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Epidemiology of injuries in UK based golfers: a retrospective study

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ABSTRACT

Objectives: Golf participation numbers have increased in recent years within the UK and globally. A recent systematic review and meta-analysis of injuries in amateur and professional golfers showed over half of golfers sustain an injury during their lifetime. This review recommended that future research should utilize the recent international consensus on reporting of injury in golf. The aim of this study was to determine the frequency and severity of injuries sustained by UK-based golfers in the previous year.

Methods: A retrospective cross-sectional online survey consisting of 35 questions was disseminated to UK-based golfers. Non-overlapping 95% confidence intervals (CI) were utilized to indicate significant differences.

Results: There were 303 participants included for analysis. The overall injury incidence was 41.26 injuries per 1000 hours (CI 35.96–47.33). Consistent with the wider literature, the lower back at 9.94 injuries per 1000 hours (CI 7.48–13.22) is the most frequent injury site. The lower back had a mean time loss of 54 ± 89 days before full recovery. Repetitive movement injuries were noted to have a higher incidence (22.00 per 1000 hours, CI 18.19–26.61) in comparison to acute injuries (10.79 per 1000 hours, CI 8.21 to 14.18).

Conclusion: Anatomically, the proportion of injuries observed was comparable to previous epidemiology studies, with the lower back and elbow having the highest incidences in this largely amateur group of golfers. Most injuries were identified to be a muscle strain, joint sprain, or tendinopathy; however, no single identifiable mechanism of injury was identified.

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KEYWORDS
Golf; epidemiology; injury prevention; golf injury; injury prevalence

Introduction

Golf participation in the UK has seen significant growth in recent years, from an estimated participation of 2.5 million in 2017 to 4.8 million in 2021 [1]. This includes an increase in golfers who participated in 52 or more rounds per year from 149,000 to 339,000 (The R&A). This increased participation is coupled with developments in golf performance and physical preparation, whereby improvements in club head velocity have been positively correlated with upper body power and lower body strength [2]. Although the increases in participation rates are positive for the growth of golf and the physical health, mental health and longevity benefits for golfers, injury exposure and risk of injury may increase [3]. However, combined with improved physical conditioning the relationship between participation and injury rates may not be linear. Injury rates may also be influenced by the age of the golfer, preexisting injuries, and skill level [4]. Within the literature, it has been expressed that strength and conditioning programs improve performance and potentially reduce the risk of injury in a range of populations [5–8]. However, the impact of this on injury rate and severity has yet to be established. Additionally, a recent systematic review and meta-analysis has recently identified a lifetime incidence of 73.5% for professionals and 56.6% for amateur golfers [9]. The increased levels of incidence in professionals are thought to arise predominantly through an increased volume of play, and increased force produced during the swing [9].

Prior epidemiological studies have had a lack of consensus regarding methodological approaches; therefore, it can be challenging to draw conclusions. However, some key trends have been identified among the literature. This includes an annual injury rate of between 15.8% and 40.9% [4,10–16]. Additionally, there is a consensus that the lumbar spine is the most frequently injured area ranging from 16.3% to 41.9% [4,11–13,15]. Since the majority of these epidemiology studies, Murray and colleagues in 2020 have developed an International Golf Federation consensus statement to help standardize epidemiological approaches which has been adopted in recent studies [16,17]. Beyond primary research, a meta-analysis identified a pooled injury incidence rate of 2.5 (CI 0.9–7.5) per 1000 athlete exposures, however, additionally concluded more research is needed within golf injury rates [18].

Information regarding time lost or the severity of injuries suffered is more limited. Gosheger et al. [11] reported the most severe injury was thoracic spine injuries with an average time loss of 137.4 days, this was followed by the elbow at 73.8 days and the most frequent injury the lumbar spine was 69 days. More recently, it has been identified that most injuries that occurred during a 12-month period required a 3- to 7-day

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downtime was 28.6%, and injuries that required more than a 30-day downtime was 14.3% [17].

