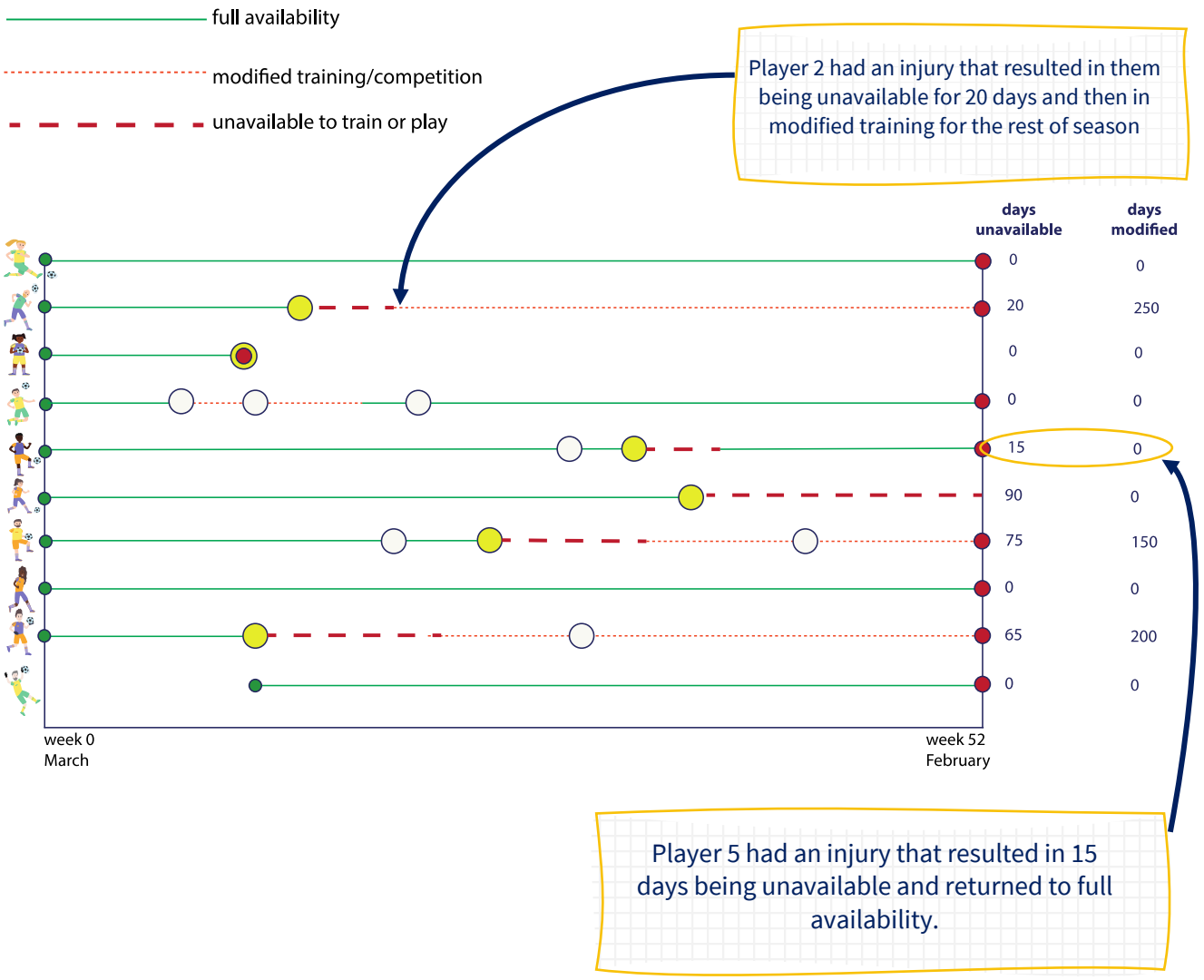
Modified availability is represented in Figure 9 by the dotted orange-red line.

Unavailable (No training or competition)

'The athlete is completely unable to participate in the primary mode of training or competition based on medical advice.'

Players who are unavailable are represented in Figure 9 by the dashed red line.

Figure 9. **Illustrative example of availability of players throughout the season**



Recovery from sports incapacity injury

The time-loss component of an injury (if present) ends when the injury status is changed within the AMS injury record from either no training or competition (red) or modified training or competition (orange) to full training and competition (green).

In the circumstance where an athlete recovers from an injury during a period where there is no planned training or competition (i.e., during the off-season), the date of return to full training and competition should be entered as the date the athlete would have resumed full training and competition participation if it has been scheduled.

It should be noted that many injuries do not fully recover which may lead to permanent modified training. For further information on how to handle this situation, please refer to Definition of recovery, page 19-20 - Data Dictionary Version 2.1.

Recovery from medical attention injury

All injuries reported within AMS are medical attention injuries. As such, these injuries are considered as recovered when the injury record is closed. Closure indicates that the injury does not require current ongoing medical attention. That is, ongoing management, in any format, related to the injury by the treating medical professionals.

Median days lost

The days lost to injury are a sum of the count from the first day of injury until recovery (as defined above). We report median as a measure of central tendency over averages as almost always injury data is skewed to the right. Data that does not meet normal distribution should be reported using non-parametric values.

The annual health report presents time loss and availability data in several ways. Table 5 has the injury count and details the split for injuries that do and do not result in sports incapacity.

Table 5. Time loss injuries in 2019 for population (n=209 athletes in population)

Measure	Non time loss injury	Sport incapacity (time loss) injury
Injury Count	221	213
Athletes Injured	83	94
Injury Median Days Lost in Agreement	0	18
Median Days Lost (inc. exceeding agreement)	0	21
Total Exposure (days)	76285	76285
Incidence Rate (per 365 athlete-days)	1.06	1.02

Some players will experience an injury that extends outside of their scholarship agreement period.

Time loss in agreement represents the days that a player is not fully available from their scholarship agreement period.

The row underneath (median days lost (including exceeding agreement)) is the total days missed within and outside of the scholarship agreement.

