INJURY IN THE WILD: UNDERSTANDING AND PREVENTING OUTDOOR EDUCATION INJURY INCIDENTS

Clare Dallat & Paul Salmon
Wilderness Risk Management Conference
Portland, Maine, November 1-3, 2017
CONTENT

• Background

• Systems thinking in accident and injury prevention

• Incident reporting and learning: UPLOADS

• Risk assessment: NET-HARMS

• Key take home messages
GOALS

• Develop critical reflection skills for better understanding why systems fail

• Accidents are more than just “people, equipment, environment”

• Understand the causes of outdoor education injury incidents

• Understand the system of risks faced when delivering outdoor education programs

• The power of partnerships
BACKGROUND

• Acknowledged risk of severe and frequent injury in active pursuits (Finch et al, 2007)

• Accidents & injuries occur in led outdoor industry domain

• Industry desire to better understand injury and injury causation

• Systems required to enhance understanding do not exist (best data available was coroners reports and the media)
Report made the following recommendations:

1. Development of a unified, theoretically underpinned accident and incident reporting system;

2. Development of a National led outdoor activity accident and incident database;

3. Development and application of a theoretically underpinned, systems-based accident analysis method;

4. In-depth analysis of led outdoor activity accident and incidents; and

THE UPLOADS PROJECT

Goal: develop a standardised, national approach to incident reporting and learning for the outdoor education sector in Australia, and a corresponding national incident dataset

Support:
- Organisations to learn from incidents; and
- The sector to understand the risks it faces, and take appropriate action.
The systems approach to accident analysis and prevention
# THE HISTORY OF ACCIDENTS

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
<th>System and Cultural Issues</th>
<th>Unsafe Acts (Errors and Violations)</th>
<th>Equipment Failures (Hardware – Software)</th>
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Reason (2008)
ACCIDENT CAUSATION – OLD AND NEW VIEWS

- Human error is the cause of incidents
- To understand failure, you must examine failures only
- Systems are safe
- Unreliable and erratic humans make them unsafe
- Systems can be made safer by restricting humans

- Human error is a symptom of problems across the system (it is a consequence not a cause)
- Incidents caused by multiple interacting factors
- To understand ‘failure’ look at why people’s actions made sense at the time
- Systems are unsafe
- Humans create safety through practices at all levels of the system
Systems Thinking

Adverse events
Real, invisible, safety boundary
Economic failure boundary
Unacceptable workload boundary

Boundary defined by official work practices

Public opinion
Changing political climate and public awareness

Changing market conditions and financial pressure

Changing competency levels and education

Fast pace of technological change

Government
Regulators, Associations
Company
Management
Staff
Work
Hazardous process
Laws
Regulations
Company Policies
Plans
Action

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SYSTEMS THINKING

• Safety impacted by the decisions and actions of all actors across the sports system, not just front line workers;

• Accidents are caused by multiple contributing factors, not just a single poor decision or action;

• Accidents result from a lack of poor communication and feedback across levels of the system, not just from deficiencies at one level alone;

• Behaviours are not static, they migrate over time and under the influence of various pressures;

• Migration occurs at multiple levels of the system;

• Migration of practices cause defences to degrade and erode gradually over time, not all at once. Accidents are caused by a combination of this migration and a triggering event(s).
ACCIDENT INVESTIGATION

FLAWS

• Hunting for the 'broken component' (Dekker, 2011)
• Looking for a 'root cause' (the root cause illusion)
• Over emphasis on PEE
• Looking for failures, inadequacies, poor decision making, judgement errors etc
• Not looking at interactions
• Going 'down and in' versus 'Up and out'

Interventions more effective when they deal with systemic issues rather than individuals or components (Dekker, 2002; Reason, 1997)
FIXING BROKEN COMPONENTS

Stay or go policy fails to cover fire severity
Lack of community education
Comms failures
Inadequate warnings
Failure of fire crews to evacuate residents
Police warning siren issued late
Fire plan failures
Delayed evacuation
IMPLICATIONS FOR SAFETY MANAGEMENT

