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Describing the Warm-up Habits of Recreational Golfers and the Associated Injury Risk

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ABSTRACT

The purpose of this research was to investigate the warm-up habits of golfers and determine whether warm-up behaviors are associated with injury risk. A total of 304 golfers who visited a university health system based golf fitness laboratory over the age of 18 years were invited to participate in this study. Golfers had to have a registered golf handicap and play golf on a regular basis over the previous 12 months (on average at least once/week) to be eligible for the study. Recruitment for this study took place at Pinehurst Resort and Country Club between December 2005 – May 2006. All golfers completed a questionnaire concerning warm-up attitudes and behaviors and injury status. A small percentage of golfers were shown to perform an appropriate warm-up prior to play (18.1%) or practice (16.8%), and an even smaller percentage of injured golfers performed an appropriate warm-up (9.6% play; 10.6% practice). Chi-square analysis showed that the golfers' warm-up behaviors both prior to play ($p < 0.001$) and practice ($p < 0.05$) were significantly associated with their injury status. Odds ratio analysis showed that golfers who did not perform an appropriate warm-up prior to golf play or practice were more likely to report sustaining a golfing injury in the previous 12 months than those who did perform an appropriate warm-up (1.3 times more likely prior to play; 1.2 times more likely prior to practice). This study has highlighted that most golfers do not perform an appropriate warm-up prior to golf play or practice, and golfers who did not warm-up were at an increased risk of sustaining an injury compared to those who did warm-up. The golfers' warm-up behaviors both prior to play and prior to practice were significantly associated with injury status. A very small percentage of golfers performed an appropriate warm-up prior to play and prior to practice and those golfers had a significantly reduced injury risk than those who did not warm-up. Golf professionals, coaches, and physicians, should emphasize the importance of undertaking all three recommend components of a warm-up program to golfers. Finally, previous research has shown that a warm-up only need take seven to eight minutes to improve performance so perhaps this warm-up should be undertaken by all golfers to potentially help reduce their injury risk and improve their performance.

Keywords: warm-up, golf, injury

INTRODUCTION

Injuries can be an unfortunate consequence of sports participation (Finch & Owen, 2001). Although injuries to golfers have not been studied in detail, they have been shown to occur. Diversity of ages and abilities among golf players leads to a wide spectra of injuries (Therriault & Lachance, 1998). The studies performed have shown a lifetime injury incidence of 57% (Batt, 1992) and 62% (McCarroll *et al.*, 1990) and a 12-month injury incidence of 33% (Fradkin *et al.*, 2005) and 35% (Fradkin *et al.*, 2003). The lower back, wrist and shoulder are the most commonly injured areas (Batt, 1992; Fradkin *et al.*, 2003; Fradkin *et al.*, 2005; McCarroll *et al.*, 1990).

The treatment of sports related injuries can be time consuming, difficult and expensive, making preventive strategies justified, not just from a medical perspective but an economic one also (Egger, 1991; Parkkari *et al.*, 2001). Preventive measures, also termed countermeasures, are one method for controlling injury risk (Hrysonmallis & Morrison, 1997). One of the most commonly recommended countermeasures is performing an appropriate warm-up (Hedrick, 1992).

The term warm-up is defined as a period of preparatory exercise in order to enhance subsequent competition or training performance (Hedrick, 1992). There are three factors that have been recommended to be incorporated into a warm-up routine (Safran *et al.*, 1989). These include:

1. A period of aerobic exercise to raise the temperature of the body;
2. A period of sport-specific stretching that focuses upon the muscles that will be used in the ensuing performance; and
3. A period of activity that incorporates activities comparable to those that will be used in the succeeding performance.

However, many sports participants only participate in one of two of these activities and assume they are performing an appropriate warm-up (Fradkin *et al.*, 2001; Fradkin *et al.*, 2003). The mechanisms of injury reported in the golf literature indicate some of the reported injuries could be reduced with an appropriate warm-up. If golfers begin by warming-up, they are likely to reduce their risk of injury which will reduce the cost burden of treatment as well as increasing their playing longevity. Together these two aspects together will help increase a golfer's health.