Seasonal variation

Some sports have strong seasonal variation of injury occurrence, particularly where there are distinct pre-season, in-season, and post-season competition periods. Figure 10 shows the count of injury types (by definition) for each month. Visually, you can see there are approximately 30 to 40 injuries each month (as represented on the y-axis). There are noticeably more injuries in April, particularly non time loss injuries. Occurrence should be interpreted as a frequency. It does not have a denominator and should be interpreted with caution as it does not account for exposure of the athletes to training and competition. Occurrence also does not take into consideration the severity of injury.

Table 6 shows the summary statistics for player availability month by month. It is important to note that towards the end of the year (November and December), there is a maximum (or cap) of days that can be missed for that year. Put simply, an injury sustained on 15 December can only miss a maximum of 16 days in that year (through to 31 December). Note - depending on your sport and the player's next scholarship or contract period being a continuous calendar time, the days 'missed' to injury may be present in the first months of the next reporting period.

Figure 10. Injury occurrence by the month of the season

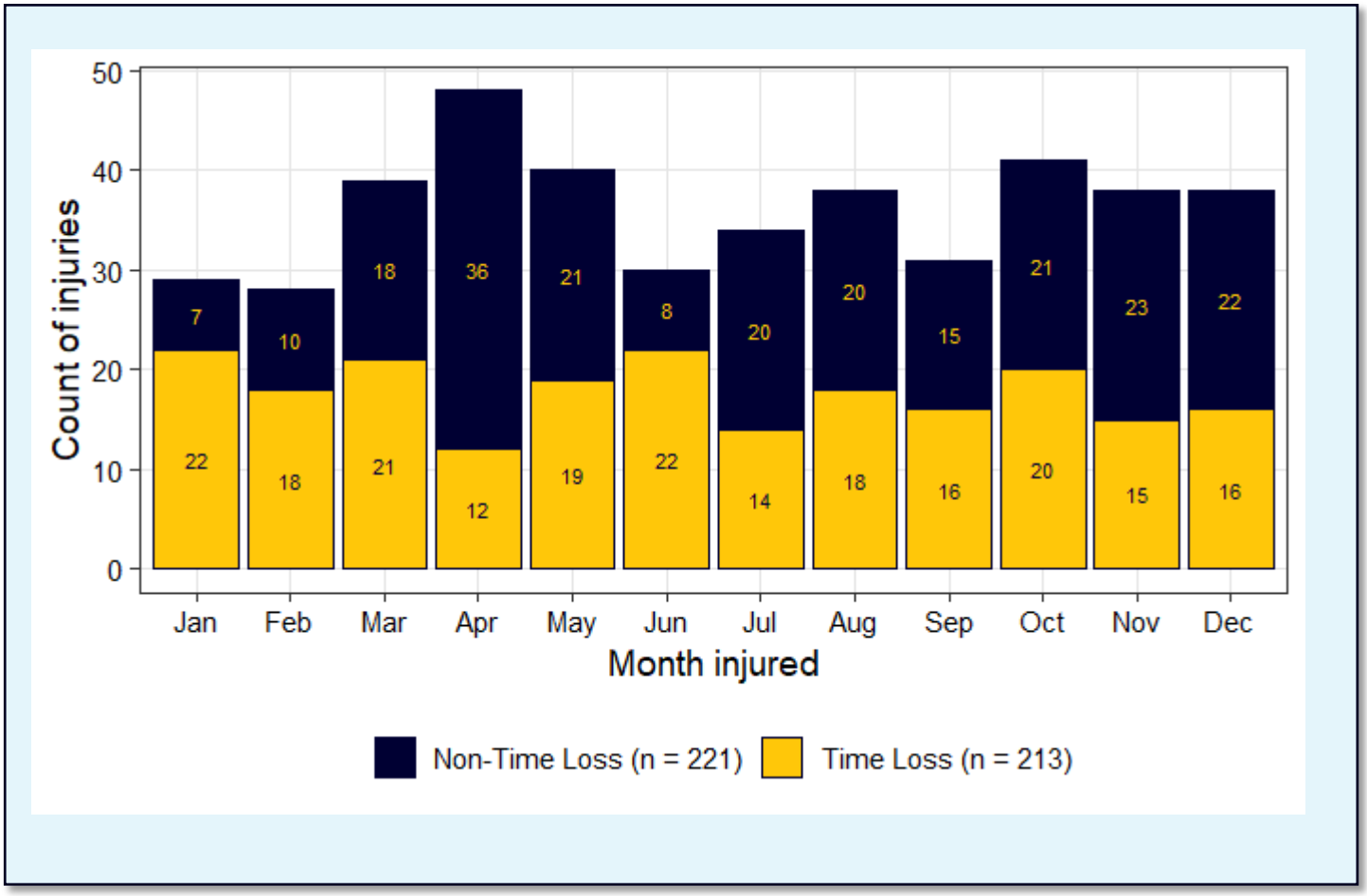


Table 6. Incidence and burden rate by month for 2019 (total athletes = 399)

Month	Injury count	Athletes injured	Time loss injury median days lost in agreement	Time loss injury median days lost (inc. exceeding agreement)	Total exposure (days)	Injury incidence rate (per 365 athlete days)	Burden rate (per 365 athlete days)
Jan	29	25	17.5	17.5	12369	0.86	15.1
Feb	28	26	17.0	17.0	11172	0.91	15.5
Mar	39	29	20.0	20.0	12369	1.15	23.0
Apr	48	29	18.0	18.0	11970	1.46	26.3
May	40	30	24.0	24.0	12369	1.18	28.3
Jun	30	24	40.0	40.0	11970	0.91	36.4
Jul	34	24	36.5	36.5	12369	1.00	36.5
Aug	38	32	29.0	29.0	12369	1.12	32.5
Sep	31	23	11.5	11.5	11970	0.95	10.9
Oct	41	26	27.0	30.5	12369	1.21	36.9
Nov	38	27	16.0	18.0	11970	1.16	20.9
Dec	38	23	10.0	24.0	12369	1.12	26.9

Column 1 presents the month of interest. This is important as a time variance is often seen in sport. E.g. This could be pre-season vs. in-season or winter months vs. summer months.

