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How do sports injury epidemiological outcomes vary depending on athletes' response rates to a weekly online questionnaire? An analysis of 39-week follow-up from 391 athletics (track and field) athletes

Pascal Edouard[1,2,3] | Pierre-Eddy Dandrieux[1,4,5] | David Blanco[6] | Jeanne Tondut[1,4] | Joris Chapon[1] | Laurent Navarro[4] | Astrid Junge[5,7] | Karsten Hollander[5]

[1]Inter-University Laboratory of Human Movement Biology (EA 7424), Université Jean Monnet Saint-Etienne, Lyon 1, Université Savoie Mont-Blanc, Saint-Etienne, France

[2]Sports Medicine Unit, Department of Clinical and Exercise Physiology, Faculty of Medicine, University Hospital of Saint-Etienne, Saint-Etienne, France

[3]European Athletics Medical & Anti-Doping Commission, European Athletics Association (EAA), Lausanne, Switzerland

[4]Mines Saint-Etienne, University of Lyon, Université Jean Monnet, INSERM, U 1059 Sainbiose, Centre CIS, Saint-Etienne, France

[5]Institute of Interdisciplinary Exercise Science and Sports Medicine, MSH Medical School Hamburg, Hamburg, Germany

[6]Physiotherapy Department, Universitat Internacional de Catalunya, Barcelona, Spain

[7]Center for Health in Performing Arts, MSH Medical School Hamburg, Hamburg, Germany

Correspondence
Pascal Edouard, Sports Medicine Unit, Department of Clinical and Exercise Physiology, Faculty of Medicine, IRMIS, Campus Santé Innovations,

Abstract

Objective: To explore how sports injury epidemiological outcomes (i.e., prevalence, average prevalence, incidence, burden, and time to first injury) vary depending on the response rates to a weekly online self-reported questionnaire for athletes.

Methods: Weekly information on athletics injuries and exposure from 391 athletics (track and field) athletes was prospectively collected over 39 weeks (control group of the PREVATHLE randomized controlled trial) using an online self-reported questionnaire. The data were used to calculate sports injury epidemiological outcomes (i.e., prevalence, average prevalence, incidence, burden, and time to first injury) for sub-groups with different minimum individual athletes' response rates (i.e., from at least 100%, at least 97%, at least 95%, ... to at least 0% response rate). We then calculated the relative variation between each sub-group and the sub-group with a 100% response rate as a reference. A substantial variation was considered when the relative variation was greater than one SD or 95% CI of the respective epidemiological outcome calculated in the sub-group with a 100% response rate.

Results: Of 15 249 expected weekly questionnaires, 7209 were completed and returned, resulting in an overall response rate of 47.3%. The individual athletes' response rates ranged from 0% ($n=51$) to 100% ($n=100$). The prevalence, average weekly prevalence, and time to first injury only varied substantially for the sub-groups below a 5%, 10% and 18% minimum individual response rate, respectively. The incidence and injury burden showed substantial variations for all sub-groups with a response rate below 100%.

Conclusions: Epidemiological outcomes varied depending on the minimum individual athletes' response rate, with injury prevalence, average weekly prevalence, and time to first injury varying less than injury incidence and injury burden. This highlights the need to take into account the individual response rate when

University Hospital of Saint-Etienne, 42 055 Saint-Etienne cedex 2, France.
Email: pascal.edouard@univ-st-etienne.fr

calculating epidemiological outcomes, and determining the optimal study-specific cut-offs of the minimum individual response rate needed.

KEYWORDS

data management, epidemiology, monitoring, sports injury, statistics, track and field

1 | INTRODUCTION

Sports injury epidemiology represents the first fundamental step of the injury prevention sequence.[1] Prospective data collection is recommended.[1,2] Regular athletes' self-reported online questionnaires, on a weekly, every 2 weeks, or monthly basis, are frequently used to record injuries and sports exposure during the preceding week or period.[3–6] Such an approach reduced the recall bias and allowed the determination of several epidemiological outcomes (e.g., prevalence, average prevalence, incidence, burden, and time to first injury).[2,7–9] This data collection approach has also been used in randomized controlled trials analyzing injury prevention strategies,[10–12] and in epidemiological studies of other athletes' health problems.[4,6]

However, the individual athlete's response rate to weekly questionnaires (then named *individual response rate*, and corresponding to the number of weekly questionnaires completed by an athlete divided by the total number of weekly questionnaires expected) was usually not optimal.[3,4,6,11–13] The average response rates (i.e., mean of individual response rates over the study period) reported in previously published studies ranged from about 20% to 91%.[3,4,6,11–13] This meant that, for some athletes and/or for some weeks, the information on injuries and exposure was missing. This may have had potential consequences on the epidemiological outcomes of interest and their calculation.[14]