Murray et al. [16] identified that one-third of golfers (37.3%) reported pain within the lumbar back region, followed by the left knee (13.6%) and the right knee (11.0%). However, data was presented as pain suffered within the previous 7 days and not annual incidence additionally did not normalize data for handedness. While 7 days are an important factor to understand, comparisons to previous literature from an annual incidence perspective are important to consider. Moreover, this study focused on golfers from the United States where golf transportation methods can differ from golfers in the UK, which can impact the physical demands on the golfer [16]. Previously it has been established that these differences in physical demands may impact the frequency and severity of injuries in golfers [19]). Therefore, the aim of this study was to determine the frequency and severity of injuries sustained by UK-based golfers in the previous 12-month period utilizing methods established in the International Consensus on reporting injuries within golf. A further aim was to determine any relationships in the severity or frequency of injuries with the volume of the different golf activities (competition, practice, and physical conditioning), age, and golf handicap and to determine injury frequencies between the lead and trail sides.

Materials and methods

Survey development and procedure

A 35-question survey was designed on Qualtrics XM (Qualtrics, Seattle, Washington, USA) in accordance with the International consensus statement of reporting golf injuries [20] and previous epidemiology studies [4,11,15]. The survey was formed of three main sections. Section one contained information on demographics, physical attributes, volume of golf activity, typical fitness activities, and warm-up habits (Q1 – Q15). Section two focused on whether the participant had or had not suffered an injury in the previous 12-month period (Q16), if no injury was reported the survey ended here. If an injury was recorded Q17 – Q26 gathered information on where the injury occurred, what side the injury occurred, classification of injury (acute or chronic), type of injury (e.g. muscle strain, bone fracture), mechanism of injury, and severity of injury. Section three (Q27 – Q35) collected data on whether the participant suffered an additional injury within the 12-month period, mirroring Section two. The survey is available as Supplementary Material 1.

Within the survey, an injury was defined as damage to the body that occurred because of competing, training, and/or participating in a golfing activity. The location of injury was a choice of 17 categories [4,11,15] with any self-reported injuries described within the 'Other' option included in the most appropriate category. The type of injury had a selection of 14 categories. The severity of the injury was determined using days lost, when the participant ceased participating in golf, and how long it took to fully recover from the injury [20]. The training was determined as any physical preparation that was undertaken to improve golf performance. Standardized estimates and hours of activity recall were utilized to normalize incident rates to 1000 hours of exposure. Both competition holes (18 holes = 4 hours) and a number of balls hit at the driving range (60 per hour) were converted to an hourly figure, whereas golf practice and golf training respondents recorded the number of hours.

Inclusion/Exclusion criteria

Inclusion criteria were:

- UK-based golfer aged 16 years or over
- Completion of a consent form at the beginning of the survey
- That participants met the minimum activity threshold of one completed round of golf per week

Surveys were excluded from analysis if:

- Survey was less than 80% complete
- Participant based not within the UK
- Not reporting the type of injury suffered or whether they had suffered an injury or not

The survey was disseminated via social media channels, golf forums, and in golf club newsletters. Following the review of inclusion and exclusion criteria, surveys were removed from analysis if they did not meet inclusion criteria. Prior to any data collection, ethical approval was granted from Abertay University, Faculty of Social and Applied Sciences.

Statistical analysis

Descriptive statistics were calculated and presented as frequencies, proportions (%), and incidence rates (per 1000 h of all exposure). Confidence intervals (95%) were also calculated whereby non-overlapping confidence intervals are considered to assess for a significant difference between categories [21,22]. Days lost per injury are presented as mean ± SD. Statistical analysis was completed on Jamovi ((Version: 2.3.18) [23]. Relationships between variables were calculated using Spearman's Rank as samples were not considered independent from one another with multiple injuries reported per participant. The boundaries set for the coefficient statistics were; $r = 0.8–1.0$, very strong; $r = 0.6–0.8$, strong; $r = 0.4–0.6$, moderate; $r = 0.2–0.4$, weak; and $r = 0.0–0.2$, no relationship. A Wilcoxon rank test was utilized to assess differences in return to golf activity and full injury recovery and activity levels between injured and non-injured groups. The level of significance for statistical tests was set at $p < 0.05$.