Median days lost in agreement –

Median days lost –

Toward the end of the scholarship agreement (i.e., November and December) you can see the time loss within agreement is reduced - this is because there is a natural cap (maximum) on possible days missed when injury occurs at the end of the year.

Burden rate

Equation 5

In Table 6, a new measure is presented - the burden rate. The burden rate considers the incidence of injury and the severity of that injury in terms of time loss.

Burden rate is calculated as:

$$Injury\ burden\ rate\ (per\ 365\ athlete\ days) = median\ time\ loss\ \times\ time\ loss\ injury\ incidence\ rate$$

From Table 6, the burden rate in January is time loss (*17.5 days*) x injury incidence (*0.86*) = *15.1 days absence per 365 athlete-days.*

Injuries that occur frequently (high incidence rate) but have a low number of missed days (Equation 6) can have a lower burden rate than injuries that occur infrequently but result in many missed days (Equation 7).

Equation 6

$$Injury\ burden\ rate = time\ loss\ (low) \times injury\ incidence\ rate\ (high)$$

= 4 days time loss x 4.0 injuries per 365 athlete-days

= 16.0 days absence per 365 athlete-days

Equation 7

$$Injury\ burden\ rate = time\ loss\ (high) \times injury\ incidence\ rate\ (low)$$

= 80 days time loss x 0.5 injuries per 365 athlete-days

= 40.0 days absence per 365 athlete-days

A burden rate of 40.0 indicates that for every 365 athlete-days, 40 athlete-days (5-6 weeks) were spent unavailable or in modified training because of injury.

Note: Injury burden considers the full duration of days an athlete spends as either *unavailable to train (red AMS status)* or in *modified training or competition (orange AMS status)* during their injury until it is resolved. For injuries that have not resolved at the end of the surveillance period, the estimated 'return to full training date' by the treating clinician is used as a proxy date for injury resolution.

Team (whole squad) availability

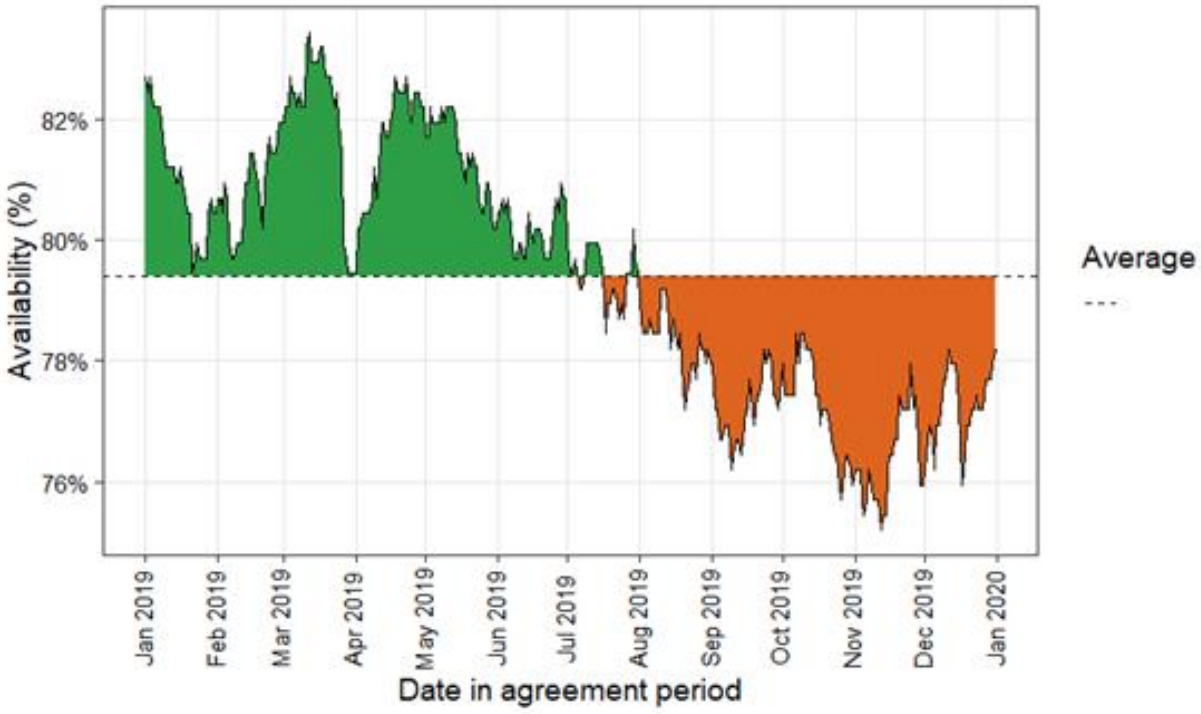
Ideally, all of the athlete population (100%) would be available throughout the whole season. This is rarely, if ever, the case in a competitive sports team or squad in high performance environments.

Presented in the annual health report is a figure that shows availability of the population throughout the year (Figure 11). The figure shows periods where the team availability was greater than or equal to the scholarship period average (green) or less than the scholarship period average (orange). In Figure 11 it can be observed that in the early part of the season, from January to July, availability is generally higher than average. In the latter part of the season, from August to end of year, availability is lower than average.

The reasons for this variation are primarily injury occurrence and the associated recovery times. In the example of Figure 11, injury with time loss could have accumulated through the year and potentially result in more players being unavailable toward the end of the season.

The size of the team/squad can mean that this figure looks dramatic. If one or two players are missing from a small team (e.g., our indoor soccer team of 10), the result will appear more drastic than one or two players missing from a large squad/team (e.g., 100 athletes). The best comparison is to look month to month for patterns of availability and then year to year to identify if availability is consistent or changing. Availability should be considered in combination with contextual factors relevant for each sport, such as when competition occurs, pre-season training, periods of travel, etc.

Figure 11. Player availability across the scholarship period



Take away messages – player availability and burden of injury

The remaining sections of the summary statistics table can now be completed with consideration of results and some short commentary (Table 7).