Several strategies are commonly used to calculate epidemiological outcomes based on data collected using weekly athletes' self-reported questionnaires. First, these outcomes can be calculated by only taking into account weekly questionnaires when there was a response regardless of the individual response rate.[4,5] Missing weeks are considered as if they did not exist. However, this approach could be inappropriate, because the athlete can have trained, competed, and/or been injured during the missing weeks. Also, the differences between athletes in their response rates can lead to heterogeneity in missing information over the population and study period, resulting in bias. The impact of this strategy on epidemiological outcomes can depend on the response rates, with a lower response rate being associated with a higher risk of bias on epidemiological outcomes. Second, some studies set cut-offs of minimum individual response rate (e.g., ≥50% or ≥75%)[10,15] to include that athlete in the calculation of epidemiological outcomes. This is intended to ensure that a minimum amount of information on that athlete is included in the analysis, which reduces the risk of bias due to missing data. Third, other studies only performed the complete case analysis, that is, only including the data of athletes with a complete dataset (i.e., 100% of response rate).[8,12,16,17] This strategy could help limit the risk of bias described above, but is usually recommended only if the proportion of missing data is below 5%,[17] which is rare in sports epidemiology.[3,4,6,11–13]

The impact of using each of the previous strategies (i.e., [1] only taking into account weekly questionnaires where there was a response regardless of the individual response rate, [2] including athletes with a minimum individual response rate (i.e., specific cut-offs), or [3] including only athletes with a 100% response rate) on the epidemiological outcomes has not been analyzed yet. In this study, we aimed to explore how several important sports injury epidemiological outcomes (i.e., prevalence, average prevalence, incidence, burden, and time to first injury) vary depending on the strategy to deal with the individual response rates.

2 | MATERIALS AND METHODS

2.1 | Study design and overall procedure

The present study is a secondary analysis of the data of the control group of the "PREVATHLE" randomized controlled trial (RCT),[12] which was approved by the Committee for the Protection of Persons (CPP Ouest II—Angers, number: 2017-A01980-53) and registered on ClinicalTrials.gov (Identifier: NCT03307434). The present study was reviewed and approved by the Saint-Etienne University Hospital Ethical Committee (Institutional Review Board: IORG0007394; IRBN292023/CHUSTE). Included athletes were asked to complete a baseline questionnaire at the start of the season, and weekly reports on athletics activity exposure and related injury complaints during the 39 weeks of the follow-up period.

2.2 | Population

Competing athletics (track and field) athletes (i.e., participating in athletics competition and not just as leisure activity (i.e., recreational)) were included at the start of the 2017–2018 athletics season, if they were licensed at the French Federation of Athletics (FFA; https://www.athle.fr) in a club of at least 15 athletes, aged between 15 and 40 years, had access to the internet, and had no contraindications for competitive athletics activity attested by the license at the FFA.[12] We only used data from the athletes from the control group of the PREVATHLE RCT to ensure that there was no influence of the proposed intervention on epidemiological outcomes.[12]

2.3 | Data collection and injury definition

Baseline information on each included athlete (i.e., sex, age, height, body mass, discipline) was collected using a Google Forms (Google LLC, Mountain View, CA, USA) survey at the start of the season.[12] Data on exposure to athletics activity and injury complaints in the preceding week were prospectively collected throughout the season (i.e., 39 weeks) using a secured weekly online questionnaire (Windows Server 2013 R2 64 bits—SP2; IBM DOMINO 9.01 fix pack 8).[12] Every Monday an e-mail with a secured link to the weekly online questionnaire was automatically sent to all included athletes followed by two automatic reminders 3 and 5 days after the first e-mail to non-responders.[12] The weekly questionnaire required recording of the number of hours of training and competition, and if present, injury complaints during the preceding week. Athletes reporting an injury complaint were asked to provide the following information: injury circumstance (training, competition, outside of athletics), mode of onset (sudden or gradual), injury location, and its consequence on athletics participation (full participation with no discomfort, full participation with discomfort, reduced participation due to injury complaint, full absence from sport due to injury complaint).[12] The baseline and weekly questionnaires are presented as Supplementary Material.

In the present study, we used the occurrence of an "injury complaint that leads to restricted participation in athletics" (ICPR) during athletics training or competition, defined as an "injury complaint reported by athletes, leading to a reduced participation in or full absence from athletics training or competition, and sustained during participation in athletics training or competition"[12] to calculate epidemiological outcomes.

