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TECHNICAL REPORT TCN 09/02

Head Injury Survey - Report

1 SUMMARY

This report summarises the results from a questionnaire compiled by Dan Middleton (BMC Technical Officer) and published on the internet. The questionnaire was linked from the BMC and ukclimbing.com websites.

The intention of this survey was to determine if the existing international helmet standards were sufficient to cover the use that British climbers were subjecting their helmets to. The survey was initiated to investigate the use of helmets in the British climbing community. A previous study carried out by Dr. Mark Taylor of Leeds University used information supplied by British Mountain Rescue Teams. This previous investigation did not include the less severe injuries that can occur whilst climbing that do not result in a Mountain Rescue Team call-out. This survey was created to gain a better understanding of all types of climbing incidents related to head injuries and helmet usage. The response to this survey was sufficient to draw some useful conclusions on helmet use in the British climbing community; these are discussed in detail below.

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Draft	E	
Published	16/05/2011	

2 INTRODUCTION

This survey was conducted in September 2007 using an off-the-shelf internet survey package linked to the BMC and ukclimbing.com websites. 472 respondents completed the survey. There were a further five respondents who did not answer all of the questions. This number of respondents ought to be enough to draw some reasonable conclusions, however, for some of the comparisons attempted in this report this size of response was inadequate to show statistical significance.

3 ANALYSIS

The published questionnaire consisted of the following questions and possible answers:

Q1 What activity were you doing when the accident occurred?

- Single Pitch Rock Climbing
- Multi-pitch Rock Climbing
- Summer mountaineering & scrambling
- Winter climbing & mountaineering

Q2 What was the cause of the accident?

- Climber fall or slip
- Falling object: rock, ice or equipment

Q3 Where best describes the impact area on the head during the accident?

- Front
- Rear
- Side
- Crown (top)

Q4 Were you wearing a helmet?

- Yes
- No

Q5 Which of the following best describes the form of any head injury you received as a result of the accident?

- Severe Injury: Hospitalised, permanent or long term impairment
- Major Injury: Hospitalised, no permanent impairment
- Minor Injury: Treated in casualty or self-treated, no permanent impairment
- None

Q6 Any other comments?

4 DISCUSSION

The survey produced a lot of data but of all the possible comparisons that could be made only a few produced statistically significant results. After comparing and contrasting the results from the survey, the pertinent comparisons were analysed using a chi squared function to test the independence of the data used for the comparison. The following conclusions were drawn from the resulting data; for more details on the comments below please see the data included in the Appendix [0]:

- The majority of the respondents were wearing helmets when they had their accident [Fig. 6.1].

- Within the respondents as a whole, the chances of being hit by a falling object are statistically no more likely than a climber fall. Incidents suffered by helmet wearers were more likely to be due to a falling object, whereas the non-helmet wearers were more likely to suffer from a climber fall [Fig. 6.2].

- Wearing a helmet significantly reduces the chances of suffering a severe or major head injury: non-helmet wearers are more than twice as likely to suffer a severe head injury than helmet wearers [Fig. 6.3].

- People not wearing helmets reported more injuries from single pitch climbing but fewer injuries from winter climbing [Fig. 6.4].

- There was not enough data to make any conclusions on the relationship between injury severity and the type of climbing [Fig 6.5].

- The data shows that winter climbing produced more injuries in the None category than would be statistically expected [Fig. 6.7].

- Incidents of single pitch climbers were more likely to be caused by a climber fall and winter climbing injuries were more likely to be caused by a falling object [Fig. 6.8].

- A crown injury was more likely to be caused by a falling object, whilst injuries to the front and rear of the head were more likely to be cause by a climber fall [Fig. 6.9].

- Injuries on the front of the head were significantly more likely to result in a severe incident [Fig. 6.10].

- Injuries that had no permanent impairments were more likely to be caused by a climber fall than by a falling object, whilst incidents resulting in ‘no injury’ were more likely to be caused by a falling object [Fig. 6.11].