• Little point in attempting to optimise parts in isolation from each other

• Strategies should impact all levels of the system and should comprise ‘webs’ of interacting interventions

• Interactions between components should be the key focus (rather than the components themselves)

• “Hard fixes change something fundamental about the organisation. This is what makes them hard. But it is also what makes them real fixes” (Dekker, 2006, pg. 190)
ACCIMAP

Government

Laws

Regulators, Associations

Company

Regulations

Management

Company Policy

Plans

Staff

Action

Work

Hazardous process

Govt Policy & Budgeting

Regulatory Bodies and Associations

Company Management

Technical & Operational Management

Physical Process & Actor Activities

Equipment & Surroundings

= Failures, decision, actions etc
• 22nd July 2005, Stockwell tube station, London, UK

• Jean Charles de Menezes

• Misidentified as one of the fugitives involved in previous days failed bombing attempts
ACCIMAP APPLIED

• Mangatepopo Gorge tragedy, 15th April 2008

• Gorge walking activity

• Group became trapped on ledge in flash flood

• Teacher and six year 12 students drowned
Mangatepopo Gorge Incident Accimap
Understanding and Preventing Led Outdoor Accident Data System (UPLOADS)
DEVELOPMENT OF UPLOADS

- Literature review on the role of Human Factors in outdoor activity incidents (Salmon et al., 2009)
- Systems analysis of fatal outdoor incidents (Salmon et al., 2010; 2012)
- Identification of the characteristics considered important for developing a national incident database (Goode et al., 2014)
- Analysis of 1014 led outdoor injury and near miss incidents (Salmon et al., 2014)

Development of Prototype Incident Reporting and Learning System

- Six month trial of the system by 15 outdoor activity providers
- Evaluation of the prototype by 22 outdoor education/recreation experts
- Evaluation of the prototype by 12 human factors/injury surveillance experts
- Reliability testing from 14 risk managers from outdoor activity providers (Goode et al., 2014)

Development of National Incident Reporting and Learning System

- National 12 month trial of the system
- Re-test reliability study

Development of Accident Causation Model for Led Outdoor Activities to guide injury prevention and risk management strategies
## THE OUTDOOR EDUCATION ‘SYSTEM’

**Led outdoor activity ACTOR-MAP**

<table>
<thead>
<tr>
<th>Government Policy and Budgeting</th>
<th>Government bodies</th>
<th>State Departments of Education e.g. Dept of Education and ECD</th>
<th>State Departments of Land Management e.g. Parks Vic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory Bodies and Associations</td>
<td>Regulatory bodies</td>
<td>Accreditation bodies</td>
<td>Auditing bodies</td>
</tr>
<tr>
<td>Local area government, parents, schools and activity centre management, planning and budgeting</td>
<td>Activity centre senior management/ board level</td>
<td>Local Govt &amp; councils</td>
<td>Schools, school principals and school councils</td>
</tr>
<tr>
<td>Technical and operational management</td>
<td>Supervisors</td>
<td>Managers (e.g. programs, training, risk, teaching)</td>
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</tr>
<tr>
<td>Physical processes and instructor/participant activities level</td>
<td>Instructor</td>
<td>Participants</td>
<td>Group</td>
</tr>
<tr>
<td>Physical processes and instructor/participant activities level</td>
<td>Equipment</td>
<td>Physical environment</td>
<td>Meteorological conditions</td>
</tr>
</tbody>
</table>
Local area government, schools and parents
Activity centre management planning and budgeting
Supervisory and management decisions and actions

Decisions and actions of leaders, participants and other actors at the scene of the incident

Equipment, environment and meteorological conditions
Documentation (e.g. maps, participant lists)
Equipment, clothing and PPE
Food and drink
Medication
Activity equipment and resources
Animal and insect hazards
Trees and vegetation
Physical environment and terrain
Water conditions
Activity environment
Weather conditions

