

PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Gender differences in snowboarding accidents in Austria: a 2005 to 2018 registry analysis
AUTHORS	Rugg, Christopher; Malzacher, Till; Ausserer, Julia; Rederlechner, Andrea; Paal, Peter; Ströhle, Mathias

VERSION 1 – REVIEW

REVIEWER	Geertsema, Celeste Aspetar Orthopaedic and Sports Medicine Hospital Sports Medicine Department
REVIEW RETURNED	13-Jun-2021

GENERAL COMMENTS	<p>Thank you for this important article, which aims to fill in a gap in existing knowledge about the differences between men and women in sports injuries. I have two comments: 1) whilst the paper describes the differences in type and severity of injury very well, it unfortunately does not describe the difference in incidence, since it does not address the question of differences in participation in snowboarding between the sexes. Are mild and severe injuries really increasing in female snowboarders, or are there just more female snowboarders? It is clear from the paper that this information is not available from the registry. Nevertheless, I would suggest the authors include some general statistics about the changes in snowboarding participation between the sexes in the discussion at least, in a similar way that they mention changes in participation in snowboarding in general. 2) One of the main aims of injury epidemiology research is eventually injury prevention. The authors postulate that risk taking behaviour plays a significant role in injury incidence in the individual who takes those risks - and highlight gender differences in this group. It would be interesting if future research also assesses risk taking behaviour as a factor in those causing injuries to others, and whether there are gender differences. Is this recorded in the registry?</p>
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REVIEWER	Alele, Faith James Cook University
REVIEW RETURNED	15-Jun-2021

GENERAL COMMENTS	<p>Gender differences in snowboarding accidents in Austria: a 2005 to 2018 registry analysis</p> <p>Thanks for the opportunity to review this article. The topic is interesting and more research is needed to answer and address current gaps. I commend the authors for their effort in putting the manuscript together. However, I have some comments for the authors.</p> <p>Abstract</p>
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	<p>In the methods section, please state the statistical analysis that was conducted. Results: While a summary of the results were presented, it would have been great to see the numerical values to give context to the burden and differences reported.</p> <p>Introduction It would have been great to see an in-depth discussion of the topic using relevant literature. The current introduction could be further developed with in-depth discussions on the gender differences in snowboarding injuries. For example, the authors have used five references for one sentence on shoulder and head injuries (Ref 9 – Ref 13). A look at the references listed showed that more details could be provided in the introduction. In addition, Ref 9 did not identify gender differences in snowboarding injuries; rather it identified males as risk takers. Given that, the authors have highlighted a number of studies that have identified gender differences in both snowboarding and skiing injuries, what is the justification for this study?</p> <p>Methods It is unclear why the authors have used non-parametric test given the large sample size. The authors also conducted a logistic regression to identify the predictors of severe or fatal injuries. However, identifying predictors of fatal injuries was not an aim of the study. Trying to identify predictors of severe injuries is a different research topic, which could have largely accommodated the aim of this current study. In my opinion, the authors need to reconsider their research questions/objectives.</p> <p>Results and discussion Given the issues raised above the results and the discussion may need to be revised. In addition, the first paragraph of the discussion section was a repetition of the results. The authors should consider revising and shorten the paragraph.</p>
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VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Celeste Geertsema, Aspetar Orthopaedic and Sports Medicine Hospital Sports Medicine Department
 Comments to the Author:

Thank you for this important article, which aims to fill in a gap in existing knowledge about the differences between men and women in sports injuries. I have two comments: 1) whilst the paper describes the differences in type and severity of injury very well, it unfortunately does not describe the difference in incidence, since it does not address the question of differences in participation in snowboarding between the sexes. Are mild and severe injuries really increasing in female snowboarders, or are there just more female snowboarders? It is clear from the paper that this information is not available from the registry. Nevertheless, I would suggest the authors include some general statistics about the changes in snowboarding participation between the sexes in the discussion at least, in a similar way that they mention changes in participation in snowboarding in general.

Dear Reviewer,

Thank you for your time and efforts and especially for your valuable input on our manuscript.

Unfortunately, hard scientific data on actual female participation in snowboarding is scarce. Therefore, we must rely on statistical polls from Snowsport industries America (SIA) and data found in theses. Since the beginning of snowboarding the female participation went from nearly nil up to a proportion of approximately 30% by 1998 – remaining in that range also in 2012 and 2019. As mentioned in the manuscript, following an initial hype the number of active snowboarders seems to be quite stable since the 2000s.

As seen in Figure 2, the absolute number of mild injuries decreased (male > female), as did severe injuries in men but not in women. With the given data (presumably stable number of female snowboarders in the observation timeframe) one must assume that indeed the incidence of severe injuries, at least have not decreased over time in female snowboarders, while they have in their male counterparts.

The following was modified in the manuscript:

Page 2 line 70f: “By 1998, the female proportion had increased to approximately 30% [8], obviously remaining in this range as seen in numbers from 2012 [9] and 2019 [10].”