Results

A total of 397 surveys were received. Of these, 6 were removed because the respondent was out with the UK, and 88 were removed due the the survey being < 80% complete.

A total of 303 completed surveys were utilized in the analysis. Of the respondents, 76% identified as male, with the remaining 24% identifying as female. 98% were right-hand dominant. Further demographics and activity levels are presented in Table 1.

Total injury incidence was 41.26 injuries per 1000 hours (CI 35.96–47.33). The anatomical location with the largest

incidence of injury was the lower back (9.94 injuries per 1000 hours; CI 7.48–13.22), and this was found to be significantly larger than other injury locations (non-overlapping CI) (Table 2). Other injury locations that had relatively high incidence, were the elbow (4.87 injuries per 1000 hours; CI 3.24–7.32), wrist (3.60 injuries per 1000 hours; CI 2.24–5.78), and knee (3.39 injuries per 1000 hours; CI 2.08–5.52). A broad range of injury severity can be noted with a significantly greater time observed for full injury recovery in comparison to return to golfing activities ($p < .01$). Within the sample, 140 golfers returned whether the injury was suffered on the lead, trail side, or centrally, and no overall difference was observed between lead (12.06 injuries per 1000 hours; CI 9.32–15.61) and trail side (12.27 injuries per 1000 hours; CI 9.50–15.85) (Table 3). However, this was significantly greater than injuries reported as central (2.75 injuries per 1000 hours; CI 1.60–4.73) and both lead and trail injuries (2.53 injuries per 1000 hours; CI 1.44–4.47). In terms of injury location, a greater number of shoulder injuries (88.9%) and wrist injuries (62.5%) occurred on the lead side, whereas a greater number of elbow injuries were observed on the trail side (65%). Lower back injuries were similar between the lead side (33.3%), trail side (33.3%), and central (33.3%). Additionally, 57.1% of knee injuries were observed on the trail side (Figure 1).

The injuries associated with the greatest time lost per injury were injuries that had low incidence, this included the head (250 ± 0 days for full recovery, $N = 1$) and upper back (248 ± 203 days, $N = 3$). Injuries that had larger incidence had relatively lower time lost in comparison (lower back 54 ± 89 days for full recovery; elbow 78 ± 92 days for full recovery).

Age was not significantly correlated with time to fully recover from injury ($r = -.039$, $p = .754$) or ceasing to

Table 1. Participant demographics.

	Participant		
All metrics are presented mean ± SD	All	Male	Female
Age (years)	50 ± 16	53 ± 15	47 ± 18
Height (cm)	177 ± 8	177 ± 8	177 ± 7
Mass (kg)	79 ± 36	79 ± 38	78 ± 14
Handicap	11.7 ± 7.1	11.5 ± 6.6	12.0 ± 8.2
Competition golf (holes)	25 ± 19	23 ± 17	32 ± 17
Practice including non-competition rounds (hours)	6 ± 14	5 ± 14	5 ± 8
Driving range/Practice area (number of balls hit)	130 ± 239	113 ± 200	190 ± 444
Golf gym and physical training (hours)	2.3 ± 4.8	2.1 ± 4.3	3.0 ± 6.5

*Metrics competition holes, practice, driving range activities, and golf training are presented per week.

Table 2. Incidence of injuries by location and average time lost.