Table 7. Summary statistics (updated from Table 1)

Summary Statistic	2019	95% CI	*Example commentary*
Burden Rate (per 365 athlete-days)	43.7		*The burden rate was 43.7 per 365 days*
Median Athlete Availability (%)	98.1		*The median availability for **individual** athletes in the squad was 98.1%. This means that more than half of the athletes had an availability greater than 98% during their own scholarship.*
Whole Squad Availability (%)	78.9		*On an average day across the surveillance period, 78.9% of the players in the squad were available to train or compete.*
Total Medical Attention Injuries	434		*There was a total of 434 injuries sustained by the squad/team during the year resulting in the need to see a health professional.*
Total Time Loss Injuries	213		*Of the 434 injuries, almost half (49.1%, n= 213) resulted in sports incapacity (that is, they missed training or competition).*
New Injury Time Loss (days)	16912		*'New' time loss injuries that resulted in a total of 16912 lost days.*
Pre-Existing Injury Time Loss (days)	13085		*There were 13085 days missed in the current season from time loss injuries that were sustained in the previous reporting period (or pre-scholarship).*

Injury diagnoses

Body region, body site and injury nature

The next set of charts (Figures 12, 13 and 14) present the number of injuries according to the body region, body site and injury nature. On the left of the figure, you should confirm that the chart shows the number (count). Sometimes, this might be displayed as the injury incidence rate or a proportion.

In Figure 12, each vertical bar (the yellow and blue combined) is the number of injuries per body region. In our example, there are 171 injuries to the lower limb, 137 injuries to the upper limb and so forth. The colours show the difference by injuries that resulted in time loss or not: of the 171 lower limb injuries, 89 were non-time loss and 82 were time loss.

The two distinct colours show those injuries that resulted in time loss (in yellow) and those that did not require time loss (blue). This distinction can be changed to show different variables not just time loss. For example, the injuries might be separated to show different colours for men and women, or different playing positions.

Figure 12. The number of injuries by body region (for time loss and non-time loss)

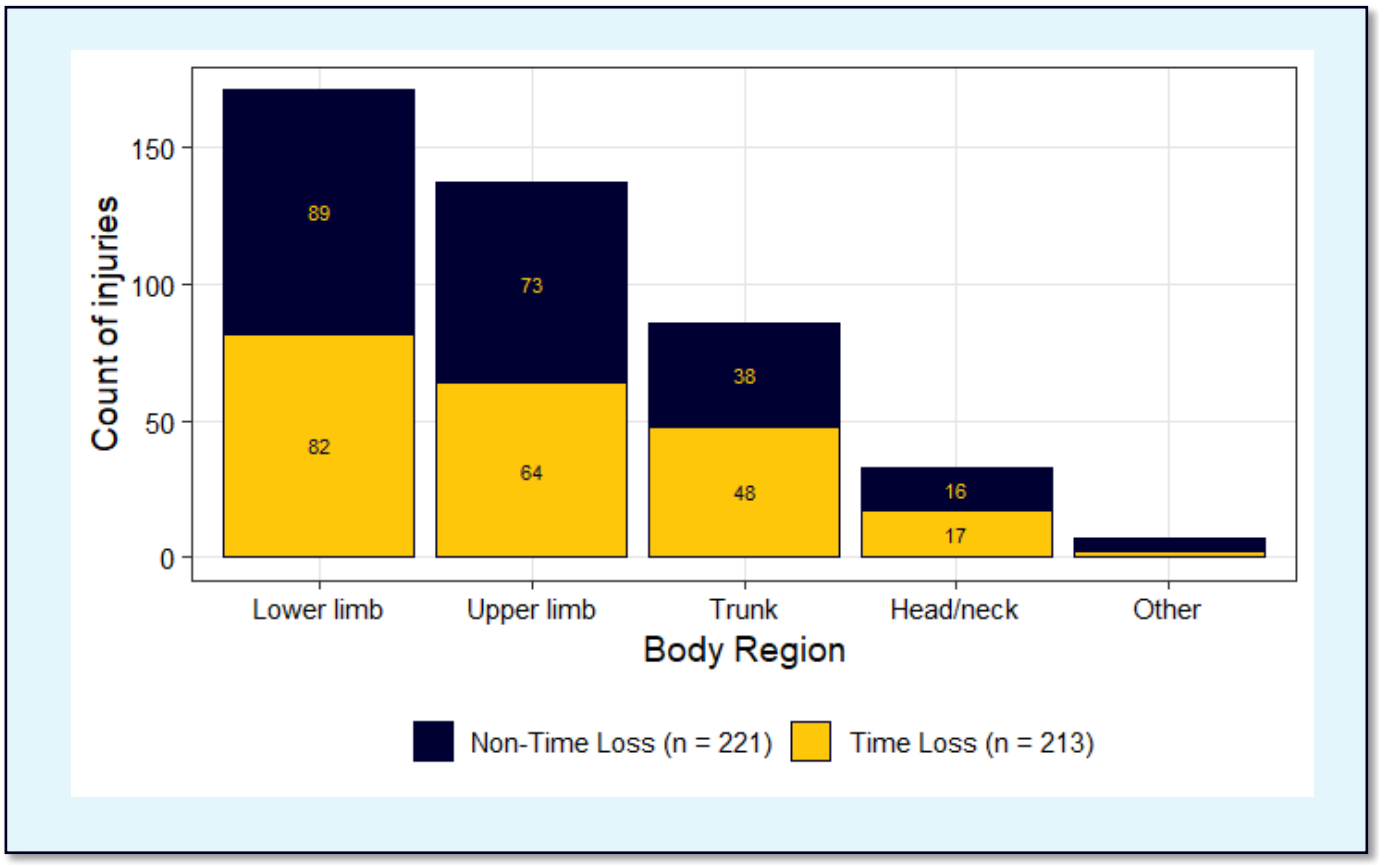


Figure 13 is similar to Figure 12, simply presenting more detail through a smaller breakdown of body region into body sites. The total count of shoulder injuries is 53, with 24 injuries resulting in no time loss and 29 resulting in time loss.