Page 7 line 215ff: “Unexplained remain the observed gender differences in injury decline. The absolute number of mild injuries decreased less steeply in females than in males and the number of severe injuries even rose. However, the overall proportion of female participation in snowboarding seems to have been quite stable (~ 30%) since the late 1990s [8–10] and so has the total number of active snowboarders per year [1]. A proportional increase in female snowboarders does not seem causative leaving an altered risk profile over the years as possible explanation. In males, fatalities declined as well, but in females they were too rare to detect any changes over time. A decreasing incidence of traumatic and non-traumatic deaths on Austrian slopes was recently described elsewhere [1].”

2) One of the main aims of injury epidemiology research is eventually injury prevention. The authors postulate that risk taking behaviour plays a significant role in injury incidence in the individual who takes those risks - and highlight gender differences in this group. It would be interesting if future research also assesses risk taking behaviour as a factor in those causing injuries to others, and whether there are gender differences. Is this recorded in the registry?

Once again, we must dearly thank you for your valuable thoughts. We totally agree that an in-depth assessment of gender differences in risk taking behavior prior to accidents would be of great interest. Particularly differentiating victim and causer!

Unfortunately, up to date we do not have such data in our registry and therefore are not able to make any statements in the presented work.

Reviewer: 2

Dr. Faith Alele, James Cook University

Comments to the Author:

Gender differences in snowboarding accidents in Austria: a 2005 to 2018 registry analysis

Thanks for the opportunity to review this article. The topic is interesting and more research is needed to answer and address current gaps. I commend the authors for their effort in putting the manuscript together. However, I have some comments for the authors.

Dear Reviewer,

We would like to dearly thank you for your time and efforts put into our manuscript!

In the following we hope to sufficiently resolve all issues raised.

Abstract

In the methods section, please state the statistical analysis that was conducted.

We modified the methods section in the Abstract:

Page 1 line 19: "Retrospective analysis of gender-specific differences in injury patterns and risk factors for severe and fatal injuries within the Austrian National Registry of Mountain Accidents regarding snowboarding accidents (2005-2018)."

Results: While a summary of the results were presented, it would have been great to see the numerical values to give context to the burden and differences reported.

As also requested by the Editor we added numerical values to the results section of the Abstract. Due to the restricted word count of max. 300 in BMJ open we decided to shorten the conclusion in the Abstract.

The Abstract has been changed as follows:

Page 1 line 17ff:

"Objectives: To elucidate gender differences in snowboarding accidents.

Methods: Retrospective analysis of gender-specific differences in injury patterns and risk factors for severe and fatal injuries within the Austrian National Registry of Mountain Accidents regarding snowboarding accidents (2005-2018).

Results: A total of 3536 males and 2155 females were analysed. Over time, the number of mild, severe and fatal injuries per season decreased in males but not in females. Accidents most frequently were interindividual collisions (>80%) and occurred when heading downhill on a slope (males: 84%; females: 78%). Males more often suffered injuries to the shoulder (15.1% vs. 9.2%) and chest (6.8% vs. 4.4%), were involved in accidents caused by falling (12.9% vs. 9.6%) or obstacle impact (4.3% vs. 1.5%), while on slopes with higher difficulty levels (red: 42.6% vs. 39.9%; black: 4.2% vs. 2.5%), while snowboarding in a park (4.8% vs. 2.1%) and under the influence of alcohol (1.6% vs. 0.5%). Females more often sustained injuries to the back (10.2% vs. 13.1%) and pelvis (2.9% vs. 4.2%), on easier slopes (blue: 46.1% vs. 52.4%) and while standing or sitting (11.0% vs. 15.8%). Mild injuries were more frequent in females (48.6% vs. 56.4%), severe and fatal injuries in males (36.0% vs. 29.7% and 0.9% vs. 0.4%). Male gender, age and the use of a helmet were risk factors for the combined outcome of severe or fatal injuries (OR (99%CI): 1.22 (1.00-1.48), 1.02 (1.02-1.03) and 1.31 (1.05-1.63)). With regard to helmet use, the relative risk for severe injuries increased while that for mild injuries decreased with helmet use in male snowboarders only (RR (95%CI): 1.21 (1.09-1.34) and 0.88 (0.83-0.95)).

Conclusions: Snowboard injuries are proportionally increasing in females and the observed injury patterns and emergency characteristics differ substantially from those of males. Further gender-specific research in snowboard-related injuries should be encouraged."

Introduction

It would have been great to see an in-depth discussion of the topic using relevant literature. The current introduction could be further developed with in-depth discussions on the gender differences in snowboarding injuries. For example, the authors have used five references for one sentence on shoulder and head injuries (Ref 9 – Ref 13). A look at the references listed showed that more details could be provided in the introduction. In addition, Ref 9 did not identify gender differences in snowboarding injuries; rather it identified males as risk takers. Given that, the authors have highlighted a number of studies that have identified gender differences in both snowboarding and skiing injuries, what is the justification for this study?

Dear Reviewer,

Thank you for your detailed and critical reading!