Injury Location	*N*	%	Incidence (per 1000 hours)	95% CI (per 1000 hours)		Ceased participating in golf activities (days; mean ± SD)	Time to fully recover from injury (days; mean ± SD)
Ankle	9	4.6	1.90	0.99	3.66	21 ± 20	56 ± 40
Elbow	23	11.8	4.87	3.24	7.32	23 ± 46	78 ± 92
Foot	8	4.1	1.69	0.85	3.38	50 ± 73	118 ± 156
Groin	6	3.1	1.27	0.57	2.82	24 ± 29	75 ± 102
Hand & Fingers	7	3.6	1.48	0.71	3.10	4 ± 5	54 ± 71
Knee	16	8.2	3.39	2.08	5.52	24 ± 40	97 ± 124
Lower Back	47	24.1	9.94*	7.48	13.22	37 ± 62	54 ± 89
Mid Back	7	3.6	1.48	0.71	3.10	31 ± 33	46 ± 49
Neck	5	2.6	1.06	0.44	2.54	7 ± 10	61 ± 51
Ribs	4	2.1	0.85	0.32	2.25	18 ± 21	125 ± 132
Shoulder	10	5.1	2.12	1.14	3.93	44 ± 73	89 ± 93
Upper Back	3	1.5	0.63	0.20	1.97	37 ± 35	248 ± 203
Wrist	17	8.7	3.60	2.24	5.78	47 ± 107	64 ± 106
Hip & Pelvis	6	3.1	1.27	0.57	2.82	32 ± 38	70 ± 77
Abdomen	2	1.0	0.42	0.11	1.69	54 ± 52	68 ± 74
Calf	3	1.5	0.63	0.20	1.97	7 ± 7	18 ± 11
Head	1	0.5	0.21	0.03	1.50	200 ± 0	250 ± 0
Not disclosed	21	10.8	4.44	2.90	6.81	NA	NA
Total	195	100	41.26	35.96	47.33	31 ± 58	74 ± 98**

Notes: Results are displayed as frequency (N), proportion (%), and incidence (per 1000 hours of exposure). CI, Confidence Intervals. *considered to be significantly significant with non-overlapping confidence intervals. **significantly different ($p < .01$).

Table 3. Incidence of injuries in relation to lead and trail side.

Injury classification	*N*	%	Incidence (per 1000 hours)	95% CI (per 1000 hours)	
Lead	57	40.7	12.06*	9.31	15.61
Trail	58	41.4	12.27*	9.50	15.85
Lead and Trail	12	8.6	2.53	1.44	4.47
Central	13	9.3	2.75	1.60	4.73

Notes: Results are displayed as frequency (N), proportion (%), and incidence (per 1000 hours of exposure). CI, Confidence Intervals. *considered to be significantly significant with non-overlapping confidence intervals.

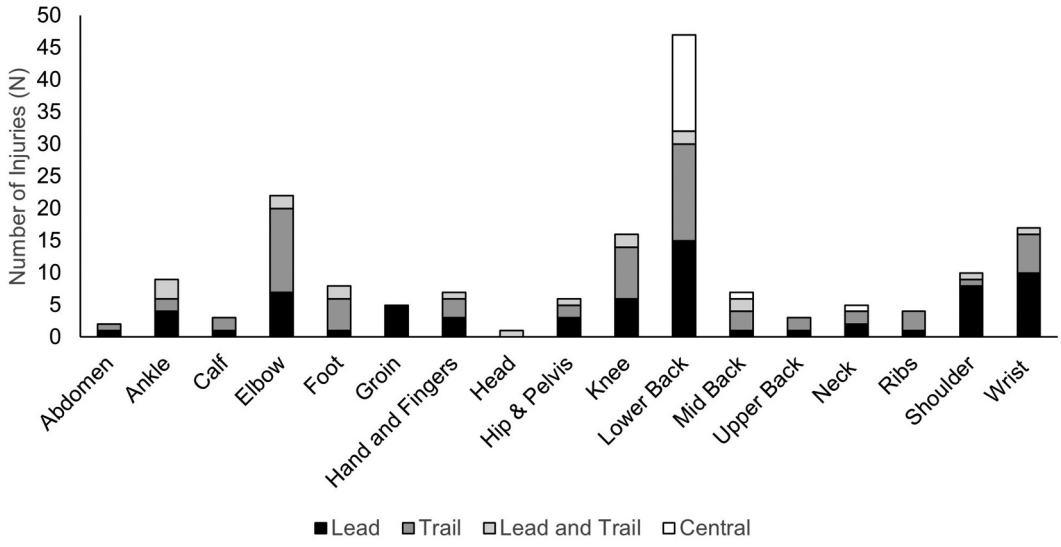

Figure 1. Location of injury in relation to lead and trail side.

participate in golf activities ($r = -.010$, $p = .914$). Additionally, no significant relationships were identified between handicap and time to fully recover from injury ($r = -.091$ $p = .480$) or ceasing to participate in golf activities ($r = -.058$ $p = .662$).