Communication, instruction and demonstration
Mental and physical condition
Compliance with procedures, violations and unsafe acts
Planning and preparation

Activity leader
Judgement and decision making
Experience, qualifications and competence
Situation awareness
Supervision/leadership of activity
Communication and following instructions
Mental and physical condition
Compliance with procedures, violations and unsafe acts
Planning and preparation

Activity participant
Judgement and decision making
Experience, qualifications and competence
Situation awareness

Other people in activity group, Other people in activity environment
Judgement and decision making
Experience, qualifications and competence
Situation awareness
Communication within group
Late arrival of group
Group composition
Teamwork
Group factors
Group dynamics
Group size
Time pressure

Communication
Mental and physical condition
Compliance with procedures, violations and unsafe acts
Planning and preparation

Activity centre supervisor decisions and actions
Judgement and decision making
Experience, qualifications and competence
Supervision of activity leaders and other staff

Supervision/Oversight
Training and evaluation programs
Risk assessment and management
Financial constraints
Staffing and recruitment
Activity centre management
Organisational culture
Policies and procedures
Audits

Local area government
Government department decisions and actions
Regulatory bodies and associations
Standards and codes of practice
Communication with stakeholders
Accreditation and licensing

Communication
with activity centre
Planning and preparation
Communication with students/parents
Schools
Teacher student ratio
Communication with activity centre
Planning and preparation
Dropping off/picking up participant
Parents

Communication
with stakeholders
Policies and legislation
Funding and budgets
Regulatory bodies and professional associations
Infrastructure and land management

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Data collection

<table>
<thead>
<tr>
<th>Process</th>
<th>Products</th>
<th>Data analysis</th>
<th>Reporting of aggregate data</th>
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</thead>
<tbody>
<tr>
<td>LOA providers</td>
<td>Standardised incident report form</td>
<td>Merging of data</td>
<td>Annual reports</td>
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<tr>
<td>Activity Leaders and Field Managers</td>
<td>Training material for reporters</td>
<td>Descriptive statistics of incident characteristics</td>
<td>Ad hoc data requests</td>
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<td></td>
<td>Training material for system administrators</td>
<td>Qualitative analysis of contributing factors</td>
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<td></td>
<td>Organisational level database (UPLOADS)</td>
<td>Accident analysis method</td>
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</tbody>
</table>

Note: LOA providers can run their analyses of their own data using UPLOADS

Data analysis

- Merging of data
- Auto-de-identification
- Descriptive statistics of incident characteristics
- Qualitative analysis of contributing factors
- Reporting of aggregate data

Process

- Data collection
- Activity Leaders and Field Managers
- Report incident
- Organisation’s UPLOADS
- Activity Leaders and Field Managers
- Report incident
- Organisation’s UPLOADS
- Activity Leaders and Field Managers
- Report incident
- Organisation’s UPLOADS
- Activity Leaders and Field Managers
- Report incident
- Organisation’s UPLOADS
- Activity Leaders and Field Managers
- Report incident
- Organisation’s UPLOADS

Products

- Standardised incident report form
- Training material for reporters
- Training material for system administrators
- Organisational level database (UPLOADS)
- National Incident Dataset
- Accident analysis method

Research Team

- **2037** incidents have been reported via UPLOADS
  - 1367 injuries
  - 454 illnesses
  - 131 near miss incidents
  - 65 social/psychological incidents, and
  - 20 incidents involving equipment damage

- **3086** Contributory factors

65 ORGANISATIONS FROM ACROSS AUSTRALIA HAVE CONTRIBUTED TO THE UPLOADS PROJECT
**INCIDENT RATE**

- Incident rate is low compared to other organised sports
  - Cricket 242/1000
  - Horse riding 122/1000
  - Soccer 107/1000
  - Netball 51/1000
INJURIES

Head 8.2% (n = 268)
- Superficial injury (74)
- Other / unspecified effects of external causes (33)
- Open wound (2)
- Effects of foreign body entering through natural orifice (3)
- Injury to nervous, fascia and tendon (4)
- Burns, corrosion (3)
- Crushing injury (5)