2.4 | Epidemiological outcomes

The following epidemiological outcomes were calculated over the 39-week follow-up period[8]: the proportion of athletes who had at least one ICPR (i.e., prevalence), the mean weekly proportion of athletes who had at least one ICPR (i.e., average weekly prevalence), the number of ICPR per 1000 h of athletics exposure (i.e., incidence), the number of days with ICPR per 1000 h of athletics exposure (i.e., burden), and the time in days until the first ICPR (i.e., time to first injury). For the burden, we used two ways of calculation: (1) we calculated the group-level injury burden as the number of days that the whole group claimed and divided by the athletics exposure of the entire group and multiplied by 1000, together with its 95% confidence interval (95% CI), and (2) we calculated the individual injury burden for each athlete as the number of days sustaining an ICPR divided by the individual athletics exposure and multiplied by 1000, together with the mean and standard deviation (SD) for the entire group.

2.5 | Statistical analysis

We performed descriptive analyses using frequencies and percentages for categorical data and means and standard deviations (SD) for continuous variables.

For each athlete, we calculated his or her individual response rate to the weekly questionnaire by dividing the number of completed weekly questionnaires by the maximum number of questionnaires expected (i.e. 39).[12] We then created sub-groups according to the minimum individual response rates: athletes with a 100% response rate (i.e., complete case analysis), athletes with at least 97% response rate (i.e., at least 38 responses), athletes with at least 95% response rate (i.e., at least 37 responses), etc., to athletes with at least 0% response rate (i.e., all athletes).

After that, we calculated the epidemiological outcomes for each sub-group following the three strategies described in the Introduction section. The first strategy (i.e., only taking into account weekly questionnaires where there was a response regardless of the individual response rate) corresponded to calculating the epidemiological outcomes for the sub-group of athletes with at least 0% response rate (i.e., all athletes). The second strategy (i.e., including athletes with a minimum individual response rate) consisted of calculating the outcomes for all possible cut-offs with minimum individual response rates between 1% and 99% (both included). The third strategy, (i.e., including only athletes with a 100% response rate) corresponded to the sub-group of athletes with a 100% response rate (i.e., complete case analysis).

Finally, for each epidemiological outcome (i.e., prevalence, average prevalence, incidence, burden, and time to first injury), we calculated the relative variation between each sub-group and the sub-group with a 100% response rate as a reference. To explore the magnitude of this variation, we analyzed for which sub-groups the relative variation was greater than one SD or 95% CI of the respective epidemiological outcome calculated in the sub-group with a 100% response rate, such cases were considered as a *substantial variation*.

TABLE 1 Characteristics of the athletes included in the present study.

	Total included athletes (*n* = 391)	
Sex (*n* [%])		
Women	149	(38.1)
Men	242	(61.9)
Age (mean [SD])	30	(6.5)
Body height in cm (mean [SD])	173.0	(8.1)
Body mass in kg (mean [SD])	64.3	(11.6)
Discipline (*n* [%])		
Endurance	305	(78.0)
Explosive	84	(21.5)

Note: Data are presented as mean and standard deviation (SD) for continuous variables, and numbers and percentages (%) for categorical variables.

3 | RESULTS

3.1 | Population and response rate

The results on athletes' characteristics and response rates have already been published in the primary analysis of the "PREVATHLE" RCT (see Edouard et al.[12] for more information). The baseline characteristics of the 391 included athletes are presented in Table 1 and Supplementary Figure S1.

During the follow-up period of 39 weeks, 7209 of the 15 249 weekly questionnaires were returned, resulting in an overall response rate of 47.3%. The individual response rates ranged from 0% (*n* = 51; 13%) to 100% (*n* = 100; 25.6%)

TABLE 2 Number of athletes per sub-groups according to the minimum individual response rates, and minimum individual response rate to the weekly questionnaire for which the relative variation in the epidemiological outcome is higher/lower than its SD or 95%CI.

	Minimum individual response rate to the weekly questionnaire																
	100	**97**	**95**	**92**	**90**	**87**	**85**	**82**	**79**	**77**	**72**	**67**	**64**	**62**	**59**	**56**	**54**
Number of athletes included in the sub-groups based on the minimum individual response rate to the weekly questionnaire	100	115	120	128	133	140	142	146	149	150	153	155	159	160	165	168	174
Number of athletes according to the specific individual response rate to the weekly questionnaire	100	15	5	8	5	7	2	4	3	1	3	2	4	1	5	3	6
Proportion of athletes with ICPR (% [95% CI])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Average weekly prevalence (mean [SD])	0	0	0	0	0	0	0	**1**	0	0	0	0	0	0	0	0	0
Time to first ICPR (weeks) (mean [SD])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Incidence of ICPR (number per 1000 h [95% CI])	0	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Group-level injury burden (number of days with ICPR per 1000 h [95% CI])	0	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Individual injury burden (number of days with ICPR per 1000 h per athlete) (mean [SD])	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Note: The grey boxes are when the relative variation is included in one SD or 95% CI of the respective epidemiological outcome calculated in the sub-group with a 100% response rate, also noted as "0." White boxes are when the relative variation is not included into one SD or 95% CI of the respective epidemiological outcome calculated in the sub-group with a 100% response rate, also indicated by a "1" in the table.

