

Evolution of Injury Rates in Skiers and Snowboarders from a Single Ski Resort: A 23 Years Overview

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Abstract

Alpine skiing and snowboarding are popular winter sports that have grown and evolved over the past years, and this could have an impact on the epidemiology of its injuries.

Cross-sectional study. A 23-year retrospective review was performed. Data was collected from registries done by physicians in a single medical centre. Injuries per 1000 skier-days indicator was used to report injury incidence. Spearman correlation was then used to determine the evolution of the injury rates by year.

A total of 58.142 injuries were reported between 1992-2015. In this period, 16.568.790 visitors were practising this sports on the resort. The global injury rate was 3,5 injuries per 1000 skier, showing no significant change during the 23 seasons studied (Spearman correlation of 0,0128 ($p = 0,95$)). However, incidence of head trauma shows a decrease, meanwhile an increased incidence of leg fractures was observed. Global Injury rate has not undergone significant changes over-examined years.

Keywords: Skiing; Snowboarding; Epidemiology; Clinical Assessment; Injury Rates; Sports Injury Incidence

Introduction

Both alpine skiing and snowboarding are winter sports that have gained popularity over the years. They have gathered 11,5 million athletes in the USA [1], and almost 200 million athletes over the world every year [2]. The participation in these activities, as a hobby or in a professional way, imply an exposure to falls and high-speed collisions that lead to a high rate of traumatic injuries [3].

Sports techniques and technology are continually evolving [4]. As the number of athletes increases, the number of injuries is expected to increase to, and some reports have shown an increase in the incidence of sports lesion in winter sport [5]. Implementation of prevention programs to diminished winter sports injuries is encourage, technology in skies design could be a contribution; since 1997 standard alpine skis have been progressively changed by side-cut or carving designs [6].

Numerous studies already describe the epidemiology of alpine ski and snowboard injuries. However, a lot of them refer only to specific injuries [7,8], are obtained from ski patrol reports (not medical reports) and count only with data from a short period.

Purpose of the Study

The purpose of this study is to determine the evolution of injury patterns and injury rates in winter sports, attended at the same emergency room of a single ski resort, over a 23-year period.

Methods

Our institutional ethics review board approved this study. The study cohort included all patients between the 1992-2015 seasons (23 years overview) that suffered traumatic accidents while practising ski or snowboard in a single resort, who sought for medical help. This ski resort counts with one emergency department, attended by an emergency physician on call. So, all visitors who had had an accident were attended in the same emergency department, by physicians specialised in traumatic sports injuries. For each patient included in the study, the following data was captured from the registry: age, sex, injury, mechanism of injury and diagnosis.

Injury rate by i season (i is the season year) was calculated as follows. Total injury rate (i)= [(number of injury(i) /visitors(i))*1000]. The ski resort administration gave the number of visitors per day data. Head trauma, glenohumeral luxation, upper extremities fractures thumb lesions and acromioclavicular disjunction, lower extremities fractures, knee lesions were analysed.

For statically analyses Spearman correlation was used to determine the evolution of the injury rates by year, whether they were increasing or not. A positive correlation means that the injury incidence was raised, a negative result that the lesion rate was decreasing, meanwhile 0 determinates that the incidence was not changing over the years. A significance level of 0.05 was established. All analyses were performed using Stata v11.2 (StataCorp LP, College Station, Texas, USA).

Results

Overall Injury Rate

From the 1992 - 1993 through the 2014 - 2015 season there was a total of 58.142 injuries reported, and a total of 16.568.790 visitors were on the resort. The global rate of injury was 3,5 injuries per 1000 skier across the 23 seasons, the minimum injury rate was 2,9 in the 1994 - 1995 season, and the maximum was 4.2 injuries per 1000 skier in the 2007 - 2008 and the 2010 - 2011 season. This global rate shows no significant change during the 23 seasons studied, with a Spearman correlation of 0,013 (p = 0,95) (Figure 1).



Figure 1: Global injury rate evolution across seasons. The global rate was 3,5 injuries per 1000 skier-days, showing no significant change during the 23 seasons studied, with a Spearman correlation of 0,0128 (p = 0,95).

Specific injury zones

Throughout the 23-season period a statically significant decrease in the rate of knee injuries (spearman = -0,54, p < 0.00), thumb trauma (spearman = -0,57, p < 0.00) and cranial trauma (Spearman = -0,53, p < 0.00) was observed. On the other hand, an increase in lower extremities injury rate was noted (spearman = 0,7, p < 0.05) (Figure 2). Other specific injuries as acromioclavicular disjunction, upper extremities fractures and glenohumeral luxation did not show any significant variation throughout the studied seasons.



Figure 2: Specific injury rate evolution across seasons. Throughout the 23 season period a decrease in the rate of knee injuries (spearman = -0,54), thumb trauma (spearman = -0,57), cranial trauma (Spearman = -0,53) and an increase in leg fractures (spearman = 0,7) was observed. Other specific injuries did not show any significant variation throughout the studied seasons.

Discussion

During the 23-year study period, at the ski resort, the overall injury rate was 3,5 injuries per 1000 skier, which is within the range described in other epidemiologic studies that show injury incidence between from 2,3 to 11 injuries per 1000 skier-days [4,6,9].

Despite the numerous epidemiologic studies of alpine ski injuries that exist, only a few analyse the global injury rate of these winter sports, including both alpine ski and snowboard. Sherry., et al. [10] show a significant decrease in the injury rate in a study with a 27-year overview and 22.000 reported injuries. Davidson., et al. [4], on the other hand, shows an increase from 1,9 to 3 injuries per 1000 skier-days in a 9-year overview study and 24.300 injuries reported. They attribute this rise to a better registry of injuries. In this study, the overall injury rate has not shown a significant variation throughout the 23 studied seasons, a result that is also insinuated in some other reviews not showing a statistical analysis of their data [1,6].

Regarding head trauma injuries, this study showed a pronounced and sustained decrease in its incidence. This could be explained because of the growing incentive in the use of a helmet while practising these winter sports. It is described in the literature that the use of helmet decreases the risk of cranial trauma [11] without increasing the risk of cervical injuries [12,13].

Decreasing trends were noted for the rates of knee injuries which includes medial collateral ligament and anterior cruciate ligaments injuries. In general, these lesions are produced by torsional mechanisms, which improvements in ski and snowboard equipment technology have had an impact on protecting athletes [14]. Lower extremities fractures, nevertheless, have evidently shown an increase in rates, especially since the last ten seasons. This fact may be explained by an increase in injuries due to collisions or falls from height, already described in the literature [15,16].

The main weakness of this studies is that only the number of visitors was registered, instead of the number of athletes practising ski or snowboard, and the amount of time that the athlete was performing. This bias is common to other epidemiologic studies. Despite these limitations and others similar studies, we believe that this work mainly contribution is that all injuries were recorded by a physician specialised in sports injuries. Another significant strength of this study is that all the medical attention were done in the same centre, which is the only emergency department in this ski resort, so all injuries were recorded. In our study we present a series of 23 seasons, being one of the longest and largest (58.142 injuries) studies published so far.

Conclusions

Despite the improvements in the safety of sports equipment, slope security, trauma prevention strategies and changes in the skier and snowboarder population, the overall injury rate has not undergone significant changes in all these years. Head trauma has a decreased incidence over time, which is very important due to mortality. On the other hand, lower extremities are increasing, what generates a challenge for prevention.

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