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Fact or Folklore? Exploring “Myths” about Outdoor Education Accidents: Some Evidence from New Zealand

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Abstract

This paper provides analysis on the frequency and nature of accidents and near accidents that have occurred in larger outdoor education centres in New Zealand. This is the first time that information of this type has been collected and analysed in New Zealand.

All 25 of the known outdoor education organisations employing three or more full-time staff were invited to participate in a study that would extract and review data from their records about accidents and near accidents. Twelve agreed to participate.

The data collected is analysed in the context of various myths that are often heard referred to by the outdoor education community. These are that:

- i. focusing on minor incidents prevents major accidents occurring,*
- ii. selecting activities with high perceived risk but low real risk reduces exposure to accidents,*
- iii. more accidents occur while under the supervision of male rather than female instructors,*
- iv. accidents are more likely in the afternoon than the morning, and*
- v. outdoor education is dangerous compared to other risks in life.*

The results lend some support to the factual nature of “myths” iii and iv, but help consign “myths” i, ii and v to the category of folklore. These results provide insights that may assist in developing strategies to improve safety in outdoor education.

In view of the current size and importance of the outdoor education sector in New Zealand and its likely future growth, one of the main recommendations arising from this study is for the establishment of a national system to formally record and report incidents and accidents.

Introduction

This paper reports the results of an investigation into serious incidents that have occurred within programmes run by larger outdoor education organisations in New Zealand for the period 1996–2000. Serious incidents and fatalities are occurring regularly in the outdoor education sector and causing significant public concern. Substantial media attention was given to some recent incidents such as three fatalities of diving students while under instruction at French Pass in March, 2000 (New Zealand Herald [NZH], 2000), the drowning of two school children during a canoeing trip operated by a professional contractor on the Clarence River in October, 2001 (Perrott & Black, 2001), and the more recent student kayak death on the Buller River as part of a tertiary programme in February, 2002 (NZH, 2002). All of these incidents took place under the supervision of instructors

purporting to be skilled and experienced. In addition to the loss of life and distress caused to the families of those killed, the negative publicity has potential to be very damaging to the outdoor education sector. This begs the question: why are such incidents occurring and what can we learn from them to reduce future occurrences?

Background Information

In the United Kingdom in May 1993, a multiple fatality of young teenage children at Lyme Bay provoked nationwide media attention. Criminal charges were brought against the staff and management of the outdoor education centre concerned resulting in convictions, fines and jail terms (Laurie, 1996). Justice Ognall, made a call for an immediate and thorough appraisal of the running of activity centres as, in his mind, the potential for injury or death was too obvious for safety procedures to be left, “to the inadequate vagaries of self regulation” (Bradford, 2000). A government imposed inspection system was introduced for all outdoor centres (excluding schools) dealing with children, with rigorous standards of operation required. Discussions with Marcus Bailie, head of inspection services for the Adventure Activities Licensing Authority (AALA) indicate that there have been no studies done on the effect of the introduction of licensing. He believes that there may have been some loss of provision from providers opting out of working with young people and that provision within schools seems to be heavily under pressure. Bailie described the reaction to the Lyme Bay incident to me as “a true moral panic”, and believes the introduction of licensing was almost certainly an over-reaction in as much as it helped fuel the fire of parental and societal paranoia.

A parallel development of government-imposed standards has occurred in the New Zealand adventure tourism industry where the Marine Safety Authority (MSA) imposed stringent operating conditions and standards on the rafting industry in the 1990s following a number of incidents. Reports into rafting fatalities show a decreased number for the five years following the imposition of the new standards compared to the five years preceding the standards. Whether this is due to the new standards or to other factors is not known; whatever, fatalities are still occurring (Brown, 2003; Maritime Safety Authority, 2002) and every effort needs to be made to reduce them.

Some of the latest writings from the United States on legal defense for outdoor education accidents argued that many types of accidents are due to the inherent risk of going into the outdoors (Gregg, 1999a, 1999b). Inherent risks are those so closely associated with an activity that they cannot be eliminated without altering the nature of the activity. A provider of services can avoid liability for losses caused by such inherent risks by state statutes, case law, or written agreements whereby such risks are assumed. The argument therefore is that an instructor making a wrong judgment is an inherent risk of outdoor activities which can't be eliminated without altering the nature of the activity and therefore must be assumed by the participants.

Whilst risk can never be reduced to zero when going into the outdoors, this is not argument enough for accepting that serious accidents should be viewed as an inevitable and unalterable part of the sector. Outdoor instructors and managers should be doing all they can to identify ways of managing activities and the associated risk to reduce the occurrence of such accidents.

Recent risk management practices in the outdoor sector in New Zealand have been driven by the Health and Safety in Employment Act 1992. This has led to a proliferation of paper-based systems whereby risks are identified and various management techniques recorded for the benefit of the instructional staff working with groups. While these systems can be of use, for many organisations they are completed at the behest of management, with the main purpose of protecting the organisation from criticism following incidents and are rarely referred to by active instructors. Critical to risk management in the future is giving these systems relevance to instructional staff and reflecting on the lessons learned about the root causes of key outdoor incidents.

My belief is that there is currently no culture within the outdoor education sector in New Zealand of sharing information about mistakes. Experience suggests that when accidents occur, there is a tendency to close ranks, keep heads down, investigate the accident internally, and do what can be done within the organisation to prevent similar incidents occurring in the future. Organisations try to contain knowledge of any accident to avoid adverse publicity, investigation by outside authorities and possible legal action.

Not only are there the legislative and punitive issues to avoid in keeping a low profile when an accident occurs, there are the more subtle negative marketing issues. The outdoor education sector in New Zealand has expanded enormously over the past three decades. From a small and unstructured beginning where experiences were offered by a number of schools and a few other groups, it is now estimated by the executive director of Outdoors New Zealand (ONZ) that including school camps, private training establishments (PTEs), Conservation Corps Programmes, Polytechnical Colleges, Universities, freelance instructors, charitable trusts and private businesses there are in excess of 800 providers involved in the delivery of outdoor education in New Zealand (Knol, 2001). There is a competitive environment for students, and within that competitive environment no organisation wants to concede an edge to other organisations by disclosing unsafe practices.

Much could be learnt if a mechanism could be found for establishing what actual incident rates are for participation in outdoor education and sharing the lessons about incidents for the betterment and health of the sector as a whole. At the end of this paper some recommendations are made about how this might happen.

The research presented here is an attempt to discover accurate information about incident occurrence in New Zealand and to share the lessons that can be learnt. The collection of this data has depended on the goodwill of contributing organisations.

Method

The goal of this research was to compile a profile of outdoor incidents in New Zealand in order to find out what is actually happening and what trends can be discerned. The study is limited to larger outdoor education organisations (defined for this study as those organisations having three or more full-time paid staff) as these are the organisations most likely to be keeping incident records and able to have staff available to respond to questions.

