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Inequality and distribution of injury burden in elite basketball: a cohort study using complementary analytical approaches

Javier Pérez-Murillo[1,2], Pedro Cotolí-Suarez[1], Borja Ricart-Luna[1,3,4], Vicente Sebastià Alcacer[1], Marcelino Pérez-Bermejo[2,5*], María Teresa Murillo-Llorente[2,6] and Eloy Jaenada-Carrilero[7]

Abstract

Background Injury epidemiology in basketball has traditionally focused on incidence and injury type, with limited attention to how injury burden is distributed within teams. Understanding the distribution of time-loss may provide a complementary perspective on the impact of injuries on player availability. The aim of this study was to describe injury epidemiology and to analyze the distribution and inequality of injury burden during a competitive season in elite basketball players.

Methods A retrospective longitudinal observational study was conducted using routinely collected clinical data from a professional basketball club during the 2024–2025 season. Forty players (male and female) from four teams were included. Injury incidence was calculated as injuries per 1000 athlete-days. Injury burden was defined as total days lost. Distribution of injury burden was assessed using Lorenz curves, the Gini coefficient, and Pareto analysis. Multilevel modelling and clustering were applied as exploratory, hypothesis-generating analyses of player-level variability. Non-parametric tests (Mann-Whitney U and Kruskal-Wallis) and chi-square tests were used for group comparisons.

Results A total of 50 injuries were recorded, accounting for 1369 days lost, corresponding to an overall incidence of 1.70 injuries per 1000 athlete-days (95% CI: 1.26–2.24). Injury burden showed a moderate-to-high degree of inequality (Gini = 0.61; 95% CI: 0.45–0.70). A relatively small proportion of injuries accounted for a substantial share of total time-loss: 5 injuries (10%) explained 50% of the burden, 18 injuries (36%) explained 80%, and 28 injuries (56%) explained 90%. No consistent relationship was observed between injury incidence and burden across teams.

Conclusions Injury burden in elite basketball appears to be unevenly distributed, with a limited number of injuries contributing substantially to total time-loss. These findings suggest that assessing the distribution of injury burden, rather than relying solely on incidence, may provide additional, preliminary insight into injury impact. However, given the observational design and limited sample size, these findings should be interpreted with caution.

Keywords Athletic injuries, Basketball, Injury burden, Health status disparities, Epidemiology, Sports medicine

*Correspondence:
Marcelino Pérez-Bermejo
marcelino.perez@ucv.es

Full list of author information is available at the end of the article

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Background

Basketball is characterized by a high incidence of musculoskeletal injuries, highlighting its clinical and epidemiological relevance [1]. It is widely practiced worldwide and involves intermittent high-intensity activity including accelerations, decelerations, jumps, landings, changes of direction, and player contact. These biomechanical demands impose substantial loads on the musculoskeletal system and are associated with a high risk of injury across competitive levels [1–4]. Epidemiological evidence consistently shows that most injuries affect the lower extremities, accounting for approximately two-thirds of all cases, with the ankle and knee being the most frequently involved sites, particularly ankle sprains and knee ligament injuries [1, 5–8].

The injury profile of basketball is closely linked to these biomechanical demands. Jumping and landing actions, particularly under contact conditions such as rebounds, represent one of the most common injury mechanisms [7]. It has been reported that up to 78% of players may experience at least one ankle sprain during their careers, underscoring the high burden of such injuries in this sport [9]. Injury incidence varies according to competitive level, age, and exposure context. In collegiate basketball, incidence rates of approximately 7.28 injuries per 1000 athlete-exposures have been reported, with higher rates during competition than training [10]. Longitudinal studies in professional leagues have also shown that a substantial proportion of injuries result in time-loss, directly affecting player availability [11].

Injury surveillance, based on standardized recording systems, is a cornerstone of sports medicine, enabling the quantification of injury magnitude and the identification of patterns and risk factors. To improve methodological quality and comparability, standardized definitions and procedures have been established. The International Olympic Committee consensus provides recommendations on injury definition, exposure measurement, and severity classification to harmonize epidemiological research in sport [12].

Traditionally, sports injury research has focused on incidence as the primary indicator of risk. However, in professional sport, incidence alone may be insufficient to capture the real impact of injuries on performance. The concept of injury burden, which integrates both frequency and severity, has been proposed to better reflect the consequences of injuries on athlete availability [13].