(Table 2 and Figure 1). Figure 2 shows the decrease in the response rate over the 39-week period.

3.2 | Epidemiological outcomes depending on the different minimum individual response rates

When calculating the epidemiological outcomes using the first strategy (i.e., all athletes included), all the epidemiological values, except the average individual injury burden, varied substantially in comparison to only including athletes with a 100% response rate (complete case analysis, third strategy) (Figures 3 and 4, and Table 2).

When calculating the epidemiological outcomes using the second strategy (i.e., including athletes with a certain minimum individual response rate, and testing all possible cut-offs between 1% and 99% minimum individual response rate), the prevalence and average weekly prevalence of ICPR only varied substantially in comparison to only including athletes with a 100% response rate for the sub-groups below a 5% and 10% minimum response rate, respectively (Figures 3 and 4, and Table 2). For the time to first ICPR, we observed a substantial variation for the sub-group of minimum response rate below 18% (Figures 3 and 4, and Table 2). The incidence and group-level injury burden showed substantial variations for all sub-groups of response rates below 100%, while the average individual injury burden did not substantially for any sub-group (Figures 3 and 4, and Table 2).

4 | DISCUSSION

The main finding of the present study was that several epidemiological outcomes varied substantially depending on the strategy to deal with the individual response rates. Some epidemiological outcomes (prevalence, average weekly prevalence, and time to first injury) varied from the complete case analysis when the minimum individual response rate considered for the analysis was less than 20%. The results for other outcomes (incidence and injury burden) were substantially different to the ones obtained with the complete case analysis for all other minimum individual

51	**49**	**46**	**44**	**41**	**38**	**36**	**33**	**31**	**28**	**26**	**23**	**21**	**18**	**15**	**13**	**10**	**8**	**5**	**3**	**0**
177	179	184	187	190	195	200	201	204	209	213	215	219	227	237	248	258	272	294	340	391
3	2	5	3	3	5	5	1	3	5	4	2	4	8	10	11	10	14	22	46	51
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**1**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**1**	**1**	**1**
0	0	0	0	0	0	0	0	0	0	0	0	0	0	**1**	**1**	**1**	**1**	**1**	**1**	**1**
1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	0	0	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
1	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

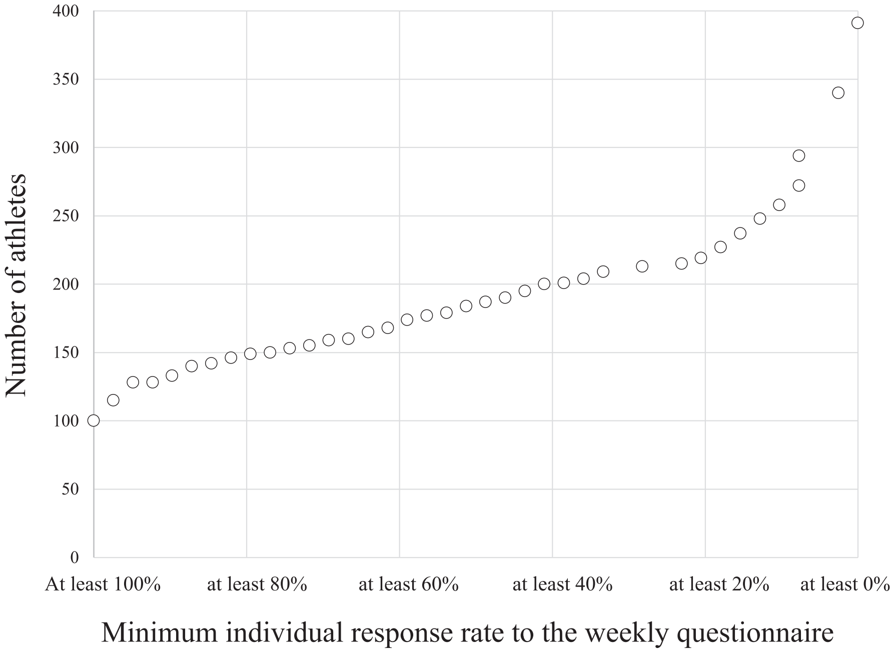

FIGURE 1 Number of athletes according to the minimum individual response rate to the weekly questionnaire.