ONZ, an umbrella membership organisation, provided a list of 25 outdoor organisations from their database that met these criteria. Each organisation was contacted by mail and asked if they were prepared to contribute their accident data. They were promised anonymity about their contribution

and the details of specific incidents. Of the 25 organisations, 12 contributed their data. The other 13 did not contribute for various reasons: one organisation simply did not want to take part, seven others failed to respond to the initial request and a follow-up request, one believed they did not meet the criteria for contributing organisations, two did not keep incident records, and two indicated that their records did not include any incidents of interest.

Although only 12 of the 25 organisations chose to contribute, the 12 organisations contained all of the larger providers and the author believes they collectively represent well in excess of 50 % of the outdoor education student days being carried out by this part of the sector.

Almost all of the 12 participating organisations had their own unique form for recording incident data, although several used the Outdoor Safety Institute's (OSI) accident / incident form for more serious incidents. The incident forms were completed by the instructor who was in charge of the group at the time of the incident, with seemingly little quality control over the standard of completion by a person in management. This lack of quality control displayed itself as incomplete information on the forms, scanty detail in narratives and almost illegibility of some forms. The variety of incident forms and incomplete nature of many of the completed forms led to a limited amount of data that could be recorded in common across all incidents.

1908 incidents from the 12 participating organisations were entered into a database of incidents for the years 1996–2000 inclusive. While most organisations had complete records for the five-year period surveyed, three organisations contributed a subset of data. This was because they had either been unable to locate certain records or they had only started collecting data in more recent years.

Results

The 1908 incidents were recorded and classified according to "Incident Type" as shown in Table 1.

Table 1
Number of recorded incidents grouped according to incident type in the years
1996 - 2000

Incident Type	Number of Recorded Incidents 1996 -2000
Death	0
Injury	1154
Near Miss	448
Illness	219
Loss of Process	2
Emotional/psychological	25
Damage to Equipment	59
Environmental Damage	1
TOTAL	1908

It is important to bear in mind that the figures in Table 1 and the analysis that follows, represent a sample of the outdoor education sector, and a sample that was self-selected. The potential for bias in the results is thus considerable. Also, bear in mind that each organisation recorded incidents according to its own criteria, and these varied from one to another.

In terms of completeness of data for the 12 organisations surveyed, it is assumed that the data for deaths and injuries are likely to be more accurate as a complete record than for any of the other categories. This belief is based on the premise that all organisations collecting data would believe it important to record data on deaths and injuries, especially injuries of moderate or major severity. Other categories of incident type mentioned above are less likely to be recorded unless either the organisation has a rigorous reporting process in place, or the loss is significant in that category. For example, the one reported incident of environmental damage resulted in fire destroying a large area of vegetation and the fire had potential for even worse consequences. Many other environmental incidents with less serious outcomes may have occurred without being reported. Recording of near misses comes down to the openness of instructional staff to share these incidents with others and this openness can be significantly affected by the culture in the organisation concerned and what is done with the data. Most of the following analysis is restricted to the top three rows of Table 1 (Deaths, Injuries and Near misses) because of the assumed incompleteness of the other data.

It is interesting to note that there were no recorded deaths in the years surveyed. This seems to be an anomaly of the survey years rather than any global measure of success in managing risk, as there have been deaths and other very serious incidents in some of the contributing organisations outside the surveyed years. The New Zealand Mountain Safety Council (MSC) keeps records of all deaths in the New Zealand outdoors. These records are put together by collating the findings from Coronial Inquests. At the time of writing the records have been completed only up to the year 1998. Coroners' reports have been collected for 1999 and 2000 but there has been no human resource available to update their records. A summary for the years 1979–1998 is shown in Table 2 for the MSC category of Instruction, Guiding or Professional Care (IGPC). This records 140 deaths over the 20 year period, an average of seven per annum.

However, when allowance is made for two exceptional tragedies in 1991 and 1996 that may be regarded as statistical outliers, the average reduces to 120 deaths or six per annum. Furthermore, when non-educational activities are excluded the total is 59 (excluding the Ruapehu and Cave Creek accidents) or three per annum.

Analysis

Analysis of the data collected for the period 1996–2000 from the 12 participating organisations is now presented. This is done in the context of five “myths” that are perpetuated within the outdoor education community.

MYTH ONE: The Accident Triangle—If we focus on the minor incidents, we will prevent the major incidents and deaths.

Often quoted in the safety management literature is a landmark study of industrial accidents undertaken in the USA in 1969 (Bird & Germaine, 1989). This study was an analysis of 1,753,498 accidents reported by 297 cooperating companies. The companies represented 21 different industrial groups employing 1,750,000 employees who worked over three billion person-hours during the exposure period analysed. The study revealed the ratio shown in Figure 1.

Table 2

Fatalities in outdoor recreation where people were involved with instruction, guidance or other professional care.

Year	A Total Fatalities	B Total Fatalities exc. outliers	C Total Fatalities exc. adv. tour.	D Total Fatalities exc. outliers & adv. tour. etc
1979	2	2	2	2
1980	8	8	6	6
1981	9	9	4	4
1982	4	4	2	2
1983	1	1	1	1
1984	7	7	5	5
1985	6	6	2	2
1986	5	5	2	2
1987	4	4	1	1
1988	6	6	5	5
1989	8	8	5	5
1990	5	5	2	2
1991	10	4	7	1
1992	8	8	3	3
1993	14	14	6	6
1994	9	9	2	2
1995	3	3	2	2
1996	18	4	15	1
1997	6	6	2	2
1998	7	7	5	5
1999	n/a	n/a	n/a	n/a
2000	n/a	n/a	n/a	n/a
Total	140	120	79	59
Mean	7.00	6.00	3.95	2.95

NOTES:

Source – New Zealand Mountain Safety Council (1998) report.

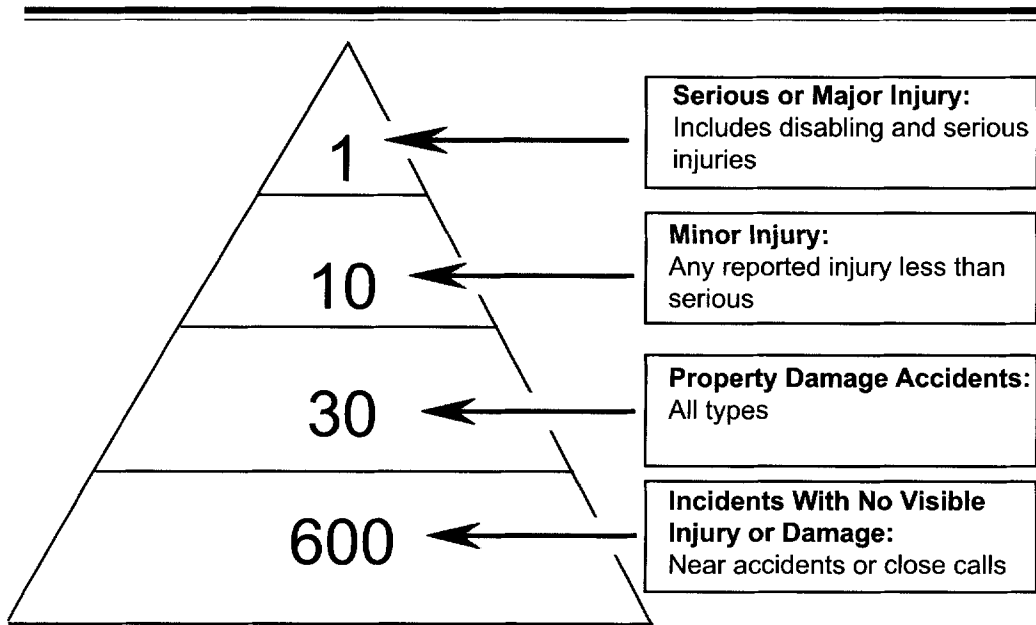
1991 and 1996 include two exceptional incidents where 6 people died in an Army exercise on Mt Ruapehu (1991) and 14 died in the Cave Creek incident (1996). Column B excludes these outliers.