A recent systematic review found that there were very few studies investigating the effects of warming-up on injury prevention (Fradkin *et al.*, 2006). Those that do exist showed that performing a sport-specific warm-up program will assist in reducing injury risk, although none of these studies were performed with golfers. However, the performance improvement benefits for golfers of participating in a warm-up have been shown (Fradkin *et al.*, 2004). Therefore, the purpose of this study is to investigate the warm-up habits of golfers and determine whether warm-up status is associated with injury risk.

METHODS

Participants and Procedures

Golfers' who visited a university golf fitness laboratory over the age of 18 years were invited to participate in this study. Golfers had to have a registered golf handicap and have played golf on a

regular basis over the previous 12 months (on average at least once/week) to be eligible for the study. Approval for this project was obtained from a University Institutional Review Board, and written consent obtained from every participant.

Recruitment for this study took place at Pinehurst Resort and Country Club in Pinehurst, North Carolina between December 2005 – May 2006. Golfers who agreed to participate in this study completed a questionnaire concerning warm-up behaviors (both prior to play and practice separately) and attitudes and injury status.

Questionnaire and Injury Definition

The questionnaire was based on previous questionnaires administered by the lead researcher concerning golf injuries (Fradkin *et al.*, 2003; Fradkin *et al.*, 2005; Fradkin *et al.*, 2007a). The questionnaire consisted of multiple choice questions with set options, which were derived from answers to the previous questionnaires. An “other” option was included to allow for additional responses and these were coded at the time of data entry. The questionnaire covered the following areas: Demographic information, golf and warm-up history, and previous 12-month injury history. Explanations of all terms were provided on the first page of the questionnaire to avoid confusion.

For purposes of this study, and to allow direct comparison between prior studies, the definition of injury was “damage to the body that occurs as a result of competing, training and / or participating in a golfing activity” (Australian Sports Injury Prevention Taskforce, 1997). This definition was chosen as it encompasses both training and actual game injuries as well as sport related illnesses such as heat stress.

Data Management and Analysis

Data were analyzed using Version 12 of SPSS (Statistical Package for the Social Sciences) and were entered on two independent occasions to ensure accuracy. For the purposes of the analysis, an appropriate warm-up is defined as performing at least two of the three recommended components suggested to be incorporated into a warm-up routine (Fradkin *et al.*, 2007a). Frequencies and descriptive statistics were generated for the relevant variables and 95% confidence intervals calculated. Chi-square tests were performed for each variable across injury status to test for associations between each variable and injury outcome. Odds ratios and their 95% confidence intervals were computed relative to a baseline category for each variable.

RESULTS

A total of 304 golfers with a median age of 53 (range: 18 - 83) years participated in this study. Most of the golfers in this study were male (71.4%) which is reflective of the average participation rates in the USA (American Sports Data, 2005). Golfers had been playing golf a median of 18.5 (range: 1 - 59) years, and had a median USGA handicap of 13 (range: 0 - 40). Over one-third

(36.5%) of the golfers reported sustaining a golfing injury in the previous 12 months. Further details on the injury status are presented in another published manuscript (Fradkin *et al.*, 2007b).

The golfers' self-reported participation in warm-up both prior to play and practice are shown in Figure 1. More than one-third of the sample reported to never or seldom warm-up prior to golf play (35.2%), and 62.5% reported never or seldom warming up prior to golf practice. The golfers who reported they warm-up most commonly stated that they perform stretches (47.3%), or air swings (38.1%) prior to play, and air swings (78.2%) prior to practice. Only 1.7% reported performing some form of aerobic exercise as part of their warm-up routine prior to play, and no golfer reported undertaking aerobic exercise prior to practice.