Muscle strains and tears had the highest incidence by type (15.23 injuries per 1000 hours; CI 12.11–19.16), this was significantly higher than all other injury types (Table 4). Other categories that were significantly higher than others were tendonitis (6.35 injuries per 1000 hours; CI 4.44–9.07) and joint sprains or ligament tears (6.14 injuries per 1000 hours; CI 4.27–8.82).

Table 5 shows a significantly greater number of repetitive injuries were noted with 53.3% (22.00 per 1000 hours; CI 18.19–26.61) in comparison to acute injuries with 26.2% (10.79 per 1000 hours; CI 8.21–14.18). An increased number of respondents were unsure of their classification compared to other survey questions (20.5%).

No identifiable single event was significantly greater than all other injury mechanisms accounting for 49.2% of injuries (15.23 per 1000 hours; CI 12.11–19.16). This is followed by non-contact trauma accounting for 15.3% (5.71 per 1000 hours; CI 3.92–8.32). All other mechanisms had low incidence (2.8–9.6%) (Table 6).

Activity levels of golfers who suffered an injury and those who did not are presented in Table 7. Significant differences were identified between the number of competition holes ($p = .036$) and the volume of golf training ($p = .013$) with injured golfers participating in significantly more training

Table 4. Incidence of injury by type.

Injury Type	*N*	%	Incidence (per 1000 hours)	95% CI (per 1000 hours)	
Bone fracture	6	2.9	1.27	0.57	2.82
Bone stress injury	4	2.0	0.85	0.32	2.25
Cartilage damage	9	4.4	1.90	0.99	3.66
Chronic instability	8	3.9	1.69	0.85	3.38
Joint sprain or ligament tear	29	14.2	6.14	4.27	8.82
Muscle strain or tear	72	35.3	15.23	12.11	19.16
Tendon rupture	4	2.0	0.85	0.32	2.25
Tendinopathy	30	14.7	6.35	4.44	9.07
Tendonitis & muscle strain	2	1.0	0.42	0.11	1.69
Arthritis	2	1.0	0.42	0.11	1.69
Disc issues (back)	2	1.0	0.42	0.11	1.69
Nerve damage	3	1.5	0.63	0.20	1.97
Concussion/Brain injury	2	1.0	0.42	0.11	1.69
Unknown	12	5.9	2.54	1.44	4.47
*Not disclosed	19	9.3	4.02	2.57	6.30

Notes: Results are displayed as frequency (N), proportion (%), and incidence (per 1000 hours of exposure). CI, Confidence Intervals. *not included in confidence interval analysis.

Table 5. Classification of injuries.

Injury classification	*N*	%	Incidence (per 1000 hours)	95% CI (per 1000 hours)	
Acute	51	26.2	10.79	8.21	14.18
Repetitive	104	53.3	22.00	18.19	26.61
Unsure/Other	40	20.5	8.46	6.22	11.52

Notes: Results are displayed as frequency (N), proportion (%), and incidence (per 1000 hours of exposure). CI, Confidence Intervals.

Table 6. Identified mechanism of injury.

Identified mechanism of injury	*N*	%	Incidence (per 1000 hours)	95% CI (per 1000 hours)	
Direct contact with the ground	5	2.8	1.06	0.44	2.54
Direct contact with object	4	2.3	0.85	0.32	2.25
Indirect contact with object	6	3.4	1.27	0.57	2.82
Indirect contact with ground	17	9.6	3.60	2.24	5.78
No identifiable single event	87	49.2	15.23	12.11	19.16
Non-contact trauma (single event)	27	15.3	5.71	3.92	8.32
Other/unsure	31	17.5	6.56	4.62	9.32

Notes: Results are displayed as frequency (N), proportion (%), and incidence (per 1000 hours of exposure). CI, Confidence Intervals.

Table 7. Average activity of golfers per week (mean ± SD).