Column C excludes fatalities in adventure tourism, free skiing and non-educational activities.

Column D excludes both outliers and adventure tourism etc.

Shaded area indicates years in which data was collected for this research.

Figure 1
Industrial Accident Ratio Study (Bird & Germaine, 1989, p.21)



The authors of this study emphasise that this ratio represents only those incidents that were reported, rather than the number that actually occurred and also that the ratio may not hold for any particular occupational group or organisation. Further, the authors point out that the significance of this study is that major incidents are rare events and that there are many more opportunities to study less serious incidents and take actions to prevent the major losses from occurring. An important corollary to this statement is that this is most effective when effort is directed at incidents that have a high loss potential.

Unfortunately this study, and the diagram shown in Figure 1 is sometimes misrepresented. At safety seminars and risk management courses, tutors have been observed explaining to students that 600 near accidents lead to 30 property damage incidents, which lead to 10 minor injuries, which in turn leads to 1 major injury. They summarise by stating that the way to stop major incidents is therefore to study and stop the minor incidents.

What Figure 1 was intended to indicate is that accidents are the culmination of a number of factors coming together to produce an accident potential. Once the sequence has been initiated, the type and degree of loss are somewhat a matter of chance, depending partly on fortuitous circumstance and partly on actions taken to minimise the loss (Bird & Germaine, 1989). What is needed to prevent serious accidents therefore, is to look not only at the causes of the serious accidents that have occurred, but also at incidents that have high potential for serious loss.

Table 3
Accident Severity Scale

Severity Ranking	Group Descriptor	Description of Injury	Description of Illness	Description of Equipment Damage \$NZ	Description of Environmental Damage	Description of Psychological or Emotional Damage
1	Minor or short term impact on individual(s) that doesn't have large effect on their participation in the programme	Splinters, insect bites, stings	Minor irritant	Minor cost	Littering	Temporary embarrassment
2		Sunburn, scrapes, bruises, minor cut	Minor cold, infection	>\$50	Minor damage to environment that will quickly recover	Temporary embarrassment with peers
3		Blisters, mild hypo/hyperthermia, minor sprain, minor dislocation	Minor asthma, cold, upset stomach, etc	>\$100	Scorched campsite, plant damage	Shown up in front of group
4	Medium impact on individual(s) that may prevent participation in the programme for a day or two	Lacerations, frostnip, minor burns, mild concussion	Mild flu, migraine	>\$500	Burnt shrubs, cut life branches to burn, washed group dishes in stream, etc	Does not want to participate again in this session
5		Sprains & hyperextensions, mod hypo/hyperthermia, minor fracture	Flu, gastroenteritis, vomiting	>\$2,000	Walked through sensitive ecological area destroying some plant life	Wants to leave group. A lot of work to bring back in.
6	Major impact on individual(s) that would mean they were unable to continue with large parts of the programme	Fractures, dislocations, frostbite, major burn	Serious asthma attack, serious infection, medical treatment required	>\$8,000	Destroyed/killed some example of flora/fauna	Leaves group and requires on site counselling
7		Arterial bleeding, severe hypo/hyperthermia	Infection or illness causing loss of consciousness, serious medical emergency	>\$20,000	Killed, destroyed or polluted small area of environment	Therapy/counselling required by professional
8		Spinal damage, concussion	Major illness requiring hospitalisation	>\$50,000	Killed example of protected species	Long term therapy required after incident
9	Life changing effect on individual(s) or death	Single death	Single Death	> \$250,000	Fire or pollution etc resulting in area of wilderness being destroyed	Suicide because of incident
10		Multiple fatality	Multiple fatality	> \$1,000,000	Major fire or pollution causing serious loss of environment or life	Multiple fatality

NOTE: Adapted and expanded from the Accident Frequency Severity Chart (Priest, 1996).

Unfortunately, of all the organisations surveyed for the New Zealand outdoor education sector, only one recorded some form of severity rating for the incident concerned and its potential outcome. Even this one organisation did not systematically categorise incidents according to potential severity and analyse those incidents with high potential severity in a different manner to other recorded incidents.

For all 1908 incidents recorded, a rating of the actual severity of the outcome was assigned and also its potential severity. The potential severity ranking that was assigned was the author's subjective view of what might have eventuated due to the sum of hazards present at the time. To assign a severity rating, the Severity Scale shown in Table 3 was used. This scale was developed based on a model devised by Priest (1996).

Restricting the cases to only those where an actual injury occurred while a group of students was under instruction, produces the severity distribution shown in Table 4.

Table 4

Number of injuries, sorted by severity, for incidents occurring while under instruction.

Rating of the Actual Severity of Injury	Number of Injuries Reported	Severity Grouping	Number	Percentage of Total
1	26	Any injury less than serious	929	94%
2	228			
3	323			
4	165			
5	187			
6	55	Serious or major injury	59	6%
7	1			
8	3			
9	0			
10	0			

NB: N = 988 of the 1154 injuries indicated in Table 1. The remaining 166 were injuries that occurred outside of the time supervised by an instructor. Also, 7 of these injuries were to accompanying teachers or the staff member

Serious Injuries: 32 fractures, 21 dislocations, 2 spinal damage, 2 burns, 1 concussion, 1 contusion

Table 5

Near misses grouped according to the potential severity of their outcomes, for incidents occurring while under instruction.