Clavicle/Thorax 6.4% (n = 19)
- Other / unspecified effects of external causes (13)
- Edentulation, sprain and strain (3)
- Crushing injury (1)
- Simple fracture (1)

Elbow and forearm 3.4% (n = 46)
- Superficial injury (27)
- Edentulation, sprain and strain (10)
- Fracture (4)
- Injury to nervous, fascia and tendon (5)
- Burns and corrosion (2)
- Other / unspecified effects of external causes (1)

Hip and thigh 4.5% (n = 62)
- Superficial injury (18)
- Edentulation, sprain and strain (8)
- Injury to nervous, fascia and tendon (8)
- Burns and corrosion (5)
- Crushing injury (1)
- Open wound (2)

Knee and lower leg 17.3% (n = 237)
- Superficial injury (128)
- Edentulation, sprain and strain (33)
- Open wound (27)
- Injury to nervous, fascia and tendon (8)
- Other / unspecified effects of external causes (14)
- Burns and corrosion (7)
- Sequence of injuries, afterwounding and of other consequences of external causes (2)
- Injury to nerves or spinal cord (2)
- Crushing injury (3)

Unspecified part of trunk, limb or body region 4.9% (n = 14)
- Other / unspecified effects of external causes (11)
- Superficial injury (2)
- Burns and corrosion (5)
- Edentulation, sprain and strain (1)
- Injury to nervous, fascia and tendon (8)
- Effects of foreign body entering through natural orifice (1)
- Injury to internal organs (1)
- Open wound (2)

Multiple body region 6.4% (n = 44)
- Superficial injury (27)
- Other / unspecified effects of external causes (8)
- Open wound (1)
- Edentulation, sprain and strain (5)
- Burns and corrosion (2)
- Injury to nervous, fascia and tendon (1)
- Injury to nerves or spinal cord (1)
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<thead>
<tr>
<th>Level</th>
<th>Factors</th>
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<td>Communication</td>
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<td>Funding / Budgets</td>
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<td>Infrastructure and Land Management</td>
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<td>Policies / Legislation</td>
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<td>Other</td>
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<td>Most frequent factors at each level are shaded in grey</td>
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### Regulatory Bodies & Professional Associations

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<th>Factors</th>
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<td>Communication</td>
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<td>Curriculum of Outdoor Education, Recreation &amp; Qualifications</td>
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<tr>
<td>Funding and Budgets</td>
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<td>Interactions with Government</td>
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<td>Standards and Code of Practice</td>
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<td>Other</td>
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### Parents / Carers

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<td>Legal Responsibility for Safety of Child</td>
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<td>Planning &amp; Preparation for Activity/Trip</td>
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<td>Policies / Procedures</td>
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### Local Area Gov’t

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<td>Communication</td>
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<td>Funding / Budgets</td>
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<td>Legal Responsibility within the County Area</td>
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<td>Policies / Procedures</td>
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### High-Level Management

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<td>Judgement &amp; Decision-making</td>
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<td>Organisational Culture</td>
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<td>Policies / Procedures for Activities / Emergencies</td>
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<td>Risk Assessment &amp; Management</td>
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<td>Supervision of Activities / Programs</td>
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<td>Training &amp; Evaluation of Staff</td>
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<td>Other</td>
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### Supervisors / Field Managers

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<th>Factors</th>
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<td>Communication</td>
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<td>Judgement &amp; Decision-making</td>
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<td>Mental &amp; Physical Condition</td>
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<td>Situation Awareness</td>
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<td>Other</td>
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### Other People in Activity (NOT ACTIVITY GROUP)

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### Activity Group Factors

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<td>Communication within Group</td>
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<td>Group Composition</td>
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<td>Group Dynamics</td>
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<td>Group Size</td>
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<td>Late Arrival of Group</td>
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<td>Teamwork</td>
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<td>Time Pressure</td>
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<td>Other</td>
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### Activity Leader