5 CONCLUSIONS

Below are the main findings of this analysis:

- More injuries were reported for single pitch climbing without a helmet than any of the other categories of climbing [Fig. 6.4].
- The high incidence of severe injury following impacts to the front of the head highlights the importance of helmet performance in this area. [Fig. 6.10].
- The helmets used by the respondents seem to be doing a good job at reducing the effects of crown impacts [Fig. 6.10].
- The larger use of helmets when winter climbing rather than single pitch climbing [Fig. 6.4] could indicate that climbers perceive that they are more likely to have a head injury when winter climbing than single pitch climbing.
- The survey shows that those who wore a helmet were more likely to report an injury severity of minor or none [Fig. 6.3].
- The data shows that from the incidents reported, climber falls produced more serious injuries than objects falling on climbers [Fig. 6.11].

6 RECOMMENDATIONS FOR FUTURE SURVEYS

This survey has been very useful and has thrown up some interesting results. The survey was designed to be short but with sufficient breadth to cover most aspects of the current British climbing scene and as such it has proved to be very useful. The survey was designed to target the “average climber”, who it was assumed is unlikely to spend a significant length of time on a questionnaire when he/she could be out climbing. If this survey is to be repeated or continued there a few points that may be changed to improve and increase the conclusions that can be drawn from the resulting data.

Although there was a good response from this survey, when the categories were split up some of the sample sizes were too small to draw a statistically representative conclusion. A possible suggestion for improving this is to repeat or continue this survey but keep the questionnaire open for an extended period and better publicise its existence.

The classification of different types of climbing detailed in this survey was reasonably broad. It may help if more and specific climbing categories were requested or even allowing the respondent to name the climb where the incident occurred. This would allow more detailed conclusions to be drawn from the results.

This survey did not include any questions about helmet construction. Including construction details would help supply information on how specific helmet designs could be attributed to injury locations.

APPENDIX

Summary of head injury data
Clare Gardiner
May 2008

Comparison of Helmet Use

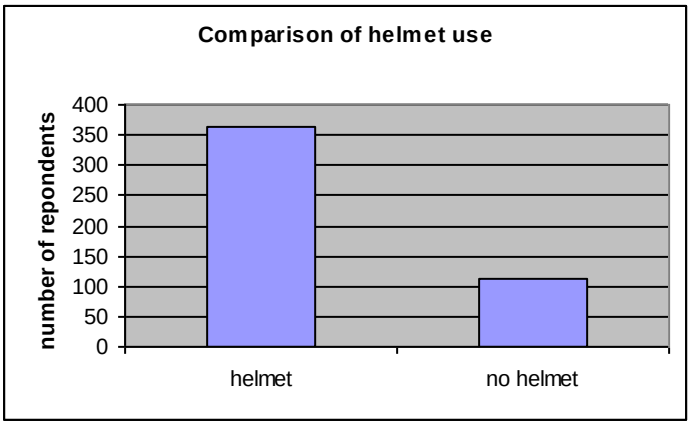


Fig 6.1

The majority of survey respondents were wearing a helmet at the time of their accident.

Possible explanations for this finding include:

1. People are no more likely to be injured when wearing a helmet, but the sample is biased towards helmet wearers (i.e. more helmet wearers completed the survey).
2. Wearing a helmet per se does not increase the chance of a head injury, but people are more likely to wear a helmet on harder climbs (where a fall is more probable or has more severe consequences), or in more dangerous situations (where a falling object is more likely).
3. Wearing a helmet makes a head injury more likely.

Although causation cannot be confirmed without further statistical analysis, a reasonable knowledge and understanding of climbing practice and helmet design would indicate that explanations 1 and 2 are the most likely.