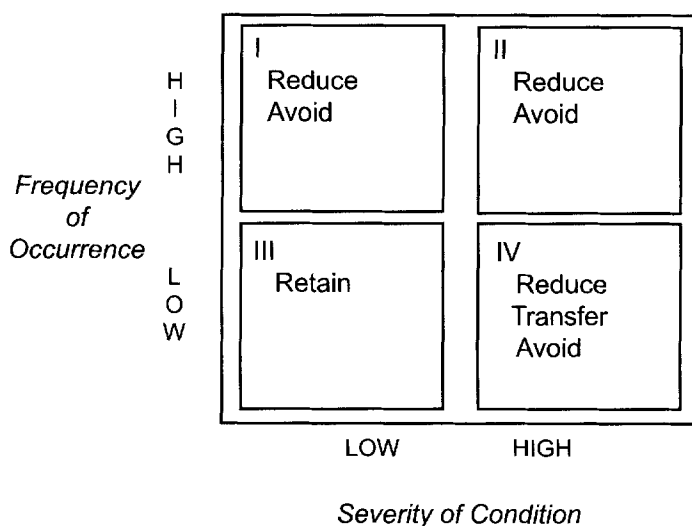
RATING OF THE POTENTIAL SEVERITY OF INJURY	NUMBER OF NEAR MISSES REPORTED	SEVERITY GROUPING	NUMBER	PERCENTAGE OF TOTAL
1	0	Potential for an injury that is less than serious	228	51% (Near misses <u>without</u> potential for serious injury)
2	12			
3	38			
4	44			
5	134			
6	104	Potential for a serious injury	220	49% (Near misses <u>with</u> potential for serious injury)
7	35			
8	33			
9	46			
10	2			

The results shown in Table 4 represent the outdoor education sector's version of the accident ratio study and can be compared with the top two sections of Figure 1. It is interesting to note that the ratio of serious to less than serious incidents is fairly comparable between the major US safety study and the outdoor education sector. The outdoor education sector has produced a ratio of 1:16 (Actual data 6:94), which is in a similar order of magnitude to the 1:10 ratio shown in Figure 1.

Every incident recorded was also assigned a potential severity rating. This used the same scale as shown above in Table 3 but was based on a subjective view of the potential outcome that could have been reasonably expected given the hazards that were encountered. By doing this it is possible to see if it is worth investigating incidents with minor injuries as a way of preventing major injuries. Of the 742 incidents that resulted in an actual injury with a severity rating of four or less, only 27 had the potential to result in an injury with a severity rating of six or more. This is only 3.6% of all cases. It seems clear that there is little point in studying minor injuries in general as a means to prevent major injuries. Intuitively it makes sense that studying 300 stubbed toes is not going to prevent someone falling off a cliff. It seems useful to discriminate between accidents and restrict our efforts to those that warrant investigation by virtue of either causing major injury, or having potential to do so.

Some researchers suggest that the probability of occurrence of the high severity outcome should also be considered (Bird & O'Shell, 1969; Haddock, 1999a; Johnson, 1980). My contention is that rating probabilities of occurrence is not a useful exercise other than through the simple test: Is there a reasonable probability that a serious injury could result? Once a hazard potential passes this test, every effort should be put into reducing the hazard. Another way of looking at this is by considering the Four Windows Matrix (Haddock, 1993) shown in Figure 2, which is commonly used to discuss risk management strategies in the outdoor sector.

Figure 2
Four Windows Matrix (Haddock, 1993, p.26)



My contention is that those incidents producing situations where the potential severity is high (Types II and IV) should be treated differently from those where the potential severity is low (Types I and III), irrespective of frequency. Certainly there is a case for acting on recurrent, low severity injuries (Type I), especially where a common cause can be established, but not with the same urgency or rigor. It is important to classify the different types of incidents after they have been reported as either having high potential severity or low potential severity. None of the accident / incident recording systems surveyed in this study discriminated between these two categories.

As shown in Table 1, there were 448 near misses recorded. These near misses were also rated for their potential severity and the results of this analysis are shown in Table 5. Table 5 shows the value of reporting near misses. Those reported have an almost 50% chance of signaling conditions that might lead to serious incidents as opposed to investigating all actual injuries where, as Table 4 shows, only 6% were serious. It seems that instructors are reporting incidents that left an impression on them and which they realised at the time had potential for serious consequences. This is to be encouraged and management should be following up on these incidents.

Assigning severity ratings to incidents and comparing the percentage of reported incidents in each severity bracket, shows distinct differences in the reporting protocols of the different organisations.

The compared profiles are shown in Figure 3. Figure 3a suggests that organisations F and K do not report many minor incidents, only major ones. This is further evidence to support the establishment of a common, standardised reporting protocol across the entire sector. Figure 3b shows that organisations E, G & I have a history from 1996–2000 of running activities that have not produced reported incidents that could have resulted in serious injury. Organisations C and H on the other hand, are either running higher risk activities, or managing them poorly.

In summary, Myth One is not supported. While the Accident Triangle is confirmed as being valid for the outdoor sector (for the top two rows of the triangle), it has been shown that there would be a lot of time wasted in following up all minor incidents if the aim is to prevent serious incidents. To prevent serious incidents, all reported incidents should be classified according to potential severity of the outcome, and those incidents that show a potential greater than six should be studied in more detail for underlying causes.

MYTH TWO: *We can manage risk in outdoor education by choosing activities where the risk is perceived as high by participants but where instructors believe the real risk to be low.*

Table 6 shows a listing of all activities surveyed across the participating outdoor education centres where incidents occurred. Unfortunately incident records analysed did not track the number of students, or student days, taking part in any particular activity. Therefore the results shown in Table 6 must be interpreted with caution as some activities will take place with much more frequency than others.

One of the surprising aspects of Table 6 is that activities such as ropes courses and abseiling would not be expected to appear as significant incident–producers, irrespective of the numbers taking part. Both of these activities are considered by many instructors as safe, or low risk, due to being in controlled settings where close supervision and strict management controls can be instigated, while

Figure 3

The number of Incidents of Differing Severity as Reported by various Organisations.

