

Injury causation during hiking activities: a systems analysis of reports from the NZ National Incident Database

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The National Incident Database (NID) has provided a standardised approach to incident reporting for the outdoor recreation and education sector in New Zealand (NZ) since 2005. Organisations involved include commercial, educational, not-for-profit and informal groups (Cessford, 2009). The Mountain Safety Council (MSC) prepares yearly summary reports (Cessford, 2009, 2010, 2013; Hill, 2011); however, these analyses have not yet explored in detail the contributory factors involved in incidents.

The aim of this study is to determine whether a systems theory accident analysis method, Rasmussen's Risk Management Framework (RRMF), is appropriate for classifying the contributory factors involved in injuries and near miss incidents during outdoor activities. RRMF (Fig. 1) argues that safety is shaped by the decisions of all actors across the system, not just those on the frontline (e.g. instructors); hence incidents are caused by multiple factors across the system. This model extends upon well-known outdoor-specific accident causation models (e.g. Davidson, 2005; Hale, 1983 as cited in Leemon, 2005) as it supports identification of factors that potentially contribute to accidents beyond activity centre management. This framework has proved useful for analysing fatal outdoor incidents (Salmon, Cornelissen, & Trotter, 2012; Salmon, Williamson, Lenné, Mitsopoulos-Rubens, & Rudin-Brown, 2010). However, it is unclear whether it applies to less severe injuries and near misses that do not have in-depth investigations associated with them.

This paper focusses on hiking-related NID reports as an initial test of the framework. “Hiking” was defined as any activity involving walking or running in natural environments. This included “hiking”, “tramping”, “field trips”, “walking”, “orienteering”, “jungle trips” and “mud runs.”

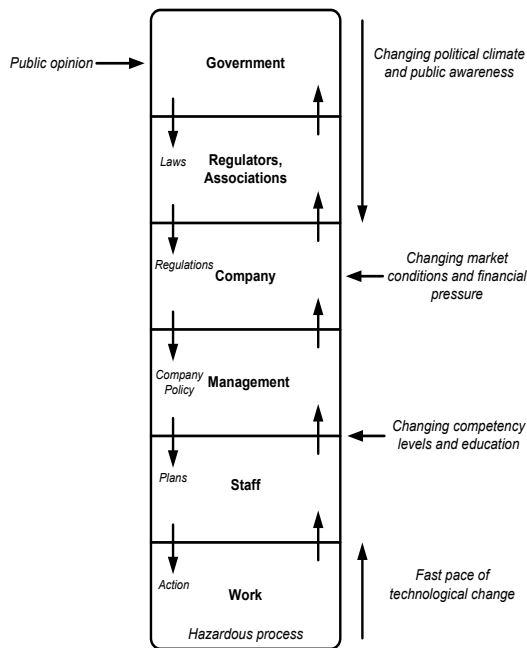


Figure 1. Rasmussen’s risk management framework (adapted from Rasmussen, 1997).

Method

Data source

Outdoor education/recreation incident reports (N = 1017) collected from 2007 to 2011 were provided to the researchers by the MSC in de-identified form. Ethics approval was granted by the Monash University Human Ethics Committee.

To qualify for analysis reports had to involve: an injury; or near miss; and “hiking” activities. Injuries and near misses were coded in the original dataset. The researchers coded the activity type. 228 cases were identified.

Data coding

Coding was conducted over four stages. Three researchers independently identified contributing factors from the *incident description* and *causal narrative* fields, and assigned descriptive codes to

the text. Each factor had to be explicitly identified in the text. One researcher collated all the factors identified from the data and ordered them into categories based on key themes. The categories were then reviewed by the other researchers, and disagreements resolved through discussion. Finally, the causal factors were classified according to the six levels of RRMF, adapted to reflect the outdoor activity domain:

1. *Government department decisions and actions;*
2. *Regulatory bodies and associations, schools and parents;*
3. *Activity centre management planning and budgeting;*
4. *Supervisory and management decisions and actions;*
5. *Instructors, participants and other actors at the scene of the incident; and*
6. *Equipment, environment and meteorological conditions.*

Results

Incident characteristics

There were 166 injuries (72.8%) and 62 near misses (27.2%). On average, there were 18.2 (SD = 18.2) participants in the activity prior to the incident; 1.33 (SD = 1.1) qualified instructors; 1 (SD = 1.4); supervisor; and 1.42 (SD = 3.3) volunteer helpers. Severity ratings¹ indicate that injuries on average had a minor to medium impact (M = 3.2, SD = 1.5), and had the potential for medium impacts (M = 4.6, SD = 1.9). In comparison, near misses were on average rated as minor (M = 2.56, SD = 1.02) but had a potential for a medium to major impacts (M = 5.32, SD = 2.2).

Contributing factors across the outdoor activity system

In total, 58 contributing factors were identified. On average, 4.3 contributing factors (SD = 2.2; range 1 to 16) were identified per incident. A summary of the factors identified across the outdoor activity system levels is presented in Figure 2. In the following sections the factors classified at each level are summarised.

Government

¹ The NID Incident Severity Scale can be downloaded here:
http://www.incidentreport.org.nz/resources/Severity_Scale.pdf

Few (5.3%) incidents involved factors at this level. However, all factors identified were associated with the Department of Conservation (e.g. failure to spray for wasps). On average these incidents were rated as minor ($M = 1.7$, $SD = .7$), but had the potential for medium impacts ($M = 4.2$, $SD = 1.7$).

Regulatory bodies and associations, schools and parents

Few (1.3%) incidents involved factors at this level. All factors identified involved failures to communicate information to the activity provider (e.g. concerning pre-existing injuries). Again, on average these incidents were rated as minor ($M = 2.7$, $SD = .6$), but had the potential for medium impacts ($M = 5.3$, $SD = 2.5$).

Activity centre management planning and budgeting

Again, few (4.8%) incidents involved factors at this level. All factors identified reflected problems with activity centre policies and systems. On average these incidents had a medium impact ($M = 4.2$, $SD = 1.6$), and had the potential for major impacts ($M = 6.9$, $SD = 1.6$).

Supervisory and management decisions and actions

10.1% of incidents involved factors at this level. All factors identified reflected problems with planning for activities. On average these incidents had a minor impact ($M = 2.7$, $SD = 1.6$), and had the potential for medium impacts ($M = 5.9$, $SD = 2.2$).

Instructors, participants and other actors at the scene of the incident

87.7% of incidents involved factors at this level. Factors at this level reflected issues with participants (77.2% of incidents), instructors or supervisors (51.3% of incidents), and other actors (6.1% of incidents). Severity ratings indicate that on average these incidents had a medium actual ($M = 3.2$, $SD = 1.3$) and potential impact ($M = 5.1$, $SD = 1.8$).

Equipment, environment and meteorological conditions

90.4% of incidents involved factors at this level. Factors at this level reflected issues with equipment (41.7% of incidents) and environment (86.4% of incidents). On average these incidents had a medium actual ($M = 3.02$, $SD = 1.4$) and potential impacts ($M = 4.87$, $SD = 2.05$).