Comparison of Injury Cause

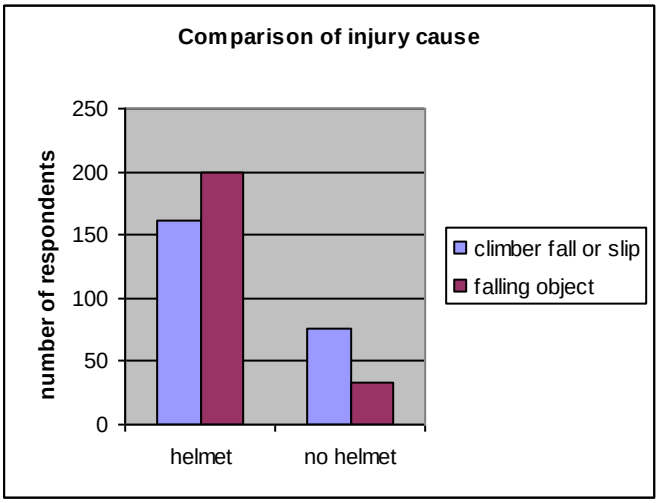
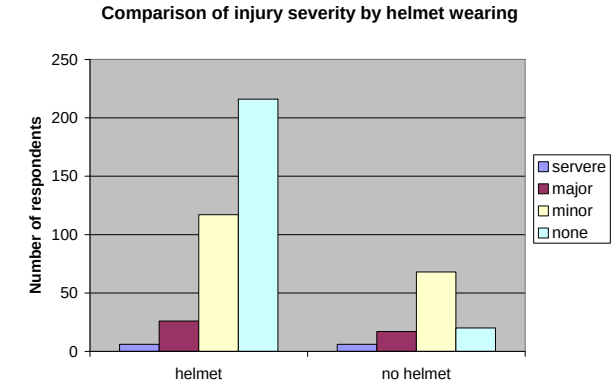


Fig 6.2

Helmet wearers were more likely to be injured by falling objects and non-helmet wearers by a climber fall.

Comparison of Injury Severity by Helmet Wearing



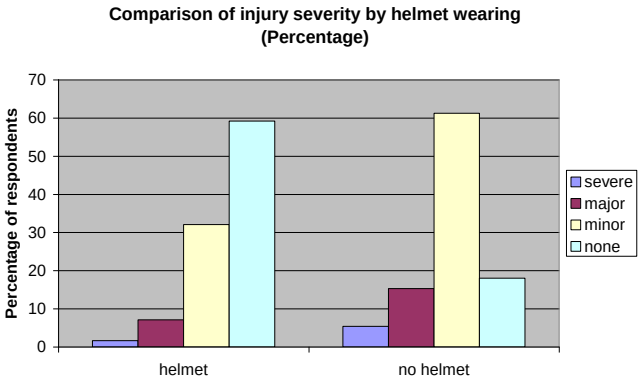


Fig 6.3

Wearing a helmet significantly reduces the chances of suffering a severe or major head injury, non-helmet wearers are more than twice as likely to suffer a severe head injury than helmet wearers.

Comparison of Activity Causing Injury in Helmet and Non-helmet Wearers

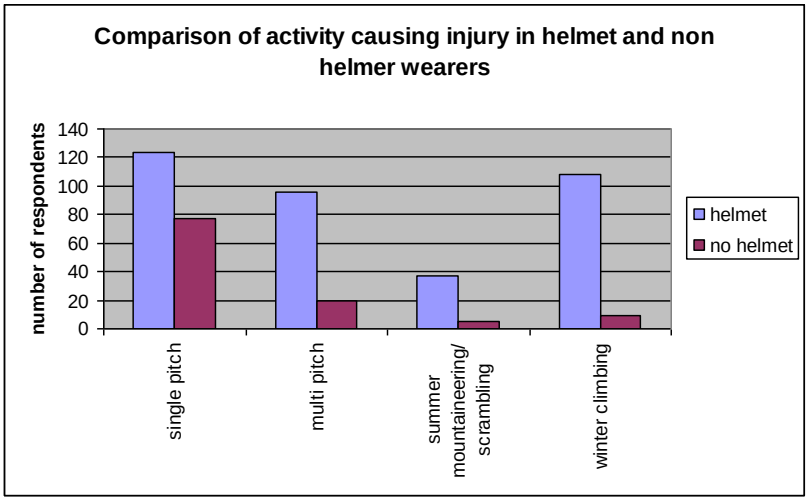


Fig 6.4

Single pitch climbing caused the majority of head injuries across the sample, this is potentially a consequence of single-pitch being the most common type of climbing.