Injury nature is the focus of Figure 14. Keep in mind that some diagnoses may be closely linked by onset such as joint sprain and joint instability or by outcome such as stress fracture and overuse syndrome. You may like to consider if there is value to your sport in considering such injury as 'one' group when looking at leading types of injury nature.

Figure 13. The number of injuries by body site (for time loss and non-time loss)

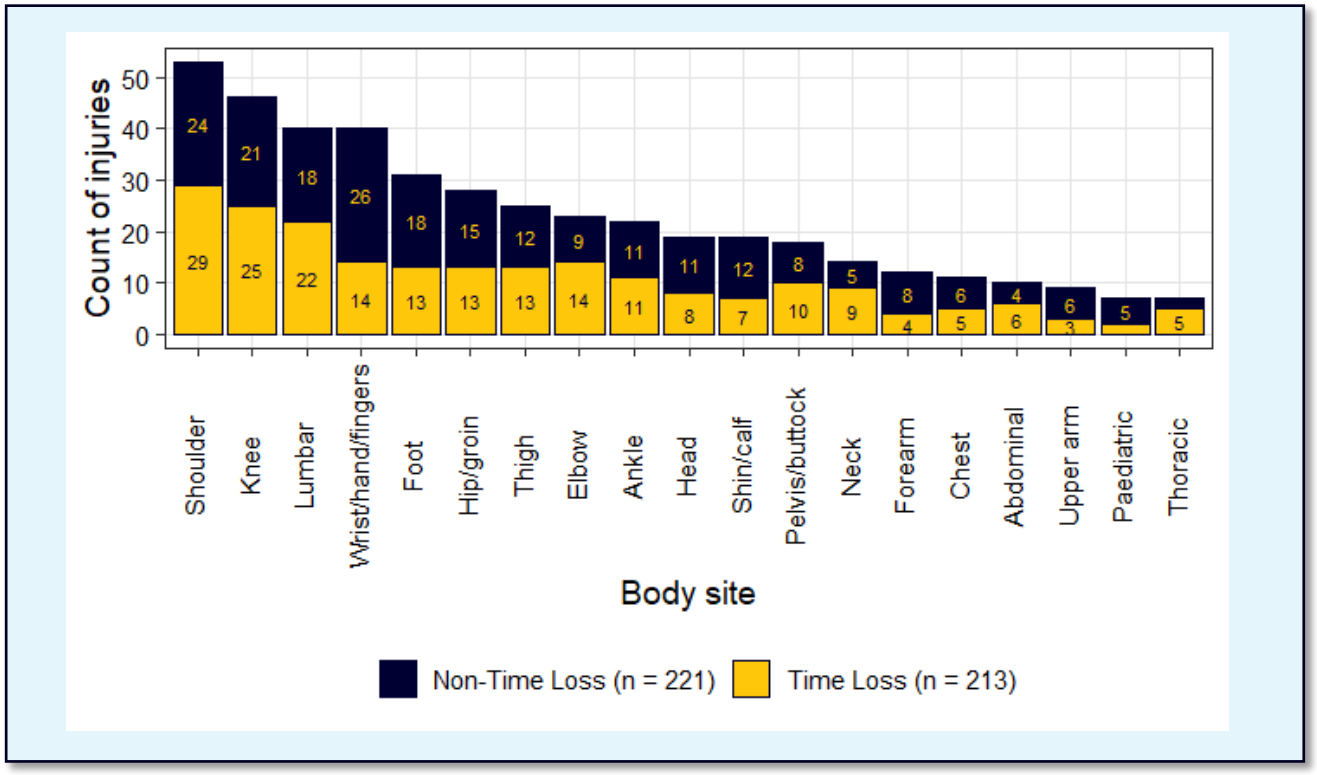
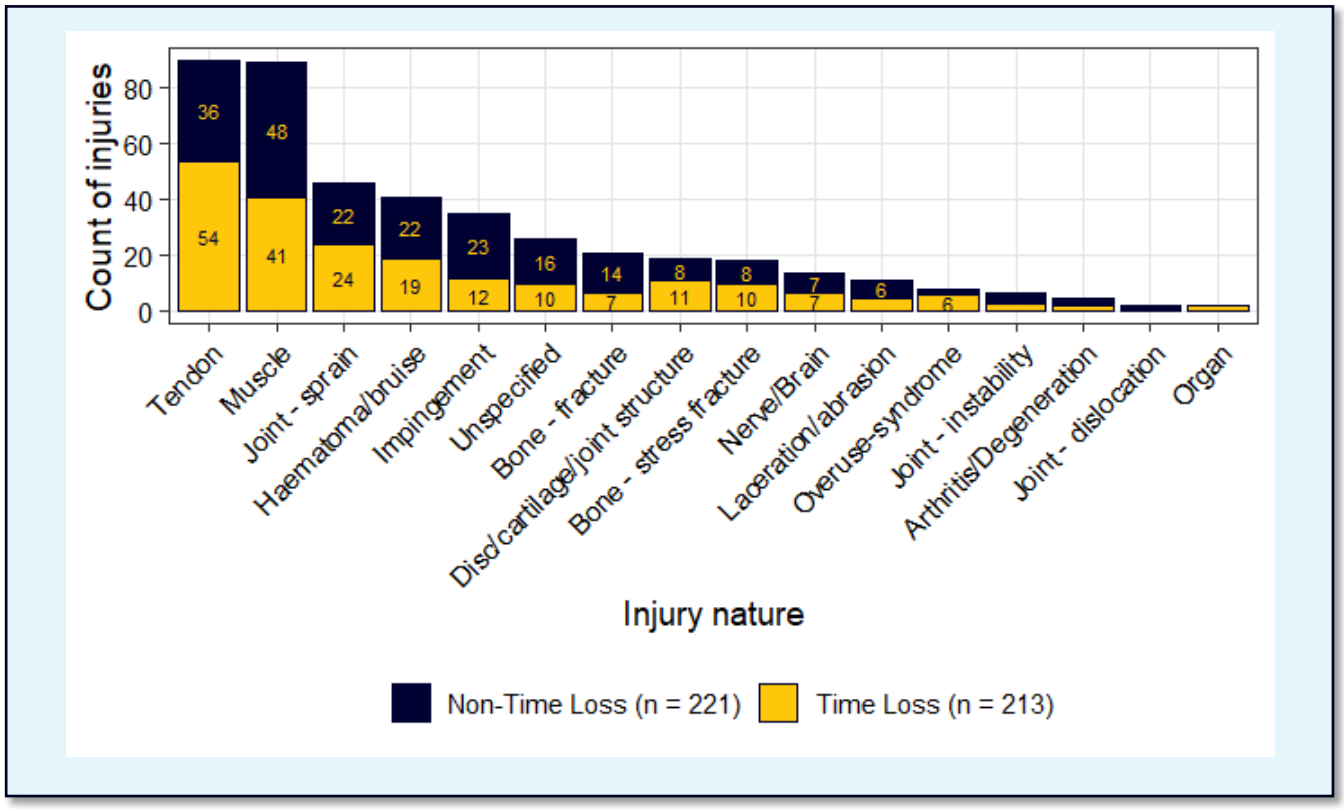