Despite this conceptual advance, most studies in basketball have continued to rely primarily on incidence-based approaches or descriptive analyses of injury types, with limited attention to how injury burden is distributed within teams. From a performance and clinical perspective, this limitation is relevant, as the competitive impact of injuries may be disproportionately driven by a relatively small subset of high-burden cases rather than by overall injury frequency [14, 15]. Specifically, although the burden concept is increasingly applied in team-sport epidemiology, no previous basketball study has quantified how injury burden is distributed within a team, leaving the distributional structure of time-loss, and the extent to which it is concentrated in a small number of injuries or players, largely uncharacterized. Addressing this gap is the specific aim of the present exploratory study.

Analytical approaches derived from inequality research, such as Lorenz curves, Gini coefficients, and Pareto analysis, provide a robust framework to quantify how injury burden is distributed and concentrated within teams. In addition, integrating these approaches with multilevel modeling and clustering techniques may offer a preliminary, exploratory characterization of player-level heterogeneity in injury burden, complementing rather than replacing traditional epidemiological descriptions. However, the application of these analytical methods in small observational cohorts requires careful interpretation, and their use in this study should be understood primarily as exploratory, aiming to generate hypotheses and provide an initial characterization of injury burden distribution rather than to establish predictive models.

Therefore, the aim of this study was to describe injury epidemiology and to analyze the distribution and inequality of injury burden during a competitive season in a cohort of elite male and female basketball players using a set of complementary, exploratory analytical approaches. Specifically, we examined injury frequency, type, and severity, as well as the distribution of time-loss across players, to provide an initial, exploratory assessment of the impact of injuries on competitive availability in professional basketball.

Methods

Study design and setting

A retrospective longitudinal observational study was conducted using secondary analysis of routinely collected clinical and performance monitoring data from the Valencia Basket Club during the 2024–2025 season. The observation period spanned from August 1, 2024, to June 30, 2025, including preseason assessment (August-September) and prospective injury follow-up during the competitive period (October-June). The study was performed under real-world professional conditions without modifications to training programs, competition schedules, or injury management protocols, and was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Participants

The study population comprised male and female players from four teams (first and second squads) competing within the same professional organization. Eligible participants were those officially registered during the study season with available preseason anthropometric assessment and complete injury records. Players lacking baseline assessment or with incomplete injury data preventing identification of injury episodes or estimation of time-loss were excluded. The four teams competed in different national and, in some cases, international competitions, with different competitive calendars and match demands. During the 2024–2025 season, the first men's team competed in the Liga Endesa (ACB), the Copa del Rey, and the BKT EuroCup (65 official matches); the first women's team competed in the Liga Femenina Endesa, the Copa de la Reina, the Supercopa Endesa, and the EuroLeague Women (51 official matches); the second men's team competed in LEB Plata, the third professional division of Spanish basketball (40 official regular-season matches); and the second women's team competed in the Liga Challenge, the second professional division of Spanish basketball (34 regular-season and 4 play-off matches). The four teams therefore differed substantially in competitive level and in the number of official matches played, which is relevant when interpreting between-team differences in workload and injury exposure.

Consequently, the teams were not subject to a single common preseason regulation; in particular, the EuroLeague players' framework agreement governs EuroLeague participants and did not formally apply to these teams during the study season. Preseason duration, the number of training sessions, and the number of preparatory and official matches were therefore not standardized across teams. For the first men's team, the preseason training camp did not exceed approximately 35 days. All eligible players within the defined cohort were included, and no formal sample size calculation was performed due to the observational nature of the study and the use of a closed, real-world population.

Injury surveillance

Injury data were extracted from the club's medical registry, where diagnoses and recovery processes are systematically recorded by sports physicians and physiotherapists. For each injury, the date of diagnosis, injury type, anatomical location, and return-to-play date were documented. Time-loss was defined as the number of days between diagnosis and full medical clearance for unrestricted participation in training and competition.

Injury definition and classification

An injury was defined as any musculoskeletal condition related to basketball participation, recorded by medical staff, that resulted in time-loss or restriction of participation, in accordance with the International Olympic Committee consensus statement [12]. In this study, time-loss was used as the primary operational criterion for defining injury severity and burden, while participation restriction was considered a complementary criterion for case identification. This distinction was applied to ensure consistency in outcome measurement and to align the definition with time-loss-based epidemiological approaches. Injuries were classified by type (muscle, ligament, tendon, bone, or joint) and anatomical location (ankle, knee, thigh, lower leg, foot, hip, lumbar region, shoulder, or hand). The club's medical registry also records other health events, including injuries of other types and common illnesses; however, only injuries meeting the time-loss musculoskeletal definition described above were included in the present analysis. During the study period, no head or facial injuries (e.g., nasal, ocular, auricular, or periorbital) were recorded among the included injuries; accordingly, the anatomical classification did not include a head or face category.