Comparison of Activity by Injury Severity in Helmet Wearers Only

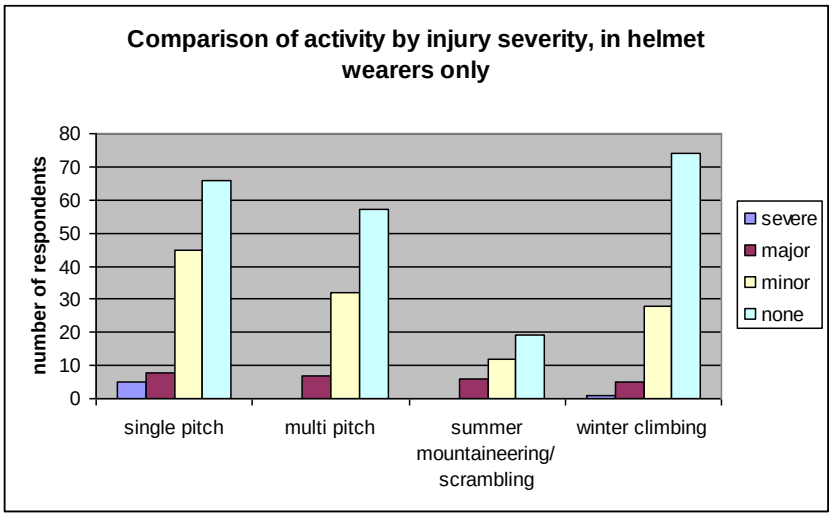


Fig 6.5

No significant differences across the pattern of results (^{2}= 16.88, df = 9, p = 0.051). However, sample size is too small to generate reliable analyses, increased sample may reveal significant result.

Comparison of Activity by Injury Severity in Non-helmet Wearers Only

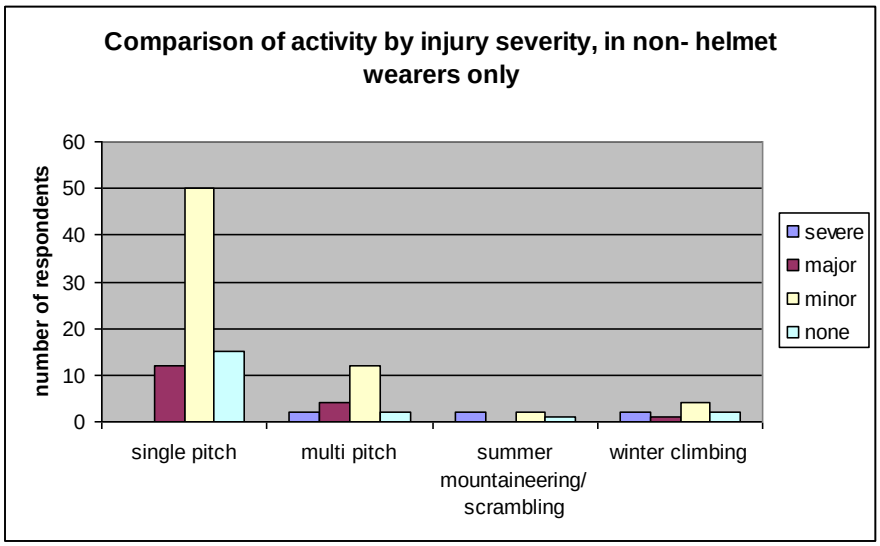


Fig 6.6

There are slight significant differences in the patterns of results (^{2} = 23.74, df = 9, p < 0.01). Again the sample size is too small to draw firm conclusions, but summer mountaineering resulted in significantly more 'severe' injuries.
When assessing impact area by helmet wearing, there were significant differences across the pattern of results *(^{2}= 27.74, df = 9, p < 0.01).*