Figure 14. The number of injuries by nature of injury (for time loss and non-time loss)



Broad and specific diagnoses

As noted in Figures 12 and 13, both the body region (broad) and the body site (specific) are important: for example, lower limb (region), then knee (site). Similarly, the injury diagnosis can be at a broad or specific level.

Table 8 combines the body part and the injury nature in combination, using the first two characters of the OSICS-10.1 coded injury. The example shows shoulder tendon injury as the leading diagnosis with 22 cases recorded. This corresponds to Figures 13 and 14 where shoulders and tendons both had the highest number of cases.

For protection of individual athlete privacy, these injury diagnoses will only be presented where there are multiple (5 or more) entries for that diagnosis. You can see that the final rows of Table 9 have five cases each for Knee MCL contusion, Pars interarticularis stress fracture, Truncal Muscle Trigger Points/ Spasm and Anteroinferior shoulder subluxation.

Table 8. Most frequent broad injury diagnosis (first two OSIICS characters, where n ≥ 5)

OSICS First 2 Letters	Body Site	Injury Nature	Frequency	Percentage
ST	Shoulder	Tendon	22	5.1
QM	Shin/calf	Muscle	14	3.2
SG	Shoulder	Impingement	14	3.2
KT	Knee	Tendon	13	3.0
NM	Neck	Muscle	13	3.0
TM	Thigh	Muscle	13	3.0
WJ	Wrist/hand/fingers	Joint - sprain	13	3.0
AT	Ankle	Tendon	12	2.8
GT	Hip/groin	Tendon	12	2.8
WT	Wrist/hand/fingers	Tendon	12	2.8
RH	Forearm	Haematoma/bruise	11	2.5
BM	Pelvis/buttock	Muscle	10	2.3
LC	Lumbar	Disc/cartilage/joint structure	10	2.3
LS	Lumbar	Bone - stress fracture	10	2.3
OM	Abdominal	Muscle	10	2.3
GM	Hip/groin	Muscle	9	2.1
ET	Elbow	Tendon	8	1.8
KJ	Knee	Joint - sprain	8	1.8
CZ	Chest	Unspecified	6	1.4
KC	Knee	Disc/cartilage/joint structure	6	1.4

OSICS First 2 Letters	Body Site	Injury Nature	Frequency	Percentage
KH	Knee	Haematoma/bruise	6	1.4
LM	Lumbar	Muscle	6	1.4
WF	Wrist/hand/fingers	Bone - fracture	6	1.4
AJ	Ankle	Joint - sprain	5	1.2
EF	Elbow	Bone - fracture	5	1.2
EN	Elbow	Nerve/Brain	5	1.2
FG	Foot	Impingement	5	1.2
FJ	Foot	Joint - sprain	5	1.2
SJ	Shoulder	Joint - sprain	5	1.2
TH	Thigh	Haematoma/bruise	5	1.2

Table 9 presents a more detailed level of specificity in presentation of the injury diagnosis using all four characters of the OSICS-10.1. Again, only where there are five or more cases will these be presented. Therefore, it is expected that only a small number of diagnoses will be shared each year. In the example, there were ten cases of forearm bruising, eight cases of supraspinatus tendinopathy and eight cases of wrist flexor tenosynovitis/ tendinopathy.

Table 9. Most frequent specific injury diagnoses (four characters, where n ≥ 5)

OSICS	Diagnosis	Frequency	Percentage
RHXX	Forearm Soft Tissue Bruising/ Haematoma	10	2.3
STST	Supraspinatus tendinopathy	8	1.8
WTVT	Wrist flexor tenosynovitis/ tendinopathy	8	1.8
LCXX	Lumbar Disc Injury (excl degen disc disease LACX)	7	1.6
KHMX	Knee MCL contusion	5	1.2
LSPA	Pars interarticularis stress fracture	5	1.2
OMYX	Truncal Muscle Trigger Points/ Spasm	5	1.2
SJSA	Anteroinferior shoulder subluxation	5	1.2