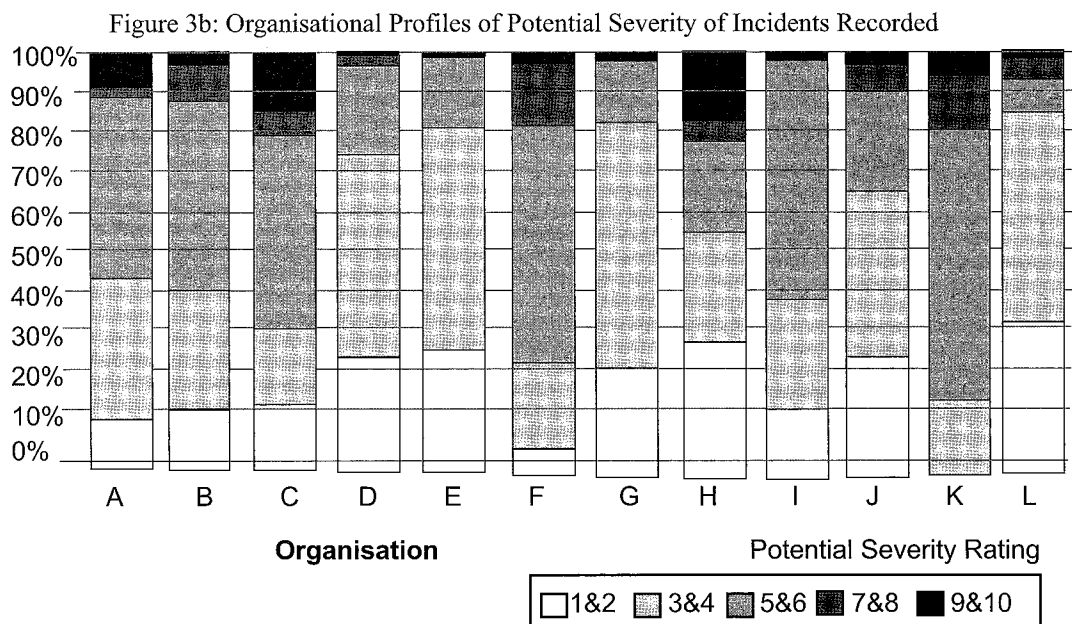
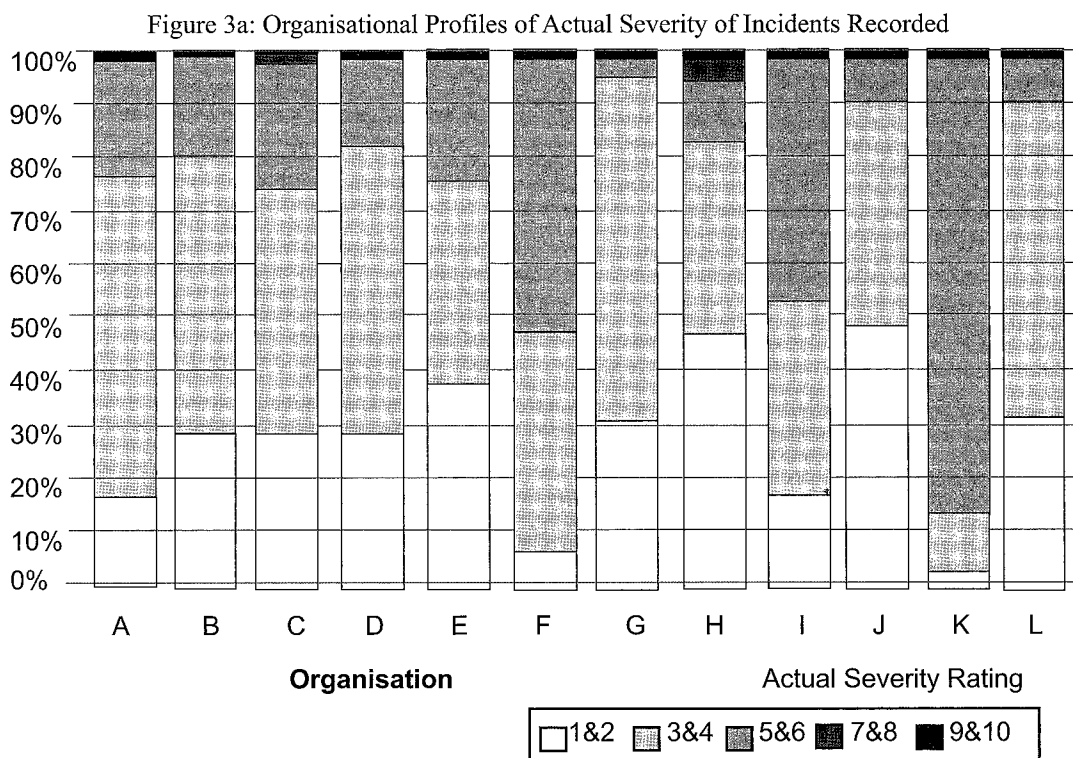


Figure 3. Organisational Profiles showing Percentages of Reported Incidents in Various Severity Categories

Table 6

Number of serious injuries, or those with potential for serious injury, in each activity type.

Activity	Serious Injuries reported while under instruction	Injuries reported while under instruction that resulted in or had potential for Serious injury	All recorded incidents that resulted in or had potential for Serious injury
Ropes course	2	2	43
Kayaking	13	15	38
Rockclimbing	4	6	32
Tramping	7	11	29
Sailing	1	5	27
Vehicle	0	0	22
Snowsports	12	19	19
Abseiling	3	4	17
Camping	1	3	16
Mountaineering	3	6	16
At Base Facilities	1	2	15
Rafting	0	2	12
Tube Rafting	0	3	11
Cooking	0	1	9
Swimming	3	4	9
Gorging/canyoning	1	2	7
Canoeing	0	1	6
Other	0	0	6
Sea Kayaking	0	2	6
Games	4	5	5
Cycling	2	4	4
Flying Fox	1	3	4
Free Time/Play	0	0	4
Rock Wall (Artificial)	0	0	4
Running	0	0	4
Maintenance	0	1	3
Community Work	0	0	2
Office	0	0	2
Bridge Swinging*	0	1	1
Caving	0	0	1
Initiatives	1	1	1
Solo	0	0	1
Tyrolean*	0	0	1
Bio/Field Trip	0	0	0
TOTAL	58	103	377

NOTES:

Shaded areas indicate the ten activities with highest (top) and lowest (bottom) incidence of actual or potential serious injury.

* denotes activities carried out by only a small number of the sampled group.

appearing at face value to participants as being high risk. In fact they are both in the top ten activities for incidents with the potential to produce serious injury. Table 6 therefore gives preliminary evidence to discount the thought that such activities are actually safe. Further research will be required to establish if this is actually true and what factors combine to produce the incidents reported here. It is interesting to note a similar conclusion being reported by the Adventure Activities Licensing Authority where they note that, "most accidents, even most serious and fatal accidents, occur on activities which were considered beforehand to be the lowest risk" (Bailie, 2003).

If the instructor's judgement of the risk present in any activity can not be used as an accurate predictor of potential for serious injury, is there anything that can be used? Petersen (1988) states that in industrial safety management, there are certain sets of circumstances which can be predicted to produce severe injuries. These circumstances are shown in Figure 4 and Petersen believes they can be identified and controlled.

Examination of Petersen's categories in relation to the outdoor sector, if extrapolated, reveal some parallels:

1. Unusual, non-routine activities: Unfortunately the data recorded in accident records does not include information about the experience level of the instructor in charge and how new (or old!) they were to the activity or the setting of the activity. A hand poll of participants at the Risk 2002 Conference in New Zealand showed that the vast majority of those attending believed that newer staff have higher incident rates than those with experience. As a corollary to this however, they also believed that over familiarisation with an activity could also lead to higher risk. This needs further research.
2. Non-productive activities: From Table VI it can be seen that the cumulative impact of students being around Base Facilities, Free-time and Games add up to a significant incident number (24 potentially serious incidents). This may be due to a lack of supervision. Inspection of the incident reports for many of the serious incidents that occurred during other activities in Table 6, including the activities such as ropes courses mentioned above, did so when the supervision level was reduced or removed.
3. Petersen's third category, High Energy Sources, seems especially pertinent to the outdoor sector. Incidents that result, or could result in serious injuries seem to be the downstream effect of one or more of the following factors being present:
 - 3.1. Height—Ropes courses, abseiling, mountaineering and rock climbing incidents generally result from people being exposed to falls or objects falling from heights. Tramping incidents often occur when cliffs or steep terrain are encountered.
 - 3.2. Speed—Snowsports, vehicles.
 - 3.3. Changes in weather resulting in cold, wind, lightning, etc—normally unexpected—most sailing and sea kayaking incidents occurred when wind increased. Strong winds are also an important contributory factor in incidents in mountaineering, tramping and other activities.
 - 3.4. Moving water where activities such as kayaking, rafting and gorging involve incidents where the pressure of moving water trap people under water against obstacles.
 - 3.5. Fire or other heat sources—burns are common across activities.
4. Certain construction situations—generally irrelevant to outdoor education. However outdoor education activities carried out in water environments warrant special attention as water accentuates any risk due to the potential for hypothermia and drowning. There is also very little time to resolve a serious situation in a water environment.