Injury severity

Injury severity was categorized based on time-loss as minimal/mild (0–7 days), moderate (8–28 days), and severe (> 28 days).

Injury burden

The primary outcome was injury burden, defined as the total number of days lost due to injury during the study period. For each player, the total number of injuries, cumulative time-loss days, and mean days lost per injury were calculated and subsequently aggregated at team level.

Injury incidence

Injury incidence was calculated as (number of injuries / total athlete-days of follow-up) × 1000, and expressed as injuries per 1000 athlete-days. Confidence intervals (95%) for injury incidence were calculated using exact Poisson methods. Athlete-days of follow-up were used as a proxy for exposure due to the absence of detailed individual exposure data (e.g., minutes of play or training load), allowing standardized comparison across teams. This approach represents a pragmatic approximation and does not fully capture individual variability in actual exposure, and therefore may introduce bias in the estimation of incidence rates. Accordingly, incidence results should be interpreted with caution. In particular, neither training nor match exposure (e.g., number of sessions or minutes played) was available, and exposure is likely to have differed across teams given their different competitions and calendars, which further limits the comparability of incidence estimates between teams.

Incidence-burden matrix

To jointly assess injury frequency and severity, an incidence-burden matrix was constructed, in which each team was represented according to injury incidence and mean time-loss per injury.

Distribution and inequality of injury burden

To examine how injury burden was distributed within teams, players were ranked according to their individual injury burden, and cumulative proportions of time-loss were calculated. Distribution was assessed using Lorenz curves, which describe the relationship between the cumulative proportion of injuries and the cumulative proportion of days lost. Inequality was quantified using the Gini coefficient. Confidence intervals (95%) for the Gini coefficient were estimated using a non-parametric bootstrap approach based on injury-level time-loss values (2000 resamples).

Additionally, a Pareto analysis was performed to identify the proportion of injuries accounting for the majority of total time-loss.

Statistical analysis

Descriptive statistics were used to summarize the characteristics of the study sample. Continuous variables are presented as mean ± standard deviation (SD) or median and interquartile range (IQR), depending on data distribution, while categorical variables are expressed as absolute and relative frequencies.

Between-group comparisons were performed using non-parametric tests due to the skewed distribution of time-loss data. The Mann-Whitney U test was used for comparisons between two groups (e.g., sex), and the Kruskal-Wallis test for comparisons across multiple groups (e.g., teams). Injury severity distributions were compared using the chi-square test. Effect sizes were calculated for the main group comparisons (epsilon-squared for the Kruskal-Wallis test, r for the Mann-Whitney U test, and Cramér's V for the chi-square test), and exact Poisson 95% confidence intervals were calculated for team-level injury incidence.

To account for the hierarchical structure of the data (injuries nested within players), a linear mixed-effects model with random intercepts for players was fitted, using log(1 + days lost) as the dependent variable. The intraclass correlation coefficient (ICC) was calculated to estimate the proportion of variance attributable to between-player differences. The use of mixed-effects modeling was justified by the nested structure of the data and aimed to provide an estimate of variability at different analytical levels rather than to develop predictive models.

Player-level patterns of injury burden were further explored using K-means clustering based on the number of injuries and total days lost per player. Variables were standardized (z-scores), and the number of clusters was determined using the elbow method. Given the limited sample size, clustering analysis was conducted as an exploratory technique to identify potential patterns of burden distribution, and its results should be interpreted with caution, particularly in relation to small cluster sizes. In particular, clusters comprising very few players, including any single-player cluster, should be regarded as reflecting extreme individual cases rather than stable or generalizable subgroups.

All analyses were conducted using R statistical software (version 4.5.3; R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was set at $p < 0.05$.

Ethical considerations

The study protocol was approved by the Ethics Committee of the Universidad Católica de Valencia (UCV/2025–2026/072). All participants provided informed consent authorizing the use of anonymized data for research purposes. Procedures complied with the Declaration of Helsinki and applicable data protection regulations.

Results

Cohort characteristics

A total of 50 injuries were recorded during the study period, accounting for 1369 days lost, corresponding to an overall incidence was 1.70 injuries per 1000 athlete-days (95% CI: 1.26–2.24). The cohort included 40 players (23 male and 17 female). Age did not differ significantly between sexes. Days lost per injury did not differ significantly between sexes, with a negligible effect size ($r = 0.08$). A relevant proportion of players sustained more than one injury during the season. Detailed descriptive characteristics are presented in Table 1.