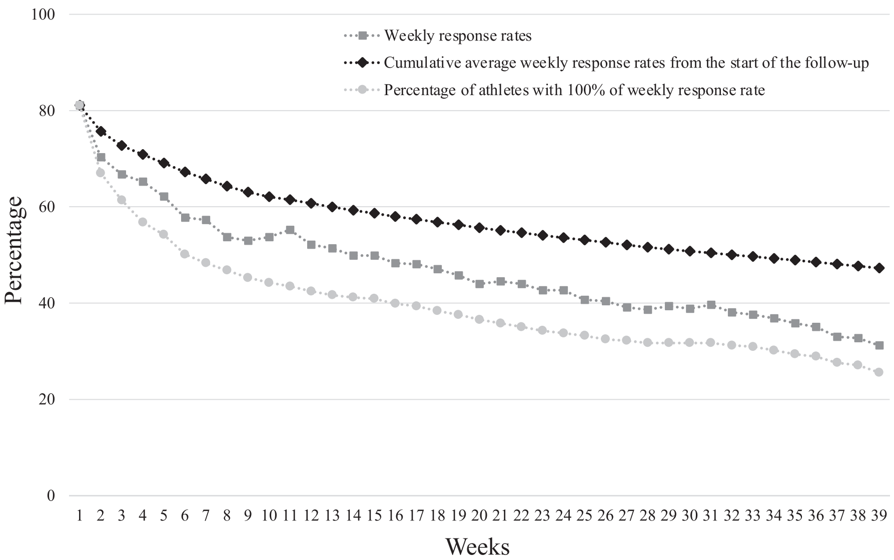

FIGURE 2 Weekly response rates (i.e., number of weekly questionnaires completed for a week divided by the total number of included athletes ($n=391$)), cumulative average weekly response rates from the start of the follow-up (i.e., mean of individual response rates over the studied period), and percentage of athletes with a 100% of weekly response rate, over the 39-week follow-up of the 391 included athletes.

response rates below 100%. When calculating epidemiological outcomes regardless of the individual response rate (i.e., all athletes), all epidemiological outcomes varied substantially compared to the complete case analysis.

4.1 | Response rates should be taken into account to calculate epidemiological outcomes

In sports epidemiological studies using weekly follow-ups, the most commonly used approach to deal with weeks where an athlete's information is missing is to consider that "the week did not exist".[4,5] In these cases, epidemiological outcomes calculation is performed by including all athletes regardless of the response rate. This also implies that athletes who did not complete any questionnaires were included in the analysis. In our present study, we showed that epidemiological outcomes calculated using this approach varied substantially in comparison to the complete case analysis. In addition, epidemiological outcomes varied substantially among the different minimum individual response rate sub-groups. This highlights the potential bias on the epidemiological outcomes that might be induced by neglecting the individual response rates. Taking into account the response rates when calculating epidemiological outcomes seems important for the validity of the results.

Some epidemiological outcomes seemed to be more robust when lower minimum individual response rates were