Comparison of Injury Severity by Activity Type

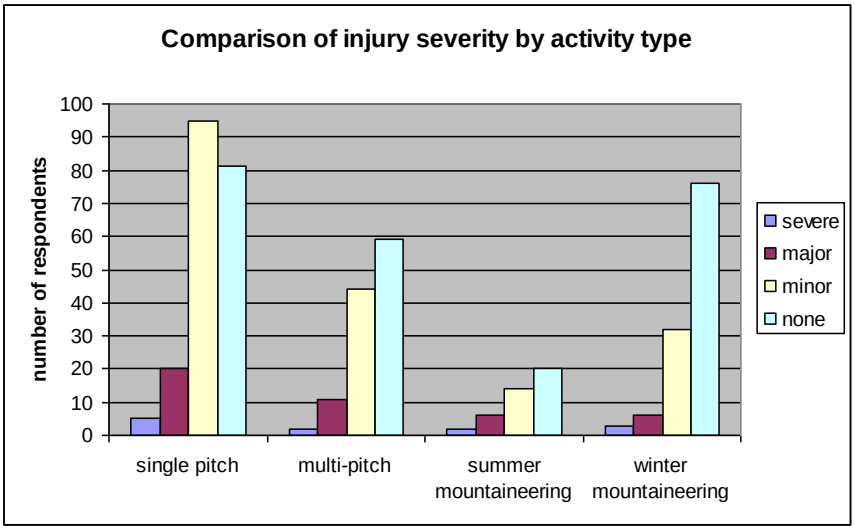


Fig 6.7

Across all types of climbing, the majority of head injuries resulted in injuries classed as minor or none, but bear in mind the majority of the sample were helmet wearers.

Comparison of Activity by Injury Cause

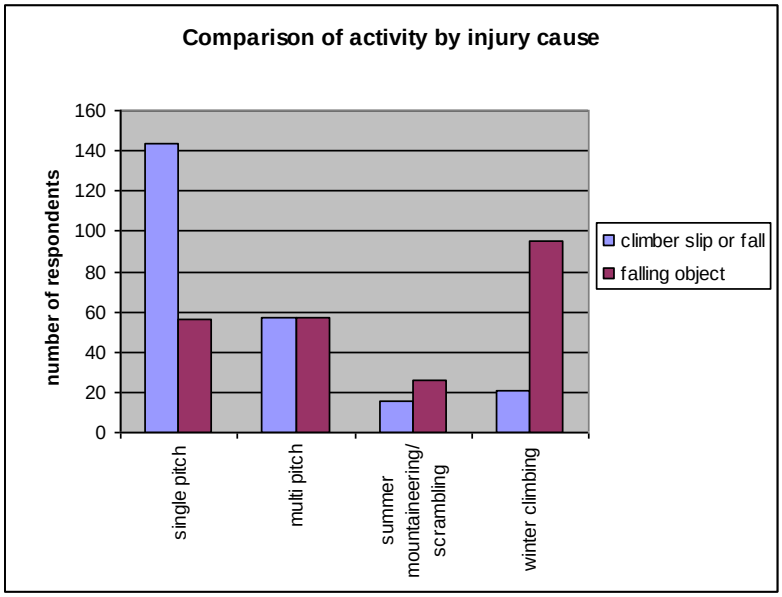


Fig 6.8

Single pitch climbing injuries are most likely to be caused by a climber fall (which most often result in injuries to the front and rear) whilst winter climbing injuries are most likely to be caused by a falling object (most commonly injuring the crown).

Comparison of Impact Area by Cause

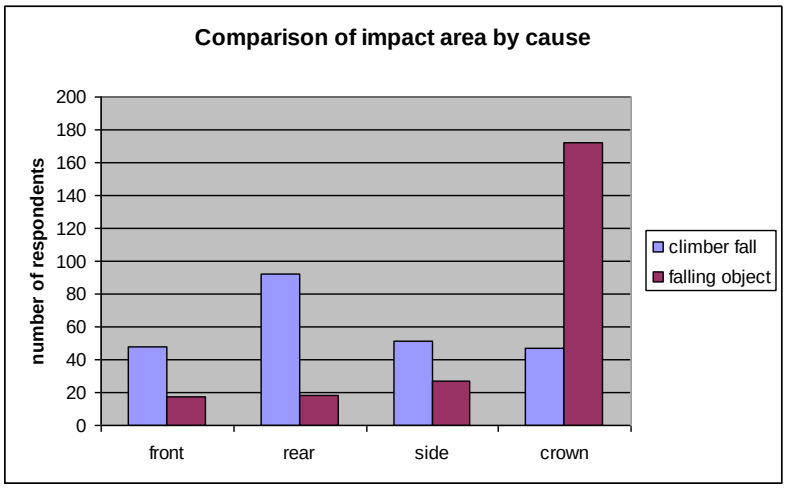


Fig 6.9

There were significant differences across the patterns of results (^{2} = 143.27, df = 3, $p < 0.001$). An injury on the crown was significantly more likely to have been caused by a falling object than by a climber fall, whilst injuries on the front and rear were significantly more likely to have been caused by a climber fall ($p < 0.01$).