Table 1 Descriptive characteristics of the cohort

Variable	Total	Male	Female	*p*-value
Players (*n*)	40	23	17	-
Age, mean ± SD	25.3 ± 5.4	24.6 ± 4.9	26.3 ± 6.0	0.403
Age, median (IQR)	25.5 (21.0-29.5)	25.0 (21.5–28.0)	27.0 (21.0–31.0)	
Injuries (*n*)	50	34	16	-
Days per injury, mean ± SD	27.4 ± 51.9	29.9 ± 60.7	22.1 ± 25.5	0.580
Days per injury, median (IQR)	11 (7–26)	10 (6–28)	12 (8–21)	

Table 2 Injury incidence, burden and severity by team

Team	Players	Injuries	Injuries / 1000 athlete-days	Total days lost	Mean ± SD (days)	Median (IQR)	*p*-value*	0–7 days	8–28 days	> 28 days	*p*-value**
1st male team	13	21	2.07	697	33.2 ± 75.2	9.0 (5.0-28.5)	0.032	8	8	5	0.790
2nd male team	10	13	1.44	319	24.5 ± 26.9	16.0 (9.0–33.0)		2	8	3	
1st female team	9	8	1.61	233	29.1 ± 29.6	18.5 (12.0–33.0)		2	4	2	
2nd female team	8	8	1.51	120	15.0 ± 17.2	9.5 (7.0–12.0)		2	5	1	

*Kruskal–Wallis test for differences in days lost across teams

**chi-square test for severity distribution

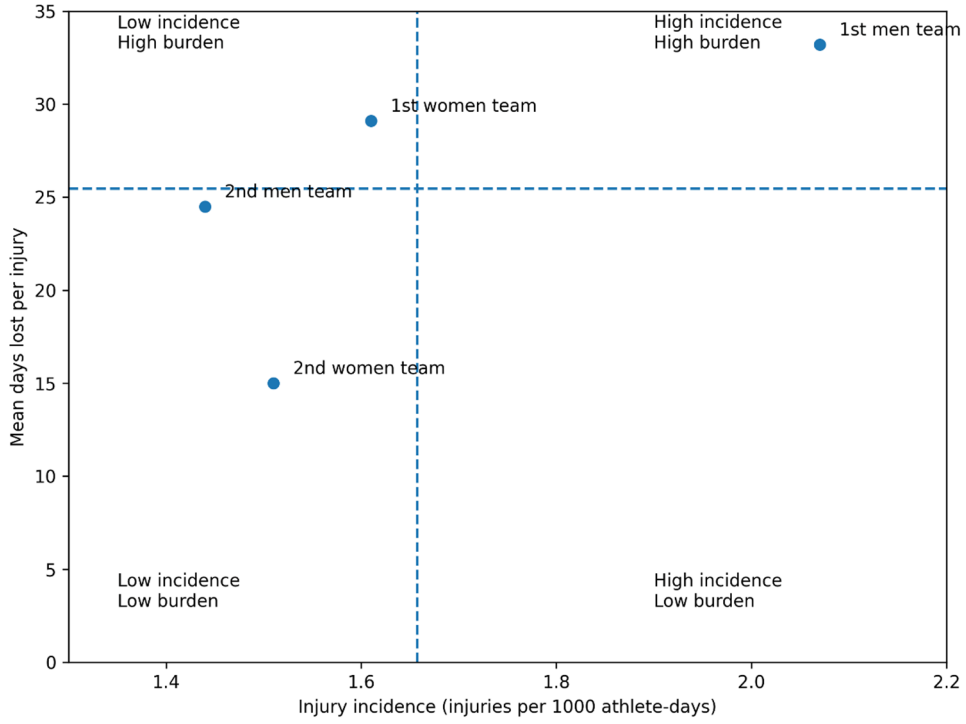

Fig. 1 Incidence-burden matrix by team. Each point represents a team positioned according to injury incidence (injuries per 1000 athlete-days) and mean time-loss per injury (days)

Injury incidence, burden and severity across teams

Team-specific injury incidence and time-loss descriptors are summarised in Table 2. Statistically significant differences were observed between teams in days lost per injury, although no consistent relationship between injury incidence and burden was identified. This pattern is illustrated in Fig. 1. The distribution of injury severity across teams is also shown in Table 2, with no significant differences between groups. Exact Poisson 95% confidence intervals for team-level incidence overlapped substantially (first men's team 2.07, 95% CI 1.28–3.16; second men's team 1.44, 95% CI 0.77–2.46; first women's team 1.61, 95% CI 0.70–3.17; second women's team 1.51, 95% CI 0.65–2.98), indicating that the apparent between-team differences in incidence were not robust. The effect size for the between-team difference in days lost per injury was moderate but unstable (epsilon-squared = 0.18), whereas the difference in severity distribution was small (Cramér's V = 0.18); given the small number of players and injuries per team, these between-team comparisons should be interpreted as preliminary.