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<td>Communication, Instruction / Demonstration</td>
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<td>Compliance with Procedures / Violations / Unsafe Acts</td>
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<td>Experience, Qualifications, and/or Competence</td>
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<td>Mental &amp; Physical Condition</td>
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<td>Planning &amp; Preparation for Activity/Trip</td>
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<td>Situation Awareness</td>
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<tr>
<td>Supervision of Activity</td>
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<td>Other</td>
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### Activity Participate

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<th>Factors</th>
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<td>Communication &amp; Following Instructions</td>
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<tr>
<td>Compliance with Procedures / Violations / Unsafe Acts</td>
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<tr>
<td>Experience, Qualifications, and/or Competence</td>
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<td>Supervision of Activity</td>
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<td>Other</td>
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### Activity Equipment & Resources

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<tr>
<th>Factors</th>
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<tbody>
<tr>
<td>Documentation</td>
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<tr>
<td>Equipment, Clothing &amp; Personal Protective Equipment</td>
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<td>Food &amp; Drink</td>
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<td>Medication</td>
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<td>Other</td>
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### Activity Environment

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<th>Factors</th>
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<tbody>
<tr>
<td>Animal &amp; Insect Hazards</td>
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<tr>
<td>Infrastructure &amp; Terrain</td>
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<tr>
<td>Trees &amp; Vegetation</td>
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<tr>
<td>Water Conditions</td>
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<tr>
<td>Weather Conditions</td>
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<tr>
<td>Other</td>
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Most frequent factors overall are shaded in red.
SUMMARY OF CONTRIBUTORY FACTORS

Local area government, schools, parents, activity centre management planning and budgeting

• Inadequate risk assessments
• Policies and procedures for activities and emergencies (e.g. management procedures for designing activities)
• Interactions between activity center, schools and parents

Supervisory & management decisions and actions

• Lack of supervision of staff in the field
• Issues relating to activity/program design
• Group with variable abilities requiring higher levels of supervision

Decisions and actions of leaders, participants, and other actors at the scene of the incident

• Communication & following instructions
• Symptoms related to pre-existing injury (e.g. knee injury, wrist injury)
• Supervision & leadership of activity
• More instruction or briefing required for activity
• Mental and physical condition (leaders not fit for work)

Equipment & Environment

• Lack of appropriate equipment (i.e. participants not bringing equipment)
• Documentation
• Activity Environment: Infrastructure & terrain
WHAT DO WE KNOW BECAUSE OF UPLOADS?

• Most LOA injuries are minor

• Incidents have multiple contributory factors spanning multiple actors

• Minor incidents have similar contributory patterns to the big ones

• Outside of usual suspects, key areas for improvements include risk assessment, interactions between parents, centres, schools, documentation, pre-existing injuries, fit between participants and activities, policy and procedures

• LOAs have a low injury incident rate compared to other sports (2.1 per 1000 participants)

• LOA sector is good at managing overtly risky activities e.g. high ropes courses

• Most injuries occur in less overtly risky activities e.g. free time, campcraft, walking/running
• Redevelopment of new UPLOADS tool

• Develop a structured process for translating systems-based accident data into appropriate and effective prevention strategies (UPLOADS-PrIMe)

• Assess the effectiveness of the UPLOADS learning cycle (reporting, analysis, decisions, implementation, follow-up)

• Testing the effectiveness of UPLOADS by comparing the incident and safety records of organisations using UPLOADS versus organisations not using UPLOADS
BROADER UPLOADS RESEARCH PROGRAM

• A systems approach to risk assessment (Dallat et al., 2017)

• Analysis and design of outdoor education regulatory systems (Carden et al., 2017)

• Near miss incident reporting and learning

• Instructor/Leader Improvisation (Trotter et al, 2017)

• Multi-national injury incident analysis
A systems approach to risk assessment

NET-HARMS
THE RESEARCH PROBLEM

• Inadequate risk assessment highlighted as contributing factor in injuries and deaths on led outdoor activities (LOA)

• Systems approach to accident causation in LOA sector (and safety critical domains generally) is now prevalent

• The extent to which schools/organizations consider the overall LOA system during risk assessment was not clear.