	Competition golf (holes)	Practice including non-competition rounds (hours)	Driving range/Practice area (number of balls hit)	Golf training (hours)
Total	25 ± 19	6 ± 14	130 ± 239	2.3 ± 4.8
Injured	27 ± 20*	6 ± 9	163 ± 295	3.0 ± 5.8*
Non-injured	23 ± 18	4 ± 7	92 ± 150	1.5 ± 2.8

and completing more competition holes. No significant differences between groups were observed for hours of golf practice ($p = .051$) and number of balls hit ($p = .050$). The number of training hours was not significantly related to injury severity for those who suffered injuries ($r = .055$, $p = .759$).

Discussion and comparison to the literature

The aim of this study was to add to the golf epidemiology literature, assessing the incidence and severity of injuries of UK-based golfers. The primary findings are that golfers suffered significantly lower back injuries in comparison to other anatomical areas (Table 2) (24.1%), which is comparable to the annual incidence observed within the literature (16.3–41.9% [4,11–13,15,17]) and the lower back having the highest lifetime prevalence of injury in amateur golfers [9]. In regard to injury severity, a large range of time lost was observed, however, no associations were established with either age or handicap. Muscle strains were identified as having a significantly greater incidence than other types of injury and repetitive injuries had a significantly higher incidence than acute injuries. Golfers who suffered an injury within the 12-month period participated in significantly more golf training and competition holes in comparison to non-injured golfers.

Within the current study, it was observed that there was an injury rate of 0.13 injuries per 1000 hours per player. Among the literature, it has been measured at 0.28–0.60 injuries per 1000 hours per player [15,24,25]. One of the predominant factors that could contribute to this lower figure, is that we have measured injuries with time loss to training or competition while others have a broader definition of injuries, including those without time loss. A further methodological difference was that only golf rounds were included in time-based analysis in some previous studies whereas all golf-related activity was included in this study, therefore the current study was more reflective of real-world golf activity. This is further supported when considering injuries per 100 players per year as utilized in the most recent systematic review [9]. In the current study, 63.9 injuries/100 players/year were observed. McHardy et al. [15] observed 15.8 injuries/100 players/year, and prior observations by Fradkin et al. [4,26] observed rates of 31–36.5 injuries/100 golfers/year. The figure may be larger in the current study due to inclusion criteria requiring golfers to play at least one round per week with golfers having higher activity levels.

When injury regions are considered the results of the current are comparable to those previously observed in the literature. The lower back had the highest incidence in the current study (24.1%) and this has consistently been observed within the literature for nonprofessional players (16.3–41.9%) [4,11–13,15,17]. Despite the lower back region having consistently higher reported incidence of injury, biomechanical factors that contribute to this remain unclear [27]. Factors potentially associated with lower back injury and pain include reduced lumbar flexion velocity, reduced lumbar torsional load, increased lumbar lateral flexion velocity, and reduced or greater erector spinae muscle activity [27]. Additionally, increased EMG activity in the rectus abdominis and latissimus dorsi has been observed among professional golfers [28]. Modernization of the golf swing may have accentuated some of these biomechanical factors to achieve performance benefits [29]. It has been suggested that the 'X-factor' and 'X-factor stretch' is a factor why professional golfers have an increased risk of lower back pain [9,30,31]. Anatomical locations that also have been identified to have higher incidence are the elbow (12.6–33.1%), the current study observed a rate of 11.8% therefore at the lower end of the literature [11–13,15,26]. In addition to the lower back, the elbow remains an area of interest within experimental research. It is thought in contrast to the lower back, higher incidences are associated with amateur golfers due to inferior swing techniques [32,33]. Non-significant findings outlined by Williamson et al. [9] support the notion that amateurs suffer elbow injury more frequently.

Lower incidence was also evident in comparisons between the current study and the literature for the shoulder, where 5.1% was seen in the current study and higher rates were observed within the majority of literature (11.8–17.6%) [4,11,13,15], however, Lee et al. observed 2.3%. When combined lower limb injuries accounted for 23.1% in comparison to the range of 7–22.9% [4,11–13,15]. Differences in injury location could be due to changes in participation rates, physical preparation, or methodological differences with the current study having increased anatomical categories.