As noticed absolutely correctly Ref 9 was cited wrong and therefore removed. We apologize for this mistake. Furthermore, we tried to rephrase the introduction in order to state more clearly that actually literature on gender-specific differences in snowboarding accidents is quite scarce. As stated correctly, we used five references for one sentence, but the actual information on gender specific differences within these references is very little. Nevertheless, we tried to pull out as much information as possible to therefore introduce the reader to this topic.

We further stressed that literature is scarce, and that we are the first to primarily focus on gender-specific differences in this regard.

The introduction now reads as follows:

“Recreational winter sport activities are numerous performed in the Austrian Alps. With fairly constant skier days per season in Austria (~50 million) [1], injury incidences in mountain winter sports are decreasing [2,3]. Nevertheless, at the national level, skiing and snowboarding continuously rank among the top five causes of sport accidents [4]. Among Austrian residents, approximately 20,000 – 25,000 people per year are involved in skiing- or snowboarding-related accidents requiring hospital attention. About 20% are snowboarding-related.

Snowboarding has long been predominated by males, but the rise in female participation is becoming more apparent [5–8]. By 1998, the female proportion had increased to approximately 30% [8], obviously remaining in this range as seen in numbers from 2012 [9] and 2019 [10]. Up to date, literature on gender-specific differences in injury patterns remains seldom and often incidental within general injury reports [3,11] or reports on particular injury types [12–14]. In summary, female snowboarders seem to suffer fewer shoulder [3,11,12], head [3,14] and facial injuries [13] than their male counterparts. But, higher incidences in arm [3] and knee [11] injuries have also been reported. Furthermore, it is known that males are prone to suffer more severe as well as fatal injuries on ski slopes, when both skiing and snowboarding [1,15–17]. Often enough, a causal relationship is drawn to an increased risk-taking behaviour of males, not only on ski slopes but also in everyday life [18–23].

To our knowledge, the following national registry analysis is the first to primarily focus on gender-specific differences in snowboarding-related accidents. Beyond mere incidences, injury severity distributions, injury patterns, emergency characteristics and risk factors for the composite outcome of severe or fatal injuries are elaborated. Utilizing data collected nationally over a considerable period of 13 years made an extensive analysis possible.”

Methods

It is unclear why the authors have used non-parametric test given the large sample size.

We are sorry for the misunderstandings. We used non-parametric tests due to non-normal distribution of the observed data.

We added the following sentence:

Page 3 line 137: “In general, due to non-normal distribution, data are presented as median and interquartile range or count and percentage, as appropriate.”

The authors also conducted a logistic regression to identify the predictors of severe or fatal injuries. However, identifying predictors of fatal injuries was not an aim of the study. Trying to identify predictors of severe injuries is a different research topic, which could have largely accommodated the aim of this current study. In my opinion, the authors need to reconsider their research questions/objectives.

We completely understand your objection and once again, are sorry for the misunderstandings.

We agree that of course, fatal and severe injuries are two different research topics. Within our data, fatal injuries were extremely seldom (<1%; 33 males and 8 females in total within the observation period).

Risk factor analysis for fatal injuries only was therefore deemed unfruitful. As we did not want to lose this information we decided to create a composite outcome most best described as “undesirable outcome” = severe or fatal injuries.

In the introduction it was stated: “..emergency characteristics and risk factors for severe and fatal injuries are elaborated.”

In order to make our study objective more clear we decided to modify the sentence as follows:

Page 2 line 94ff: “Beyond mere incidences, injury severity distributions, injury patterns, emergency characteristics and risk factors for the composite outcome of severe or fatal injuries are elaborated.”

Results and discussion

Given the issues raised above the results and the discussion may need to be revised. In addition, the first paragraph of the discussion section was a repetition of the results. The authors should consider revising and shorten the paragraph.

Changes to the results section were deemed not necessary in the eye of the answers given above.

The first part of the discussion was deliberately constructed as summary of the main results. Since the presented tables and figures are quite extensive, we feel that this practice brings back the focus of the reader to the essential results before we go on to further discuss them. We furthermore think that this practice is not unusual and that readability is actually improved. If not absolutely insisted by the reviewer or editor, we would be glad to keep this section.

Further changes to the discussion are:

Page 7 line 247ff: “Unexplained remain the observed gender differences in injury decline. The absolute number of mild injuries decreased less steeply in females than in males and the number of severe injuries even rose. However, the overall proportion of female participation in snowboarding seems to have been quite stable (~ 30%) since the late 1990s [8–10] and so has the total number of active snowboarders per year [1]. A proportional increase in female snowboarders does not seem causative leaving an altered risk profile over the years as possible explanation. In males, fatalities declined as well, but in females they were too rare to detect any changes over time. A decreasing incidence of traumatic and non-traumatic deaths on Austrian slopes was recently described elsewhere [1].”

Lastly, we would like to once more thank the reviewers for their valuable input and particularly their time spent. We do believe our manuscript has substantially improved!

VERSION 2 – REVIEW

REVIEWER	Alele, Faith James Cook University
REVIEW RETURNED	04-Sep-2021
GENERAL COMMENTS	The authors have addressed my questions and I have no further comments.