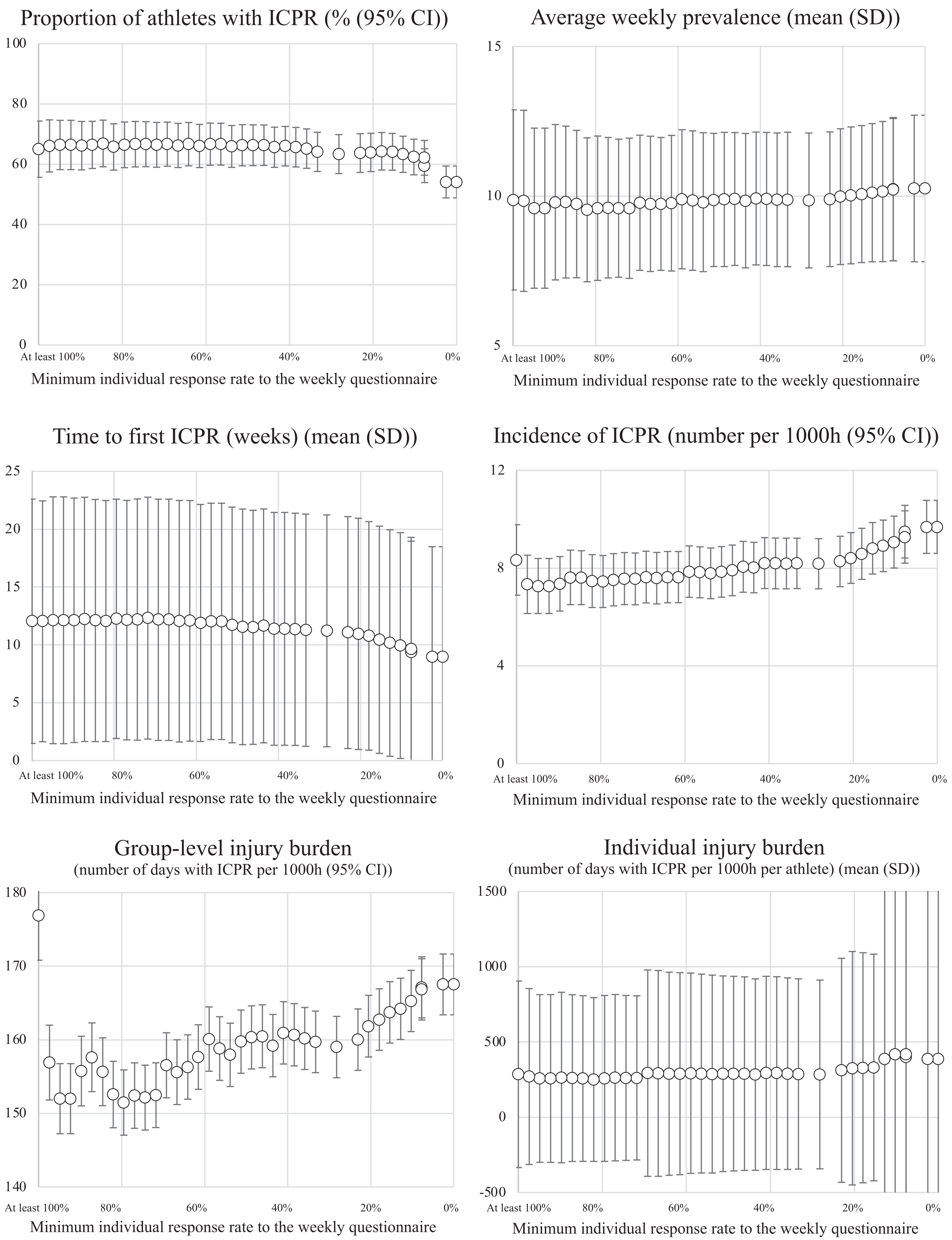

FIGURE 3 Epidemiological outcomes depending on the minimum individual response rate to the weekly questionnaire for total (training and competition) athletics-related injury complaints leading to participation restriction (ICPR).

FIGURE 4 Relative variation of the epidemiological outcomes (circle) compared to the epidemiological outcomes calculated with a 100% of response rate for total (training and competition) athletics-related injury complaints leading to participation restriction (ICPR). The grey zone corresponds to one SD or 95% CI of the respective epidemiological outcome calculated in the sub-group with a 100% response rate.

considered (e.g., prevalence and average weekly prevalence) than others (e.g., incidence and injury burden). This could be explained by the difference in the range of values as numerator and denominator since values to calculate incidence and injury burden varied from 0 to very high values (in our study, for the numerator: number of injuries from 0 to 5 and number of days of time loss from 0 to 224; and for the denominator: exposure to athletics from 0 to 2165) compared to values to calculate prevalence varying from 0 to the total of included athletes (in our study $n=168$). Further, numerator values used to calculate prevalence were closely associated with denominator values.

4.2 | Methodological considerations

We would like to emphasize that our results are valid only for the present dataset, the present data collection methods and the population included in the present study. Thus, we discourage any generalization of the present results regarding the cut-offs of minimal individual response rates for calculating and presenting epidemiological outcomes with other weekly questionnaires and/or population (e.g., sports, countries, levels). However, we suggest that future studies follow the analytical approach of determining study- and outcome-specific cut-offs.

A limitation of the present study was that the SD or 95% CI were high for some outcomes (e.g., individual injury burden), and thus variations were not significant although there were substantial changes. The cause might be an insufficient sample size, not powered enough for the calculation of these outcomes, or the high inter-athlete variability of the outcomes themselves. This raises the question of sample size calculation for epidemiological studies and highlights the importance of considering the SD or 95% CI when analyzing and interpreting epidemiological parameters.

Additionally, we used the values calculated based on athletes with a 100% of the response rate as a reference. However, it has not been proven that the specific sub-group of athletes with a 100% response rate is representative of the entire population, as they could be more prone to reply because they never had any injury or because they are worried about their amounts of injuries. This could result in an under- or over-estimation of the epidemiological results of the total population. Our present study provides some indication about the representativity of the athletes with a 100% response rate. For example, the average weekly prevalence and the time to first injury in the sub-group with a 100% response rate was similar to most other sub-groups with lower response rates, but this did not apply to the incidence and injury burden. In addition, this raises the question of the minimum number of athletes with a 100% of the response rate to determine reference values.