While further research is required to validate these suggestions, this indicates that there may be circumstances that can be predicted to produce serious injuries. These conditions can all be identified in advance and controlled.

These predictors can be used as a tool to help point out when extra management and higher supervision of any activity is required. They should not be used as a reason to avoid a particular outdoor activity as that would remove the very medium in which outdoor educators work—cliffs, mountains, rivers, lakes and caves.

In summary, while further research is required in this area, preliminary data suggest that Myth Two is not supported. A safe experience cannot be guaranteed by choosing activities that have traditionally been thought of as having high perceived risk for participants and low real risk as judged by instructors, such as ropes courses. Instead there are predictors that have been suggested in Figure 4 where the potential for serious injury is increased. When using activities where one or more of these predictors is encountered, greater care and supervision is required.

MYTH THREE: Men are greater risk takers than women and therefore male instructors will have more serious accidents than female instructors.

There is a myth in the outdoor world and probably the world in general, that men are more risk-seeking than women. It follows that if this is true, male instructors may place their students in more risky situations than female instructors and therefore have more serious incidents.

There is some difficulty in exploring this hypothesis because of the lack of data. Although ten of the twelve contributing organisations kept records of the gender of the supervising instructor, none recorded the number of student days run by female versus male instructors in a given period. The data does allow a comparison of the number of serious versus non-serious incidents for each gender, for those organisations that recorded the gender of the instructor associated with any incident. This assumes that the reporting characteristics of both genders are the same. This is a reasonable assumption given that the reporting protocols are established by the organisations concerned and are not gender specific.

If there was no difference in the risk-taking propensity of men and women instructors, then we would expect the same ratio of serious to non-serious incidents for groups instructed by men and women. The comparative results are shown in the cross-tabulations of Tables 7a–7d.

Considering only those reported incidents that resulted in an actual injury, Table 7a shows that there is a significant difference between the ratio of serious to less serious injuries reported among groups led by male (40:329 or 1:8) compared to female (14:201 or 1:14) instructors, with men exposing their groups to a greater proportion of serious injuries. This is further confirmed by Table 7b where there is an even stronger indication that men put their groups in situations where the potential for serious injury is greater (male 70:299 or 1:4 compared to female 24:191 or 1:8).

Table 7c compares the ratio of those incidents with no potential for serious outcome to those with potential for serious outcome for all reported near misses across the two instructor genders. Again there is a significant difference showing male instructors are exposing their groups to a greater proportion of potentially serious situations (134:104 or 1.3:1) than female instructors (42:48 or 0.88:1).

Figure 4
Predictors of Serious Injury

Circumstances which can be predicted to produce severe injuries in Industrial Settings (Petersen, 1988)	
1.	Unusual, non-routine activities
2.	Non-productive activities
3.	High Energy Sources
4.	Certain construction situations.

Predictors of Serious Injuries in Outdoor Education Activities EXTRAPOLATED BY THE AUTHOR FROM PETERSEN (1988)	
1.	Activities run by instructors new to an activity, or overly familiar with an activity
2.	Activities with low levels of supervision or no supervision at all
3.	Activities involving high energy sources such as height, speed, extreme weather, moving water, fire or heat
4.	Any activity involving water
NB: While there is some preliminary data in this research to support the validity of predictors 2,3 and 4, all of these predictors need further research.	

Table 7d looks at the number of injury-causing incidents that had the potential for serious injury and compares the two genders of instructors to see if one is better at resolving the incident to cause a non-serious outcome than the other. The result shows that there is no significant difference between the two genders.

In summary, the data collected for this study supports Myth Three that men are more likely to expose their groups to greater risks than women. The results show that male instructors have a greater ratio of high severity injuries compared to low severity injuries in their groups. Once a group is in a situation of high potential injury, both genders of instructors have the same likelihood of resolving the situation successfully. As noted earlier, more convincing analysis could be undertaken if records were kept and reported of the overall amount of instruction carried out and broken down by gender.

MYTH FOUR: Accidents are more likely to occur in the afternoon.

There is a myth in the outdoor education world that accidents are more likely to occur in the afternoon. Of the 12 organisations contributing data, seven consistently recorded the time of day of the incident, four sometimes recorded the time and one almost never recorded the time. Table 8 shows the breakdown of incidents versus time of day where it has been recorded.

Figure 5 shows these results in graphical form. During the period of the most activity in outdoor education, which is assumed to be between 9am and 5pm, there is a discernable increase in injuries and near misses. The worst time period appears to be the two-hour time slot between 2:30pm and 4:29pm.

Table 7

Effect of Instructor Gender on the Severity of Injury or the Potential Severity of Injury

7a. Gender by Actual Severity of Injuries for Incidents under Instruction, grouped by Severity

	Less Serious Injury (Severity Rating <6)	Serious Injury (Severity Rating ≥6)
Male Instructor in Charge (n = 369)	329	40
Female Instructor in Charge (n = 215)	201	14
(Chi-square result p = 0.0044)		

7b. Gender by Potential Severity of Injuries for Incidents resulting in Injury while under Instruction, grouped by Severity

	No Potential for Serious Injury (Severity Rating <6)	Potential for Serious Injury (Severity Rating ≥6)
Male Instructor in Charge (n = 369)	299	70
Female Instructor in Charge (n = 215)	191	24
Chisquare result p < .0001)		

7c. Gender by Potential Severity of Near Misses while under Instruction, grouped by Severity

	No Potential for Serious Outcome (Severity Rating <6)	Potential for Serious Outcome (Severity Rating ≥6)
Male Instructor in Charge (n = 238)	104	134
Female Instructor in Charge (n = 90)	48	42
(Chisquare result p = 0.0042)		