Distribution and inequality of injury burden

The cumulative distribution of time-loss revealed a moderate-to-high degree of inequality in injury burden (Gini = 0.61; 95% CI: 0.45–0.70). A relatively small proportion of injuries accounted for a substantial share of total time-loss: 5 injuries (10%) explained 50% of the burden, 18 injuries (36%) explained 80%, and 28 injuries (56%) explained 90%.

The Lorenz curve (Fig. 2A) illustrates the unequal distribution of time-loss across injuries, while the Pareto curve (Fig. 2B) further highlights the concentration of burden within a subset of cases. Overall, these findings indicate that injury burden was not evenly distributed

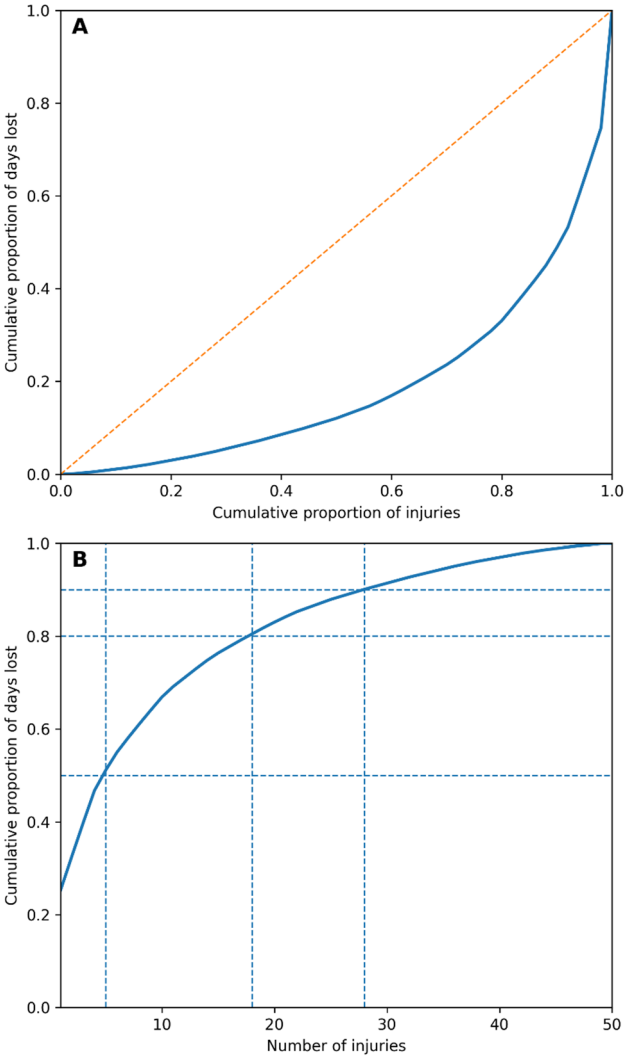

Fig. 2 Distribution of injury burden. Panel (**A**): Lorenz curve illustrating inequality in the cumulative distribution of time-loss across injuries. Panel (**B**): Pareto curve showing the cumulative proportion of total time-loss attributable to injuries

but instead showed a concentration within a subset of higher-burden episodes.

Multilevel modeling of injury burden

To account for the hierarchical structure of the data (injuries nested within players), a linear mixed-effects model was fitted. The intraclass correlation coefficient (ICC = 0.04) indicated that approximately 4% of the variance in time-loss was attributable to between-player differences, with most variability occurring at the injury level. Given the limited sample size and the low number of injuries, this estimate is statistically unstable, and the variance components should be interpreted with caution. These results should be interpreted descriptively, as the model was applied to characterize variability rather than to support predictive inference.

Table 3 Player-level injury burden clusters

Cluster	Mean injuries	Total days lost	Mean days per player	Mean duration (days)	Players
Cluster 1	1.4	434	18.9	13.6	23
Cluster 2	2.3	585	83.6	36.5	7
Cluster 3	2.0	350	350.0	175.0	1

Player-level heterogeneity and clustering

Clustering analysis identified preliminary, exploratory groupings of players according to injury burden (Table 3). The majority of players belonged to a low-burden group characterized by a low number of injuries and limited cumulative time-loss. A smaller subgroup exhibited higher burden, while a single player represented an extreme case with disproportionately high time-loss. This single-player cluster should be interpreted as an extreme individual outlier rather than as evidence of a distinct, reproducible burden pattern. Given the limited sample size and the presence of a cluster consisting of a single player, these findings should be interpreted as exploratory.

The distribution of these profiles is shown in Fig. 3. These findings suggest the presence of heterogeneity in injury burden at the player level, reinforcing the notion that team-level burden may be driven by a limited subset of high-burden cases.