4.3 | Practical implications

Our results have a clear implication for epidemiological and interventional studies on sports injury and sports-related health problems using regular data collection. For future studies, we suggest pre-analyzing the data and defining a study-specific cut-off of minimal individual response rate to include athletes in the analyses of epidemiological outcomes. We recommend using only the sub-group of athletes with a minimum response rate that allows for keeping the epidemiological outcomes stable in the analysis. Some proposals of practical implications on how to process such analysis are in Box 1. We also suggest explaining this approach in the methods section of the manuscripts and presenting the results of this analysis in the results section or Supplementary Materials. If such analysis is not performed, we suggest only presenting the results for prevalence, average weekly prevalence, and/or time to first injury, as, in the present study, they seemed to vary less as lower values of minimum individual response rates are considered.

In addition, further efforts should be put into increasing athletes' response rates so that the amount of missing information is as little as possible.[18] Some suggestions have been reported in the literature[6,12,13]: regular automatic reminders to athletes, having one investigator monitoring the response proportion during the study and trying to enforce participation, educating end-users on the interest in monitoring the change of some characteristics of athletes over the time (e.g., training load, pain, fatigue), providing some visual feedbacks of these characteristics and changes, and providing scientific evidence of the improvement of health and/or performance by using this monitoring.

Furthermore, missing data are common in every field of human research.[14,19] Our results highlight that missing data may strongly impact the study results and it is therefore of great importance to manage them appropriately.[14,18] The management of missing data can depend on the mechanisms causing the missing data, which are usually classified as missing completely at random, missing at random, and missing not at random.[17,18] However, in sports injury epidemiology, the mechanisms that may cause missing data are rarely presented and little information is reported on how these missing data are managed.[8,12,16] This consequently clearly represents an important perspective in sports injury, illness or other health problems epidemiology.

BOX 1 Proposed approach to analyse and report epidemiological outcomes from prospective data collection studies using weekly (or regular) self-reported online questionnaires for athletes

1. Calculate the response rate to the weekly online questionnaire based on the primary outcome for each athlete included in the study;
2. calculate the different epidemiological outcomes according to the minimum athletes' response rate, ranging from the sub-group of athletes with a 100% response rate to all included athletes;
3. calculate the relative variation for each epidemiological outcome between the sub-group of athletes with a 100% response rate and each other sub-group of athletes according to their minimum response rate;
4. determine the minimum athletes' response rate for which the relative variation of the epidemiological outcome is higher or lower than its SD or 95% CI;
5. report the epidemiological outcomes calculated for the sub-group of athletes with minimum athletes' response rate for which there were no variation of the epidemiological outcomes in comparison to its SD or 95% CI (i.e., value included in the SD or 95% CI);
6. present the details of this analytical procedure in the methods section, and report the details of the analysis of the different epidemiological outcomes for each minimum athletes' response rate in the results section or supplementary materials.

5 | PERSPECTIVES

The present study showed that the results of epidemiological outcomes varied substantially depending on the strategy to deal with the individual response rates. Injury prevalence, average weekly prevalence, and time to first injury were affected less than injury incidence and burden by including in the analysis athletes with lower individual response rates. This highlights the importance of carefully determining the minimum individual response rates for athletes to be included in the analysis when calculating the epidemiological outcomes (e.g., prevalence, average prevalence, incidence, burden, and time to injury). Thus, we propose that prospective studies using weekly athletes' self-reported questionnaires determine the optimal study- and outcome-specific cut-off of minimal individual response rate and use this in the analysis and reporting of epidemiological outcomes (Box 1).

AUTHOR CONTRIBUTIONS

Pascal Edouard conceived the study, performed data analyses and drafted the manuscript. All co-authors discussed the analysis, contributed substantially to interpreting the results, provided important revisions, and approved the manuscript. All authors understand that they are accountable for all aspects of the work and ensure the accuracy or integrity of this manuscript.

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CONFLICT OF INTEREST STATEMENT

None declared. PE is an Associate Editor for the British Journal of Sports Medicine. KH is an Editor for the German Journal of Sports Medicine. PE and KH are Associate Editors for the BMJ Open Sports and Exercise Medicine.

DATA AVAILABILITY STATEMENT

Data are available upon reasonable request. Requests for data sharing from appropriate researchers and entities will be considered on a case-by-case basis. Interested parties should contact the corresponding author Pascal Edouard (pascal.edouard@univ-st-etienne.fr).

INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study.