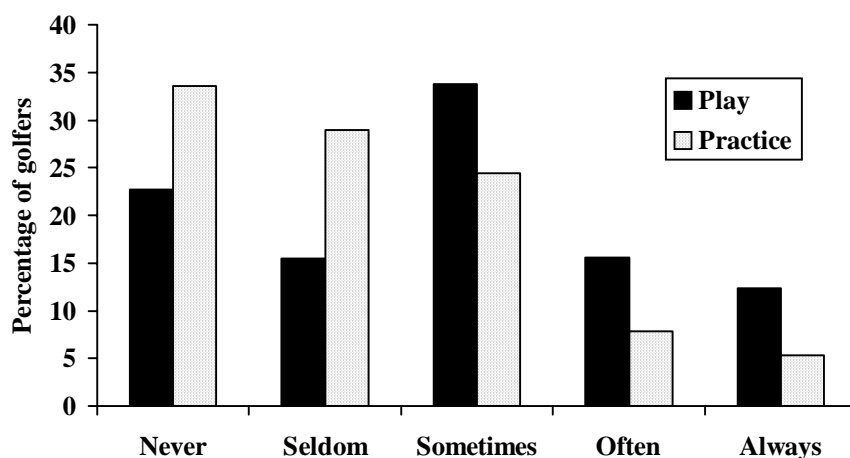


Figure 1. Golfers' self-reported frequency of warm-up participation prior to play and practice.

The golfers were also asked to estimate their usual length of warm-up both prior to play and practice. Of the golfers who claim to warm-up prior to play, the majority warm-up for less than 30 seconds (36.4%). The next most frequent responses were warming-up for between 30 - 59 seconds, or between 60 - 120 seconds (23.3% and 21.1% respectively). Only 19.2% of golfers who reported warming-up prior to play do so for more than 120 seconds. Of the golfers who claim to warm-up prior to practice, the majority warm-up for less than 30 seconds (38.9%). The next most frequent responses were warming-up for between 30 seconds and 1 minute, or between 1 and 2 minutes (26.3% and 17.7% respectively). Only 17.1% of golfers who reported warming-up prior to practice do so for more than 2 minutes.

A small percentage of golfers were shown to perform an appropriate warm-up prior to play (18.1%) or practice (16.8%), with only 14.3% of all golfers performing an appropriate warm-up prior to both. When examining the injury status of golfers who did perform an appropriate

warm-up prior to play and practice, it was found that a very small percentage of the injured golfers actually performed an appropriate warm-up (9.6% and 10.6% respectively).

Results of the chi-square analysis showed that the golfers' warm-up behaviors both prior to play ($\chi^2 = 7.665$, $p = 0.006$; 95% CI: 0.038, 0.220) and practice ($\chi^2 = 4.351$, $p = 0.037$; 95% CI: 0.006, 0.183) were significantly associated with their injury status.

Table 1. Adjusted odds-ratio (OR) for the predictors of amateur golfers sustaining an injury.

Predictor		Adjusted OR	95% CI for OR	p-value
Warm-up prior to play	Yes	1.0		p=0.047
	No	3.2	(1.0, 8.5)	
Warm-up prior to practice	Yes	1.0		ns (p=0.473)
	No	1.3	(1.1, 1.5)	

*ns = not significant at the $p < 0.05$ level

The odds ratio analysis showed that golfers who did not perform an appropriate warm-up prior to golf play were significantly more likely (3.2 times) to report sustaining a golfing injury in the previous 12 months than those who did perform an appropriate warm-up. Although not significant, this analysis also showed that golfers who did not perform an appropriate warm-up prior to practice were 1.3 times more likely to report sustaining a golfing injury in the previous 12 months than those who did perform an appropriate warm-up (See Table 1).