Discussion

Principal findings

The present study examined injury epidemiology and the distribution of injury burden during a competitive season in elite basketball. The main finding was a moderate-to-high inequality in time-loss distribution, indicating that injury burden was not evenly distributed across injuries or players. From a performance perspective, these results suggest that the competitive impact of injuries may not be determined solely by overall injury frequency but may also be influenced by how time-loss is distributed within the team, with a relatively small subset of injuries accounting for a substantial proportion of total days lost.

Comparison with previous literature

The epidemiological patterns observed in this study are consistent with previous research in basketball, which has reported a high incidence of musculoskeletal injuries, predominantly affecting the lower extremities [1, 5–8]. Prior studies have consistently identified ankle sprains, knee injuries, and muscle injuries as the most common diagnoses in both amateur and professional settings [1, 10, 11]. These findings reinforce the external validity of our data and confirm that the overall injury profile of the present cohort aligns with established patterns in basketball injury epidemiology.

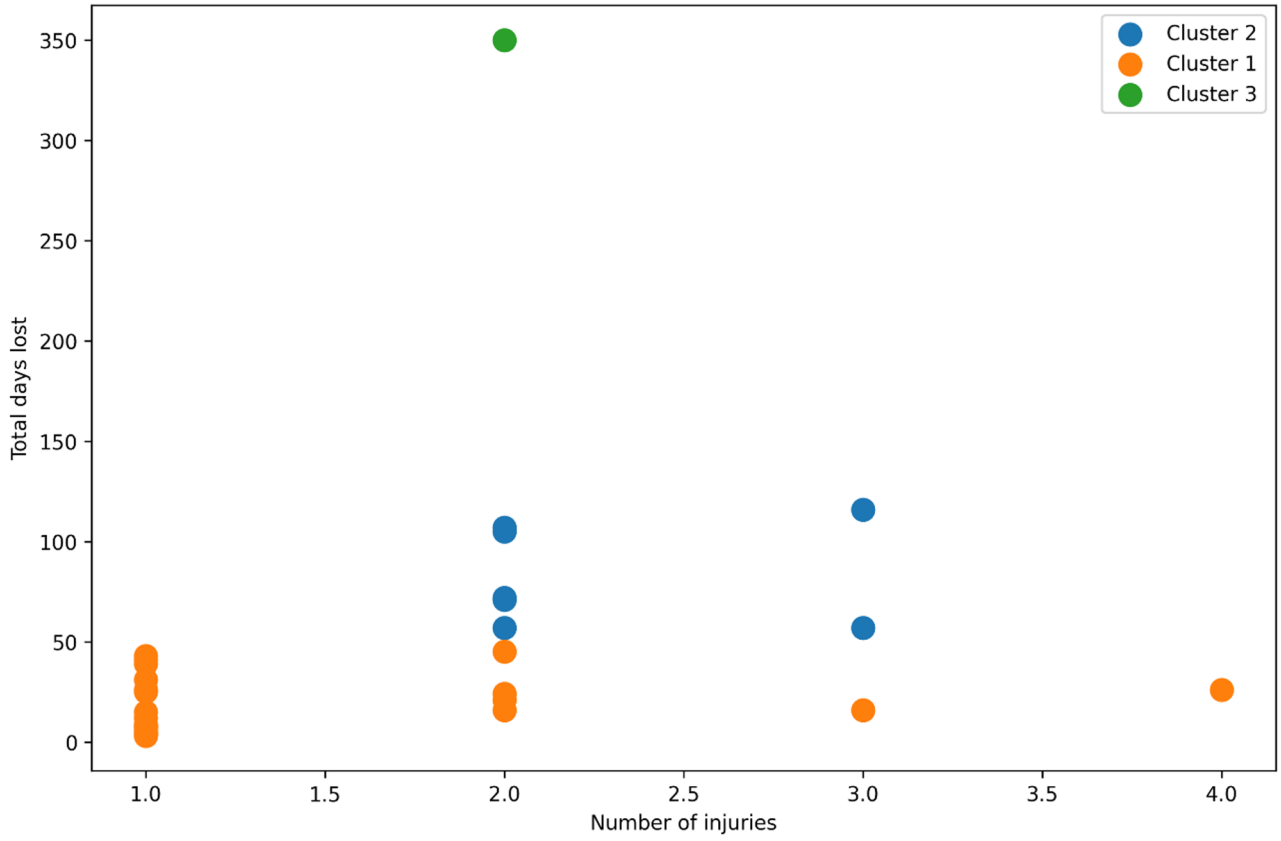

Fig. 3 Player-level injury burden groupings identified through exploratory clustering analysis. The scatter plot shows the distribution of players according to number of injuries and total time-loss. Each point represents an individual player, and colors indicate the clusters identified using the K-means algorithm

However, the main contribution of this study lies not in the description of injury incidence or types, but in the analysis of how injury burden is distributed within teams. While previous studies have reported time-loss and severity, these metrics have typically been analyzed descriptively, without examining their distributional structure.