ORCID

Pascal Edouard https://orcid.org/0000-0003-1969-3612
Pierre-Eddy Dandrieux https://orcid.org/0000-0001-7230-6728

David Blanco https://orcid.org/0000-0003-2961-9328
Laurent Navarro https://orcid.org/0000-0002-8788-8027
Astrid Junge https://orcid.org/0000-0002-6815-9793
Karsten Hollander https://orcid.org/0000-0002-5682-9665

REFERENCES

1. van Mechelen W, Hlobil H, Kemper HCG. Incidence, severity, aetiology and prevention of sports injuries. *Sport Med*. 1992;14:82-99.
2. Bahr R, Clarsen B, Derman W, et al. International Olympic Committee consensus statement: methods for recording and reporting of epidemiological data on injury and illness in sport 2020 (including STROBE extension for sport injury and illness surveillance (STROBE-SIIS)). *Br J Sports Med*. 2020;54:372-389. doi:10.1136/bjsports-2019-101969
3. Jacobsson J, Timpka T, Kowalski J, et al. Injury patterns in Swedish elite athletics: annual incidence, injury types and risk factors. *Br J Sports Med*. 2013;47:986-991. doi:10.1136/bjsports-2013-092676
4. Clarsen B, Rønsen O, Myklebust G, Flørenes TW, Bahr R. The Oslo sports trauma research center questionnaire on health problems: a new approach to prospective monitoring of illness and injury in elite athletes. *Br J Sports Med*. 2014;48:754-760. doi:10.1136/bjsports-2012-092087
5. Clarsen B, Bahr R, Myklebust G, et al. Improved reporting of overuse injuries and health problems in sport: an update of the Oslo Sport Trauma Research Center questionnaires. *Br J Sports Med*. 2020;54:390-396. doi:10.1136/bjsports-2019-101337
6. Clarsen B, Steffen K, Berge HM, et al. Methods, challenges and benefits of a health monitoring programme for Norwegian Olympic and Paralympic athletes: the road from London 2012 to Tokyo 2020. *Br J Sports Med*. 2021;55:1342-1349. doi:10.1136/bjsports-2020-103717
7. Gabbe BJ, Finch CF, Bennell KL, Wajswelner H. How valid is a self reported 12 month sports injury history? *Br J Sports Med*. 2003;37:545-547. doi:10.1136/bjsm.37.6.545
8. Edouard P, Dandrieux P-E, Chapon J, et al. One-season epidemiology of injury complaints in athletics (track and field). *Dtsch Z Sportmed*. 2022;73:215-220. doi:10.5960/dzsm.2022.544
9. Junge A, Dvorak J. Influence of definition and data collection on the incidence of injuries in football. *Am J Sports Med*. 2000;28:S40-S46.
10. Andersson SH, Bahr R, Clarsen B, Myklebust G. Preventing overuse shoulder injuries among throwing athletes: a cluster-randomised controlled trial in 660 elite handball players. *Br J Sports Med*. 2017;51:1073-1080. doi:10.1136/bjsports-2016-096226
11. Pas HIMFL, Pluim BM, Kilic O, et al. Effectiveness of an e-health tennis-specific injury prevention programme: randomised controlled trial in adult recreational tennis players. *Br J Sports Med*. 2020;54:1036-1041. doi:10.1136/bjsports-2019-101142
12. Edouard P, Steffen K, Peuriere M, Gardet P, Navarro L, Blanco D. Effect of an unsupervised exercises-based athletics injury prevention programme on injury complaints leading to participation restriction in athletics: a cluster-randomised controlled trial. *Int J Environ Res Public Health*. 2021;18:11334. doi:10.3390/ijerph182111334
13. Barboza SD, Bolling CS, Nauta J, Mechelen W, Verhagen E. Acceptability and perceptions of end-users towards an online sports-health surveillance system. *BMJ Open Sport Exerc Med*. 2017;3:1-8. doi:10.1136/bmjsem-2017-000275
14. Altman DG, Bland JM. Missing data. *Br Med J*. 2007;334:424. doi:10.1136/bmj.38977.682025.2C
15. Edouard P, Cugy E, Dolin R, et al. The athletics injury prevention programme can help to reduce the occurrence at short term of participation restriction injury complaints in athletics: a prospective cohort study. *Sports*. 2020;8:84. doi:10.3390/sports8060084
16. Hespanhol Junior LC, Huisstede BMA, Smits DW, et al. The NLstart2run study: economic burden of running-related injuries in novice runners participating in a novice running program. *J Sci Med Sport*. 2016;19:800-804. doi:10.1016/j.jsams.2015.12.004
17. Jakobsen JC, Gluud C, Wetterslev J, Winkel P. When and how should multiple imputation be used for handling missing data in randomised clinical trials—a practical guide with flowcharts. *BMC Med Res Methodol*. 2017;17:162. doi:10.1186/s12874-017-0442-1
18. Heymans MW, Twisk JWR. Handling missing data in clinical research. *J Clin Epidemiol*. 2022;151:185-188. doi:10.1016/j.jclinepi.2022.08.016
19. Little RJ, D'Agostino R, Cohen ML, et al. The prevention and treatment of missing data in clinical trials. *N Engl J Med*. 2012;367:1355-1360. doi:10.1056/nejmsr1203730

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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