Injury severity was assessed in two ways, time (days) to fully recover from the injury (person is pain-free) and time (days)

they ceased participating in golf activity. Both categories are comparable to previous literature. The more frequent injuries including the lower back region had an average of 54 days until full recovery and 37 days until return to play, Gosheger et al. [11] reported an average of 69 days. This was also evident for the elbow whereby an average of 78 days until full recovery and 23 days until return to play in comparison to Gosheger et al. [11] value of 73.8 days. Some anatomical locations had longer periods of time missed including the upper back and head; however, the frequency of these injuries was low, therefore, likely skewed by the small sample size (Table 2). However, what was consistently observed within the current study was the return to golf activity before full pain-free recovery had occurred. This potentially could prolong time to full pain-free recovery with a general consensus that returns to play should be pain-free for acute muscle and ligament injuries and spinal injuries [34–36], with 26.2% of golfers reported their injury was acute in nature. Additionally, a significant difference was noted between injured and non-injured populations that the former participated in more golf training (Table 7). This has previously been observed within the literature [17] and a possible explanation for this may be the higher associated golf swing forces and velocities in trained populations [2,7].

The type of injury most frequently reported was a muscle strain or tear (35.3%), significantly greater than the other more frequent types being tendinopathy (14.7%) and ligament strain or tears (14.2%). Data among injury types is limited among the literature, however, a recent study observed muscle sprains or ruptures at a similar 30.9% [17]. Tendinopathies and ligament injuries also followed the same trend as the current study both recording 9.5% of total injuries [17]. Golf is often considered a largely a low-impact sport, however, large amounts of force are developed during the golf swing, for example, 1.6 bodyweights during the downswing phase of the swing (284–306 ms) [37,38]. This may explain the higher prevalence of muscle strains, with golfers who attain higher club head velocities demonstrating increased proficiencies in impulse development and peak power during jumping activities, combined with the improved physical conditioning of golfers [5,39,40]. However, some of the identified muscle injuries may be repetitive in nature rather than acute with a larger volume of injuries noted as the former (Table 5).

Mechanism of injury data supports that of Gosheger et al. [11] who noted 82.6% of injuries being from overuse, with most injuries within the present study considered to have no single identifiable event (49.2%). This is, however, in contrast to McHardy et al. [15] who reported overuse to be accountable for 23.7% of injuries, with the golf swing identified as the most common mechanism (46.2%). This is further supported by injury classification with most injuries reported to be of a repetitive nature (53.3%). With a distinct lack of data around this area, it is difficult to draw conclusions with the contrasting data between published literature. Considering specific injury locations, the results show similarities to Gosheger et al. [11] that the lower back mechanism of injury was predominantly accounted for no identifiable single event (65%) with Gosheger et al. [11] reporting 91%, and this was also evident for the elbow (88%; Gosheger et al., 99%).

Limitations and strengths of the study

A limitation of the current study was the retrospective study design, whereby injury data may be misreported due to the 12-month recall period. This partially is emphasized by self-reporting injuries and additionally the ease of completing online surveys. To address this limitation, future studies should be designed to be prospective in nature allowing for a more accurate injury recall. However, there are strengths of the study, this is one of the first epidemiology papers to the authors' knowledge evaluating injury prevalence of the whole body with the inclusion of all golf-related activities that have utilized the guidance of the injury and illness consensus statement [20]. Additionally, future studies should aim to further identify specific locations of injury, for example, medial and lateral sides of a joint.

Conclusion

In conclusion, the current study has added to the golf epidemiology literature pool and is one of the first studies to utilize the international consensus on reporting injuries. Despite the increased popularity in golf, technical advancements, improved conditioning, and changes in golf habits, the results of the study are generally in consensus with previously published literature. Finding that the most frequent injury was to the lower back region (24.1%) and an overall injury incidence of 41.26 injuries per 1000 hours. More injuries of a repetitive (chronic) nature were observed with no single identifiable mechanism of injury suggesting volume of golf activity could be a key indicator of risk of injury with golfers participating in increased amounts of golf training and competition holes more likely to suffer from injury. The majority of injuries were reported to be a muscle strain, joint sprain, or tendinopathy. This study has provided additional epidemiological information that will help inform future injury surveillance studies and methods to reduce injury risk within golf.

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Conflict of interest statements

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