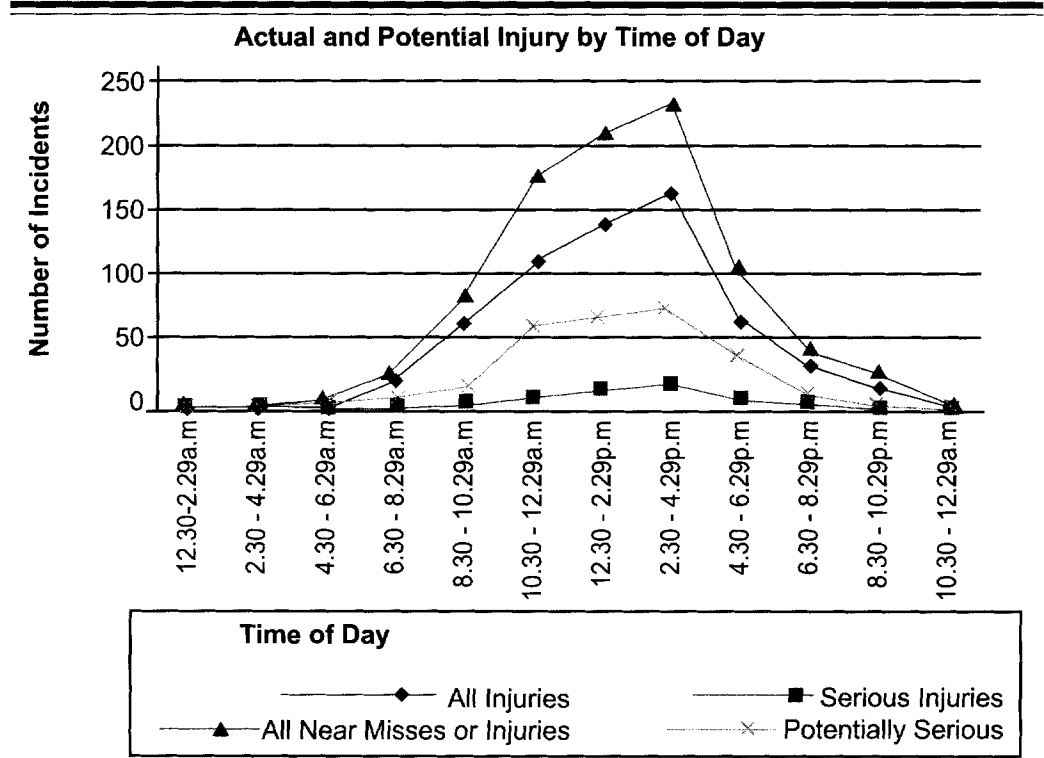
7d. Gender by Actual Severity of Final Injury for All Injury-causing Incidents where there was Potential for Serious Injury

	Cases where there was Potential for Serious Outcome but only Non- serious Injury Resulted (Severity Rating < 6)	Cases where there was Potential for Serious Outcome and Serious Injury Resulted (Severity Rating ≥6)
Male Instructor in Charge (n = 70)	30	40
Female Instructor in Charge (n = 24)	10	14
(Chisquare result p = 0.808)		

Table 8
Effect of Time of Day on Incident Frequency

Time of Day	Injuries Under Instruction		Near Misses or Injuries While Under Instruction	
	All Injuries	Serious Injuries	All Near Misses or Injuries	Potentially Serious
12:30 – 2:29am	2	0	2	0
2:30 – 4:29am	1	0	2	2
4:30 – 6:29am	4	1	6	2
6:30 – 8:29am	25	1	26	3
8:30 – 10:29am	59	4	83	17
10:30 – 12:29pm	107	7	175	54
12:30 – 2:29pm	135	14	204	60
2:30 – 4:29pm	157	17	229	66
4:30 – 6:29pm	61	4	101	32
6:30 – 8:29pm	32	3	45	11
8:30 – 10:29pm	19	0	26	2
10:30 – 12:29am	2	0	3	1

Figure 5
Graph of Incidence of Actual and Potential Severity of Injury versus Time of Occurrence



If it is assumed that most activities will take place between 8:30am–12:29pm and 12:30–4:29pm in the afternoon, then we can compare incident numbers in these two, four-hour time slots.

Table 9

Number of Incidents Occurring in Morning and Afternoon Activity Sessions.

Table 9a Number of Incidents occurring by Time of Instructional Session for Injuries Reported while under Instruction

	All Incidents
Morning 8:30am – 12:29pm	166
Afternoon 12:30 – 4:29pm	292
(Chisquare result $p < .0001$)	

Table 9b Number of Incidents occurring by Time of Instructional Session for Near Misses and Injuries reported while under Instruction.

	All Incidents
Morning 8:30am – 12:29pm	258
Afternoon 12:30 – 4:29pm	433
(Chi-square result $p < .0001$)	

The results shown in Tables 9a and 9b support the hypothesis that there is a greater likelihood of having an incident while being instructed in the afternoon compared to the morning. This suggested correlation between time of day and frequency of incident needs more study as it may relate to other variables. For example, groups could be spending more time walking or driving to activities in the morning, whereas they may be more actively involved in the activity in the afternoon.

Table 10 analyses the ratio of serious to non-serious incidents occurring in the morning and afternoon activity sessions.

Table 10

Comparison of the Seriousness of Incidents by Time of Instructional Session

Table 10a Seriousness of Injuries by Time of Instructional Session for Injuries reported while under Instruction.

	Less Serious Injuries (Severity Rating < 6)	Serious Injuries (Severity Rating ≥ 6)
Morning 8:30am – 12:29pm	155	11
Afternoon 12:30 – 4:29pm	261	31
(Chi-square result $p = 0.08$)		

Table 10b Potential Seriousness of Injuries by Time of Instructional Session for Near Misses and Injuries reported while under Instruction.

	Less Potentially Serious Incidents (Severity Rating < 6)	Potentially Serious Incidents (Severity Rating >= 6)
Morning 8:30am – 12:29pm	187	71
Afternoon 12:30 – 4:29pm	307 (71%)	126
(Chi-square result p = 0.58)		

Despite the increased number of incidents occurring in the afternoon, Tables 10a and 10b show that there is no significant difference between the seriousness of incidents that occur in morning and afternoon sessions.

In summary the data collected here support Myth Four that accidents are more likely to occur in the afternoon compared to the morning in outdoor education. There seems to be no evidence to suggest that the outcome will be any different in severity between morning and afternoon sessions however.

MYTH FIVE: Outdoor education is a dangerous activity.

There is a common public perception that outdoor education in New Zealand exposes students to unnecessary risks. This is not surprising when most media attention is generally negative and in the wake of an accident. Research on accident rates in outdoor education in New Zealand is not available, however statistics have been published for American organisations in the various *Wilderness Risk Management Conference Proceedings* (2000).

The data collected in this New Zealand study for the five year period 1996–2000 corresponds to 532,912 student days of instructing, which converts to 4.3 million student hours (assuming a conservative eight hour day). The combined data for the 12 outdoor education centres that contributed to this study produces incident rates as shown in Table 11.

As can be seen from Table 11, the New Zealand Outdoor Education accident rates are comparable with the organisations in the US that are regarded as being of the highest standard—the National Outdoor Leadership School (NOLS), and the five Outward Bound Schools (OB). The injury and fatality rates appear less than training or playing American Football and adolescents driving in the US.