Comparison of Impact Area by Injury Severity

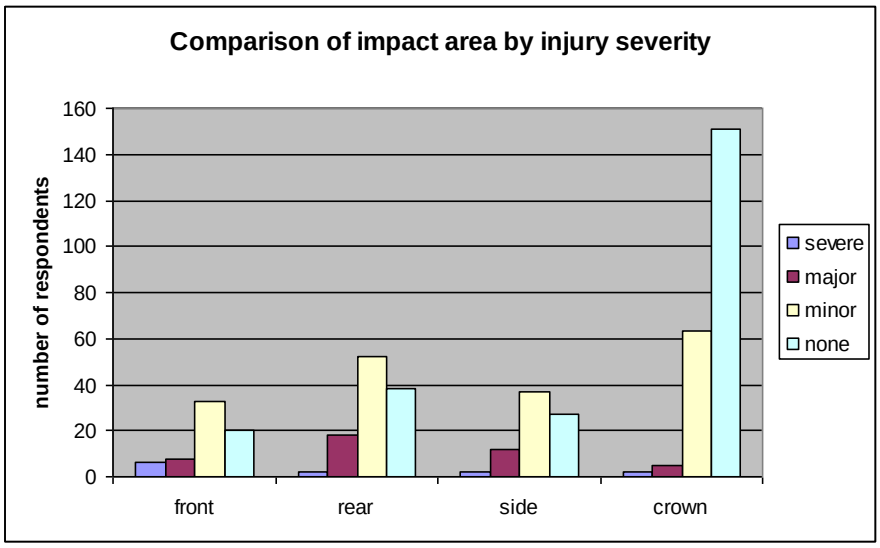


Fig 6.10

Nearly half of all impacts were to the crown and this area of impact was most likely to result in 'no injury'. Injuries to the front of the head were likely to result in a 'severe' injury. However, this finding relates to all climbers (helmet and non-helmet wearers) and it is not possible to dissociate the effects of helmet wearing on impact location and injury severity.

Comparison of Injury Severity by Cause

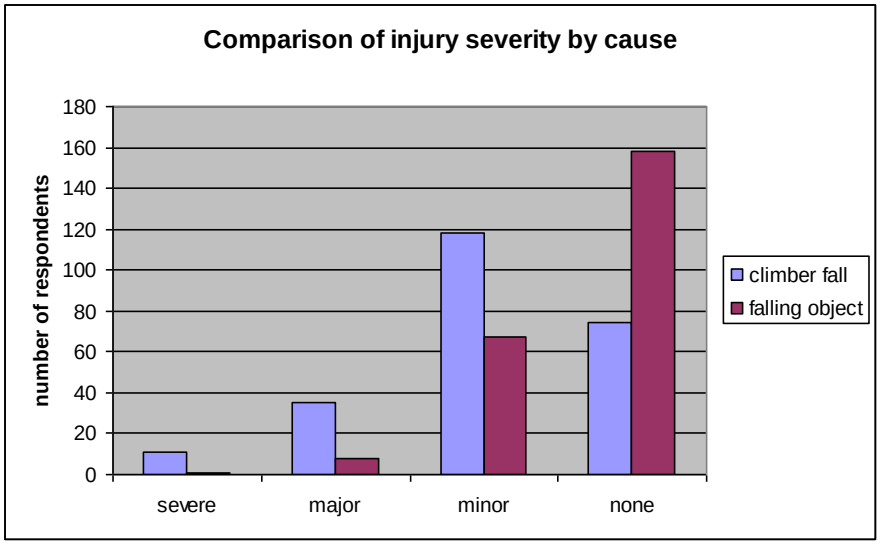


Fig 6.11

There were significant differences across the patterns of results (2 = 69.73, df = 3, p < 0.001). 'Major' and 'minor' injuries were both more likely to be caused by a climber fall than by a falling object, whilst incidents resulting in 'no injury' were more likely to be caused by a falling object (p < 0.01).