In this regard, our findings are consistent with research in other team sports, where it has been shown that a relatively small proportion of injuries can account for a disproportionately large share of total time-loss [16–18]. In professional soccer, for example, studies from the UEFA Elite Club Injury Study have demonstrated that severe injuries, although less frequent, contribute substantially to the overall burden of time-loss [19]. These observations support the notion that the impact of injuries in team sports may be influenced by their severity and distribution, rather than by incidence alone.

Interpretation from an inequality perspective

The application of inequality metrics, such as the Gini coefficient and Lorenz curves, provides a complementary perspective to traditional epidemiological approaches. In the present study, the Gini coefficient (0.61; 95% CI: 0.45–0.70) indicates a moderate-to-high degree of inequality, suggesting that injury burden is moderately concentrated but not exclusively driven by extreme outliers [13].

This pattern suggests that injury burden may be distributed across a subgroup of players and injuries contributing cumulatively to time-loss, rather than being driven by a single extreme case. The Pareto analysis further supports this interpretation, showing that a limited proportion of injuries accounted for the majority of days lost, although the distribution was less extreme than would be expected under highly concentrated scenarios.

Player-level heterogeneity and injury patterns

The clustering analysis suggested preliminary, exploratory groupings of injury burden at the player level, with the majority of players exhibiting low burden and a smaller subgroup accumulating higher time-loss. In addition, the presence of an extreme case underscores the variability in individual injury trajectories.

These findings are consistent with conceptual models of injury etiology that emphasize the dynamic and multifactorial nature of injury risk [14, 15]. According to these models, injury occurrence is influenced by the

interaction of intrinsic factors, exposure, and previous injury history, which may lead to heterogeneous patterns of injury accumulation across players. However, given the limited sample size and the presence of a cluster consisting of a single player, these findings should be interpreted as exploratory.

From an analytical perspective, these exploratory groupings are consistent with some variability in injury burden within the team; however, given the very small sample and the single-player cluster, they should be regarded as hypothesis-generating and require confirmation in larger cohorts.

Practical implications

From a practical standpoint, these findings may have implications for injury prevention and performance management in elite basketball. If injury burden is unevenly distributed, interventions focused solely on reducing overall incidence may be insufficient to fully capture the complexity of injury impact. In practical terms, concentration metrics such as the Lorenz curve and the Gini coefficient could be used to quantify the degree to which time-loss is driven by a small number of cases and, on that basis, to help prioritize monitoring, individualized load management, and return-to-play resources toward the highest-burden players. This potential application is, however, hypothesis-generating: given the exploratory design and the limited, single-club sample, these suggestions would require validation in larger, multi-club cohorts before they could inform clinical or performance decisions.

Instead, targeted strategies aimed at identifying and managing high-burden cases may offer greater impact. These may include individualized load monitoring, tailored rehabilitation protocols, and more cautious return-to-play strategies for players at increased risk of recurrent or severe injuries. In this context, previous research has highlighted the importance of monitoring training load and recovery to reduce injury risk in elite athletes [20].

Strengths and limitations

This study has several strengths, including the use of real-world data from a professional basketball setting and the integration of multiple analytical approaches to examine injury burden. The combination of inequality metrics, multilevel modeling, and clustering provides a broader descriptive assessment of injury impact compared to traditional descriptive analyses.

However, several limitations should be considered. First, the study was conducted in a single professional club, which may limit the generalizability of the findings. Second, the relatively small sample size restricts statistical power and limits the robustness of more complex analytical approaches. In addition, the cohort was heterogeneous: male and female players, and first- and second-team squads competing in different competitions with different physical demands, workloads, and medical management, were pooled in the same analyses. This heterogeneity may have introduced between-group variability that the present design and sample size cannot fully disentangle, and the results should therefore be interpreted primarily within the context of this single club rather than generalized to elite basketball as a whole. In particular, the clustering analysis should be interpreted with caution due to the presence of small cluster sizes. One cluster comprised a single player, so the clustering structure is unstable and should be regarded as exploratory rather than as evidence of distinct, reproducible player profiles. Relatedly, the low number of injuries limits the robustness of the variance components estimated in the mixed-effects model, including the ICC, which should be considered unstable. Third, injury incidence was estimated using athlete-days as a proxy for exposure, which does not fully capture individual workload, and may introduce bias in incidence estimates. Fourth, between-team comparisons should be interpreted with caution: although exact Poisson 95% confidence intervals for team-level incidence and effect sizes for the main group comparisons are now reported, the number of players and injuries per team was small and the confidence intervals were wide and overlapping, so apparent between-team differences should be regarded as preliminary. This limitation should be considered when interpreting incidence-related findings. Finally, the retrospective design relies on the accuracy and completeness of clinical records and may be subject to underreporting of minor injuries.