New Zealand Accident Compensation Corporation (ACC) statistics for 2001 (Accident Compensation Corporation, 2001) state that the rate of claims for all non-work related injuries was 2,639 per 100,000 people. The rate of claims for all work-related injuries was 1,726 per 100,000 people. Assuming that the 100,000 people could be exposed to both work and non-work related hazards 365 days of the year (which is conservative as an individual cannot be at work and not at work for all of the same day) this translates to a claims rate of 0.11 per 1000 participant days. To make a claim to ACC, the injury would need to be relatively serious. The serious injury rate recorded in the study of NZ Outdoor Education Centres is also 0.11 per 1000 participant days. It seems then that Myth Five is not supported, as outdoor education in New Zealand is no more dangerous than normal, everyday living.

Table 11

Comparison of Injury Rates Between Outdoor Education Centres in NZ and other activities.

Injury Rates per 1,000 Participant Days and Fatality Rates per 1,000,000 Participant Days		
Activity	Injury/1000 Participant Days	Fatality/Million Participant Days
Outdoor Education in NZ: Results from the study of 12 large centres for the years 1996 – 2000 (All Injuries)	2.165	0
Outdoor Education in NZ: Results from the study of 12 large centres for the years 1996 – 2000 (Serious Injuries only)	0.11	0
NOLS (1984 – 1994) (Leemon, 1999)	1.99	2
NOLS (1995 – 1998) (Leemon, 1999)	1.29	2
US High School Football Practice (Zemper, 1998)*	19.74	
US High School Football Games (Mueller and Cantu, 1998)*	35	.63 (plus 0.63 permanently disabling injuries, mostly paralysis)
US White Adolescents 15 – 19, all accidental causes (National Centre for Injury Prevention and Control, 1999b)*	?	1.5
US Adolescent Drivers and Occupants 15 – 19 (National Centre for Injury Prevention and Control, 1999a)*	?	4.5
US Outward Bound Schools (1962 – 1989) (Paton, 1995)	0.49 - 1.14	5.59
US Outward Bound Schools 1998 (Outward Bound, 1998) *	0.34 - 1.7 (N.B Outward Bound counts incidents differently than most. The standard criteria is a person unable to participate in the programme the following day.)	?

* As reported in Cooley (2000)

Conclusions

This study has collected and analysed data about incidents and accidents at a sample of the larger outdoor education centres in New Zealand. This has enabled various "myths" about the risks and safety associated with that educational experience to be tested:

1. The results here show that the outdoor education sector follows the Bird and Germaine (1989) Accident Study Triangle at least in part, with one serious accident for every 16 non-serious accidents reported.
2. Studying non-serious accidents to try to prevent serious accidents is wasteful of time and energy. Non-serious accidents are not necessarily a predictor of serious accidents with only 3.7% of accidents with an actual severity rating less than five having the potential for resulting in a serious injury with a rating of six or more.
3. Near misses and accidents should be assessed for their potential for serious outcomes. Those that are assessed as having the potential for serious injury should be studied in greater detail to help prevent further serious accidents.
4. While more research needs to be carried out on these factors, there is preliminary evidence from this data to suggest that we can extrapolate Petersen's model to the outdoor sector, to reveal predictors of serious accidents to be those activities:
 - i. Where there is limited or no supervision.
 - ii. Containing high energy sources such as:
 - a. Height
 - b. Speed
 - c. Changes in weather—Wind, cold, lightning, etc
 - d. Moving water
 - e. Fire or other heat.
 - iii. Carried out in a water environment
5. Instructor training programmes and centre managers should be cognisant of these predictors and act to minimise the increased hazard whenever one or more of the factors is present.
6. Activities such as high ropes course, abseiling and tramping, which are often used in outdoor education as they are considered low risk by instructors while challenging participants mentally and physically, can have potential for serious injury if one or more of the above predictors is present.
7. The ratio of reported serious to non-serious injuries is higher for groups supervised by male instructors compared to female instructors. This supports the contention that males are more likely to put their groups in risky situations than women. The data suggests that neither sex is better than the other at resolving potentially serious situations once they have been encountered.
8. Injuries happen more often during afternoon sessions compared to morning sessions with the worst period being between 2:30pm and 4:29pm. Note: At the Risk 2002 Conference, a national conference for outdoor educators on risk management, Rick Curtis of Princeton University Outdoor Action and OutdoorEd.com in the U.S. stated that similar results had been obtained from data there. He stated that in addition there had been a small peak in incident rates observed in the late morning as well as the afternoon peak. He suggested a hypothesis that the higher incident rates could be due to lower blood-sugar levels in students and instructors leading to lower ability to concentrate and carry out activities. I have been unable to find any published research in the U.S. on the findings that Curtis

- referred to. In light of this finding, it may be prudent to ensure food and drink breaks are taken before and during afternoon instruction sessions. The British tradition of morning and afternoon teas, which has been extended to the colonies, may be very sensible.
9. There is no evidence to suggest that an incident will be more or less serious if it occurs in the morning or the afternoon.
 10. The overall injury rate for NZ outdoor education compares favourably with US counterparts who tend to be conservative due to the threat of litigation. The rate is comparable with the risk faced in everyday life when compared to ACC statistics.

Further Study

These results indicate several areas for future research including: whether there is any correlation between the familiarity of an instructor with a particular activity and incident rates; any correlation between gender and incident rates; any correlation between the predictors of serious accidents extrapolated from Petersen's model and incident rates; and factors causing the observed correlation between time of day and incident rate.

Recommendation

Perhaps the most important recommendation arising from this study is the need for a national incident database (NID) for the sector. By analysing incidents and disseminating the learning it should be possible to prevent many reoccurrences of similar events and therefore reduce incident rates. The NID needs to be designed and used in such a way that it collects the same information from all sources and therefore a national template for incident reporting should be created. The Wilderness Risk Management Committee Incident Reporting Project (WRMC, 2000) could provide the basis for such a system that could be adapted to the NZ culture and activities. As part of any system, each incident should be rated for potential severity by the organisation reporting the incident as that organisation is most able to assess the various hazards at play. The annual trends from the NID should be distributed throughout the outdoor education community to provide learning points in order to improve risk management practices. The incident rates produced could also be used in a positive media campaign for the outdoor education sector, highlighting the positive aspects of the experience and dispelling ideas that participation is unduly dangerous.

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Glossary

Accident: "An undesired event that results in harm to people, damage to property or loss to process. It is usually the result of a contact with a substance or source of energy above the threshold limit of the body or structure." (Bird & Germain, 1989, p.36)

Incident: "Either an accident or near accident. . In the broader loss control definition, it refers to an event which could or does result in a loss." (Bird & Germain, 1989, p.36)

Near Accident: "An event which, under slightly different circumstances, could have resulted in harm to people, damage to property or loss to process." (Bird & Germain, 1989, p.36)

Root Causes: "Those causes of accidents which would effect permanent results when corrected. They are those weaknesses which not only affect the single accident being investigated, but also might affect many other future accidents and operational problems." (Petersen, 1988, p.11)