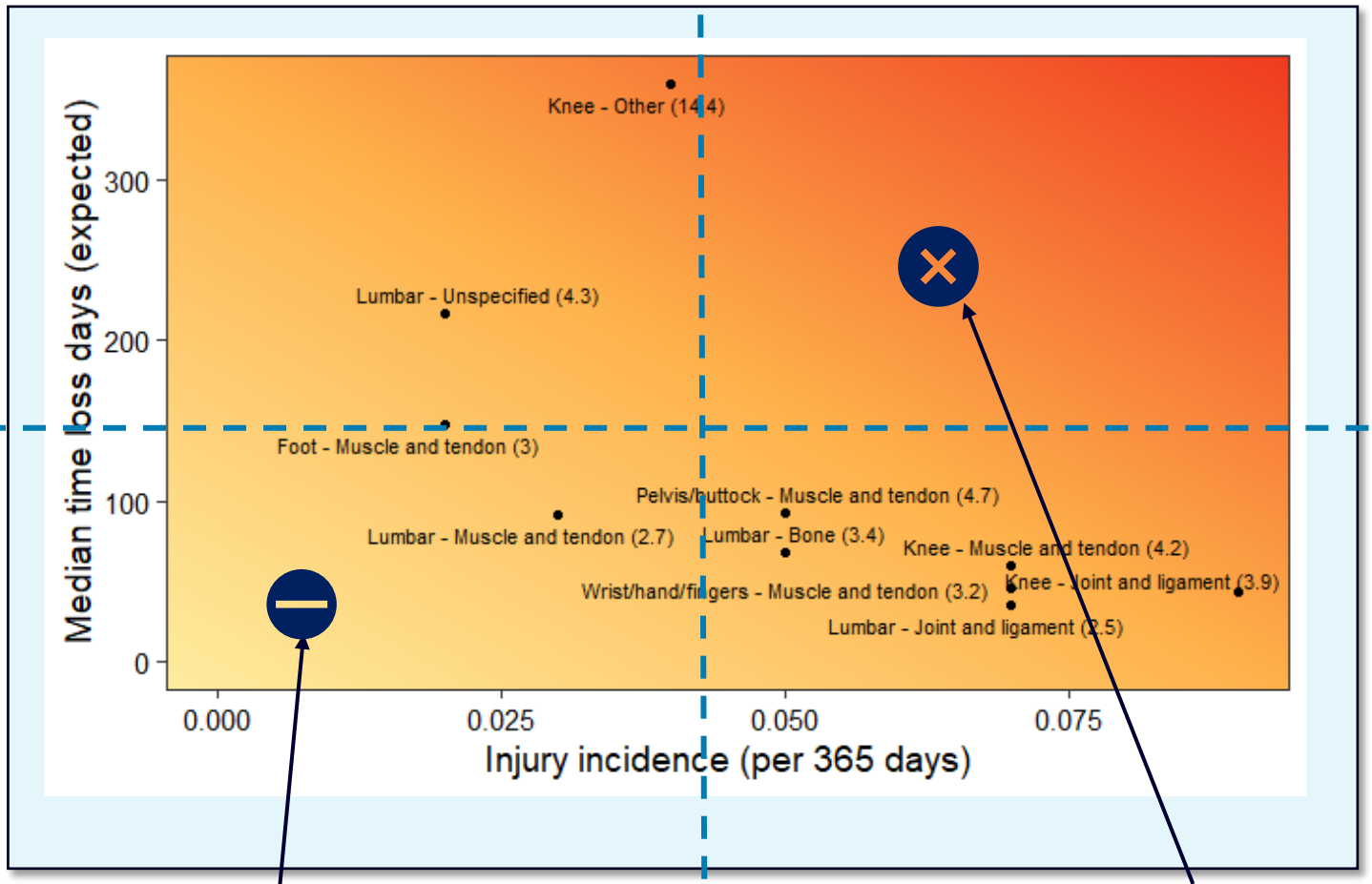
Additional presentation of injury characteristics

Your report might include additional charts and tables that present the information above in different ways (Burden of injury according to diagnosis), with additional injury variables (e.g. Figure 16) or with additional variables specific to your sport (Figure 17). Each of these will address needs specific to understanding and preventing injuries in your sport.

Burden of injury according to diagnosis

The first example (Figure 15) combines information on injury diagnosis, injury incidence rate and time loss from injury in days. By combining data in this way, these figures are useful to identify priorities based on multiple factors. Imagine the chart is split into four quadrants (as depicted with the dotted line). Injuries in the bottom left quadrant occur infrequently (low injury incidence rate) and result in a lower number of days missed (e.g. Lumbar – muscle and tendon). Injuries in the bottom right quadrant have a high injury incidence rate (they occur often) but do not result in many days missed from sport (e.g. Lumbar – joint and ligament). Injuries in the top left are relatively infrequent but result in many days lost to sport. (e.g. Lumbar – unspecified). The top right quadrant represents injuries with a high incidence and resulting in many days missed.

Figure 15. Injury diagnosis mapped to injury incidence and time loss from injury



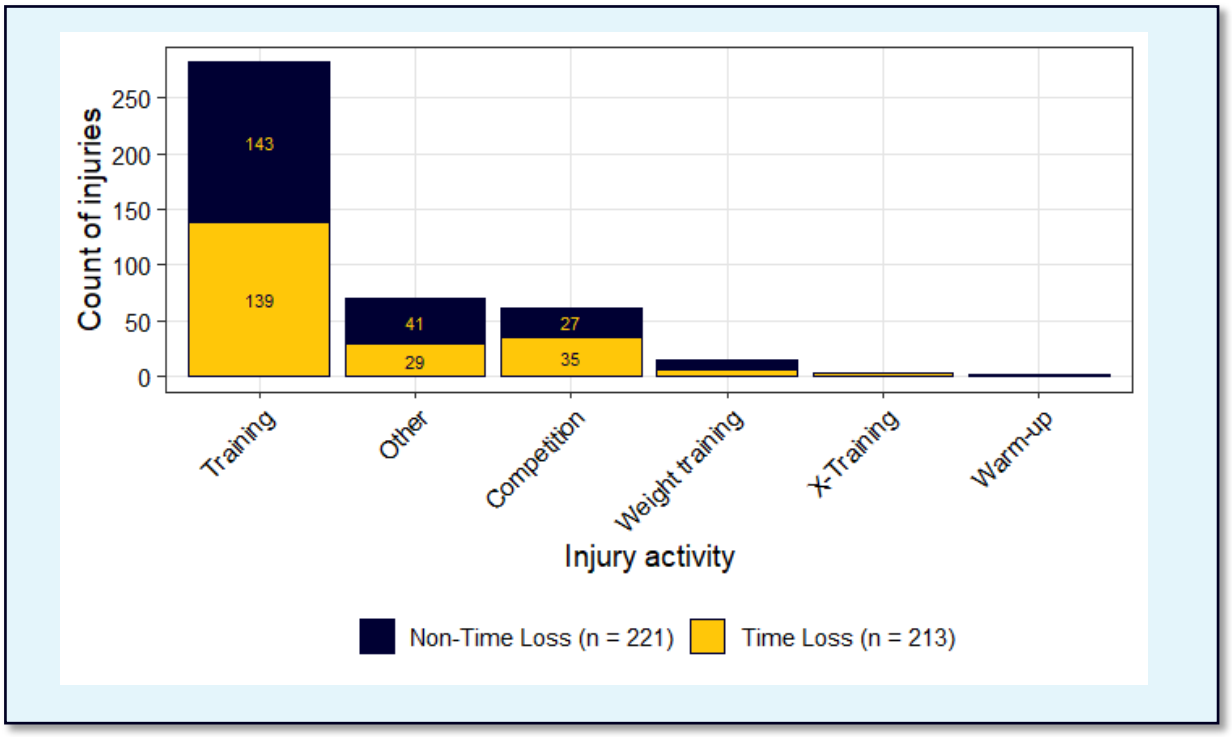
The area to the lower left presents injuries that are relatively infrequent (low incidence rate) and do not result in many days missed. These injuries are less likely to be a priority. Typically, you would not target injury prevention programs here.