Future directions

Future research should aim to replicate these findings in larger, multicenter cohorts across different competitive levels and sports. The application of inequality-based approaches in sports injury research remains limited, and further studies are needed to establish their utility in different contexts.

In addition, integrating detailed exposure metrics, longitudinal designs, and advanced analytical techniques may provide deeper insight into the mechanisms underlying injury burden distribution and support the development of improved prevention strategies. In particular, future studies should examine contextual factors that may influence injury risk and burden, such as the length and content of the preseason, the number of official matches, and the number of simultaneous competitions in which elite European clubs participate (frequently two or three), since characterizing these factors may help to prevent injuries and, especially, to reduce the occurrence of severe injuries. In particular, larger datasets will

be necessary to support more robust application of these analytical approaches.

Conclusions

In elite basketball, injury burden appears to be unevenly distributed across injuries and players, with a relatively small proportion of cases accounting for a substantial share of total time-loss. This study suggests that, beyond overall incidence, the distribution of injury burden may be an important determinant of its impact on player availability.

By combining inequality metrics with multilevel modelling, this study provides preliminary insight into how injury burden is structured within teams. These findings highlight the relevance of examining not only how often injuries occur, but also how their impact may be distributed across players and injury events.

From a practical perspective, strategies aimed at reducing injury burden in elite basketball may benefit from focusing on the identification and management of high-burden cases, rather than relying exclusively on reducing overall injury incidence. Incorporating distribution-based approaches into injury surveillance systems may enhance decision-making in sports medicine and performance management. However, given the observational design and limited sample size, these findings should be interpreted with caution.

Abbreviations

ICC	Intraclass correlation coefficient
IQR	Interquartile range
SD	Standard deviation
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13102-026-01780-z.

Supplementary Material 1.

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Authors' contributions

JPM and EJC conceived the study, and JPM, MPB and MTML conducted the data analysis. JPM, MPB, MTML and EJC drafted the initial version of the manuscript. MPB and JPM led the manuscript revision. JPM, PCS, BRL, VSA, MPB, MTML and EJC critically reviewed the manuscript. All authors contributed to the interpretation of the data and approved the final version of the manuscript. JPM is the guarantor.

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Data availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Ethics Committee of the Universidad Católica de Valencia (UCV/2025–2026/072). All participants provided informed consent. Procedures complied with the Declaration of Helsinki and data protection regulations.

Consent for publication

Not applicable.

Competing interests

Javier Pérez-Murillo, Pedro Cotolí-Suarez, Borja Ricart-Luna, and Vicente Sebastià Alcacer are employed by Valencia Basket Club and contributed to the collection of data as part of their regular clinical and performance-related responsibilities. The data used in this study were obtained within the context of routine professional practice.This research did not receive any external funding. Valencia Basket Club was not involved in the design of the study, the analysis or interpretation of the data, the preparation of the manuscript, or the decision to submit the work for publication.The remaining authors declare that the study was carried out without any commercial or financial relationships that could be interpreted as potential conflicts of interest.

Author details

[1]Alqueria Lab Department, Valencia Basket, Valencia, Spain
[2]SONEV Research Group, Faculty of Medicine and Health Sciences, Catholic University of Valencia San Vicente Mártir, C/Quevedo No. 2, Valencia 46001, Spain
[3]Department of Physiotherapy, Nutrition and Sports Sciences, Universidad Europea de Valencia, Valencia, Spain
[4]Integrated Translational Research in Health and Performance Group (INTEGRA), Universidad Europea de Valencia, Valencia, Spain
[5]Faculty of Medicine and Health Sciences, Catholic University of Valencia San Vicente Mártir, C/Quevedo No. 2, Valencia 46001, Spain
[6]Department of Nursing, Faculty of Medicine and Health Sciences, Catholic University of Valencia San Vicente Mártir, C/Espartero No. 7, Valencia 46007, Spain
[7]Department of Physiotherapy, Faculty of Medicine and Health Sciences, Catholic University of Valencia San Vicente Mártir, C/Ramiro de Maeztu, 19, Torrent, Valencia 46900, Spain

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