DISCUSSION

A small percentage of golfers in this study were shown to perform an appropriate warm-up prior to play and prior to practice which is in agreement with previous studies (Fradkin *et al.*, 2001; Fradkin *et al.*, 2007a). When examining the injury status of golfers who did perform an appropriate warm-up prior to play and prior to practice, it was found that a very small percentage of the injured golfers actually performed an appropriate warm-up. This suggests that many golfers are not undertaking an appropriate warm-up prior to play or prior to practice and are thus placing themselves at an increased risk of sustaining a golfing injury.

Golfers who did not warm-up prior to play and those who did not warm-up prior to practice were more likely to report sustaining a golfing injury than those who did warm-up. This suggests that efforts aimed at increasing knowledge about warm-up could lead to an increased number of golfers warming-up, and as such could potentially help reduce the number of golfing injuries. However, as this was a retrospective study, the impact of the injury on warm-up participation could not be established. To ascertain whether warming-up prior to golf participation reduces the injury risk, further studies are required. This study does however agree with a previous study showing that golfers who do not warm-up were more at risk of sustaining an injury than

those who do (Fradkin *et al.*, 2007a). The previous study by Fradkin and colleagues (2007a) was undertaken in Australia and found a stronger, more significant association between warm-up and injury (odds ratios 45.2). However that study incorporated a wider subset of participants who did not warm-up as frequently as the golfers in this study which may account for the large difference in results. Findings of the current study combined with a previous study which has shown that golfers' performances were significantly improved by undertaking a golf specific warm-up program compared to not performing the warm-up, also suggest this is warranted.

This study also provides insights into the frequency of warm-up behavior that is in agreement with previous studies showing that there are fewer golfers who report warming up prior to practice compared to prior to play (Fradkin *et al.*, 2005; Fradkin *et al.*, 2007a). Finally, analysis of the golfers' actual warm-up behaviors showed that only three golfers performed some form of aerobic exercise which is the first recommended component for inclusion in a warm-up program (Safran *et al.*, 1989). This suggests that golfers may be attempting to stretch and use muscles that are not already warm, which could put them at increased risk of injury when in fact, they are attempting to reduce their risk. This adds further weight to the suggestion that an educational campaign may be warranted to help educate golfers about how to warm-up appropriately.

This study has a few limitations that could potentially restrict the generalizability of these results. Only golfers who played at least once a week, and had a registered USGA golf handicap were eligible for this study. This population would potentially play and practice more frequently than the average golfer, thus it is possible that the incidence of warm-up would be higher in this group which may have effected the association between injury status and warm-up behavior. Furthermore, the self-reported warm-up behavior data needs to be validated, though the findings in this study agree with those of two previously published studies (Fradkin *et al.*, 2001; Fradkin *et al.*, 2007a). This would require direct observation of the golfers to accurately determine the extent of their warm-up behaviors, and would need to include all activity undertaken prior to beginning golf. Finally, the data in this study were all self-reported and validation was not undertaken. To obtain a completely accurate picture, all data would need to be validated by qualified personnel.

In conclusion, this study has highlighted that most golfers do not perform an appropriate warm-up prior to golf play or prior to practice, and golfers who did not warm-up were at an increased risk of sustaining an injury compared to those who did warm-up. Golfers' warm-up behaviors prior to play were significantly associated with injury status, and although not significant, the golfers' warm-up behaviors prior to practice also showed the same trend. A very small percentage of golfers performed an appropriate warm-up prior to play or practice and those golfers had a significantly reduced injury risk than those who did not warm-up.

APPLICATION

This research suggests that golfers need to be educated about how to perform an appropriate warm-up to help reduce their injury risk. This research also shows that even those golfers who do undertake some warm-up activities, are not actually warming-up appropriately and are thus still at risk of sustaining a golfing injury. Investigation needs to be undertaken in order to determine the best way to promote safe and effective warm-up behaviours to all golfers. Golf professionals, coaches, and physicians, should emphasize the importance of undertaking all three recommend

components of a warm-up program to golfers. Finally, previous research has shown a warm-up only need take seven - eight minutes to improve performance so perhaps this warm-up should be undertaken by all golfers to help reduce their injury risk and improve their performance.

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