Injuries that fall into the dark red zone result in most days missed and occur with a higher injury incidence. Typically, this is where you would want to target your injury prevention programs.

Additional injury and sport specific variables

Two examples are presented for the additional variables that may be included in your report. First, the activity at time of injury (Figure 16) shows many training injuries in this example. Other information that may be shown is the position the athlete was in at the time of injury or the specific skill/action they were performing. For sports, details on how the injuries occur (such as acute trauma compared to a gradual, overuse injury) can be important. Understanding this data will allow you to consider high priority areas to investigate and potentially provide changes, support, or interventions to reduce the overall injury burden in your sport. Figure 16 shows the distinction of injury onset being an acute or overuse injury.

Figure 16. Activity at the time of injury occurrence, according to time loss or no time loss



In Figure 16, a very small proportion of injuries occur during weight training, cross training and warm-up with most injuries occurring during training. Therefore, it would be reasonable to target injury prevention strategies at training as opposed to trying to prevent injuries during weight training, which would provide little overall benefit.

Figure 17. Onset of injury (overuse or traumatic), according to time loss or no time loss

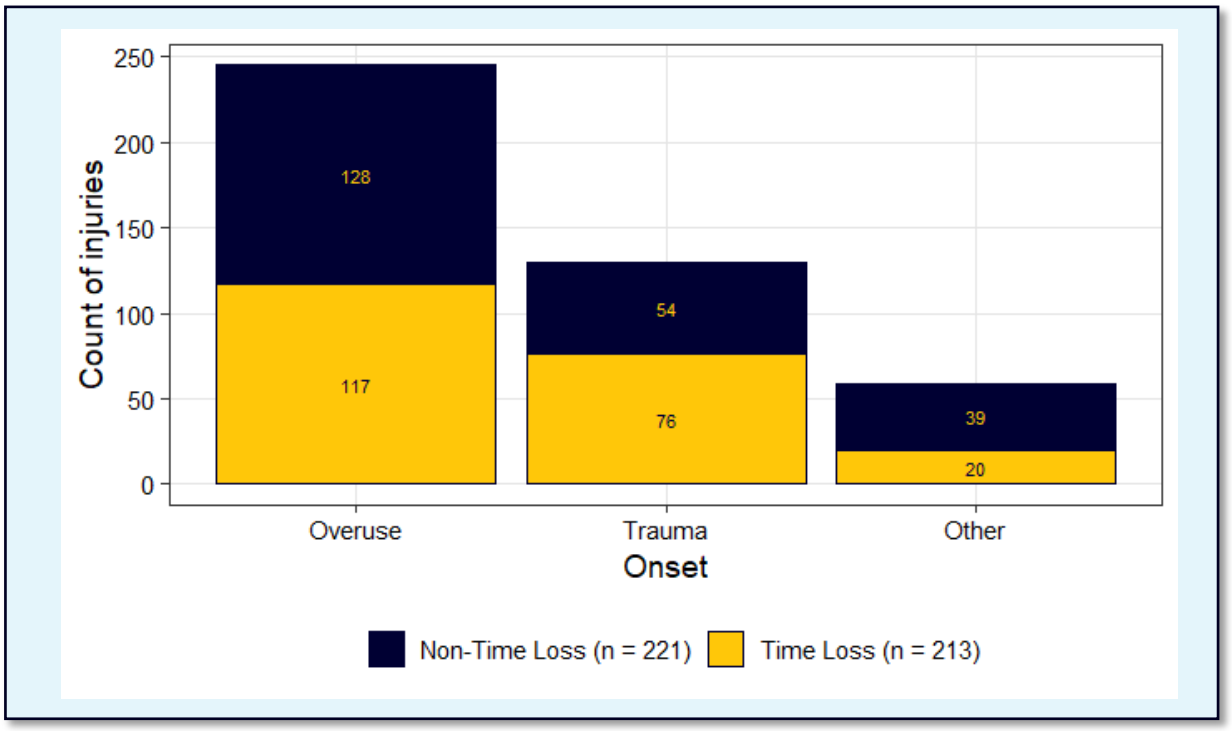


Figure 17 presents data that shows overuse and traumatic injuries both occur within this athlete population. Therefore, injury prevention strategies should target both overuse and acute traumatic injuries to have the largest effect on reducing the number of injuries.

Concluding comments

This guidebook is only intended as a minimum level of information to help inform your data report and prioritise prevention strategies. Many factors contribute to the injury occurrence in your players and not everything can be incorporated in a data report that is designed for multiple sports. The interpretation relies on you and your colleagues to consider possible influences on injuries over the year. We encourage a cautious approach in analysis because generally, most sports have small sample (team) sizes and there will be inevitable errors in data capture. Critically, the data within your health report is only as good as that captured. Encouraging good practice in data entry is helpful to this process.