In short – are we predicting potential accidents with the same underpinning perspective as when we investigate them?
## Example 1

### Risk Assessment

**Explain all requirements expected from parent helpers**

Determine the number of staff required to adequately supervise the children (Ideally 1 adult to every 2 children, or 1 adult to every 4 children) this depends on the destination of the excursion.

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>general agreement (medical)</td>
</tr>
<tr>
<td>emergency contact and phone number for that day</td>
</tr>
<tr>
<td>name and contact of Doctor</td>
</tr>
</tbody>
</table>

- Any other adults required to supervise the children that need to have specialised skills such as first aid, anaphylaxis or asthma training

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>The transport to and from the proposed destination for the excursion (bus over 12 seats do not require booster seats)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>The proposed route and destination for the excursion</td>
</tr>
</tbody>
</table>
Will there be any water based activities/risk?

______________________________

The proposed activities at the excursion

______________________________

Proposed duration of the excursion

______________________________

Date Risk Assessment completed: ________________________________

Staff member completing the Risk Assessment: ________________________________

Approved by the Nominated Supervisor: ________________________________

Team Leader to evaluate the excursions and supervisory practices after the excursion

______________________________
**Sample Risk Management Plan: Excursion**

<table>
<thead>
<tr>
<th>Task/Activity</th>
<th>Hazard Identification &amp; Associated Risk Type/Cause</th>
<th>Assess Risk* use matrix</th>
<th>Elimination or Control Measures</th>
<th>Who</th>
<th>When</th>
</tr>
</thead>
</table>
| Bushwalking in national park | - uneven ground surfaces, bites and stings, exposure to sun, wind, rain and dehydration  
- allergies to insects, reptiles and plants  
- becoming lost or isolated from the group  
- change in weather conditions | 4 | - Notify national park staff of expected arrival and departure times, location of walk and participants, students with medical conditions  
- National Park staff to lead walk. Adult supervision at front and back to keep group together  
- Inform excursion participants of National Park safety instructions  
- Wear enclosed footwear suitable for walking, clothing to protect arms and legs and suitable for changing weather conditions  
- Wear hats, shirts with sleeves and sunscreen while outdoors  
- Ensure participants carry water bottles  
- Staff carry insect repellent, additional sunscreen and ensure rest breaks are taken in the shade  
- Identify participants with known medical conditions and ensure appropriate medication/treatments available  
- Ensure participation of students with known allergies has been considered, implement appropriate risk controls, e.g. a trained staff member is available to provide appropriate first aid (e.g. epipen for student with anaphylaxis)  
- Ensure staff and students are aware of emergency response procedures  
- Check weather forecast on day of excursion  
- Carry maps and compass  
- Emergency plans communicated for dealing with potential incidents  
- Carry first aid kit | Excursion Coordinator  
Supervision  
- All  
- Teachers  
Excursion Coordinator  
Teachers | Prior to walk  
On walk |

* Risk assessment is based on a 1-5 scale, where 5 is the highest risk.

Number in group/class: 55  
Name of excursion coordinator: K Citizen  
Contact number: XXXX  
Accompanying staff, parents, caregivers, volunteers: 2 class teachers and 4 parent/carer volunteers.
### Identified Risks

<table>
<thead>
<tr>
<th>Event</th>
<th>Inherent Risk Level (Circle)</th>
<th>Hazard Details (Tour leader to complete)</th>
<th>Required Management Strategies</th>
<th>Details of additional Management strategies to be implemented (Tour leader to complete)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of mobile phone contact between staff</td>
<td>Low Medium High Extreme</td>
<td>Inability for staff to communicate while participating in activities.</td>
<td>Arrangements should be known in advance. All staff to carry mobile phones with appropriate access. Share contact details with all staff.</td>
<td></td>
</tr>
<tr>
<td>Lack of mobile contact between staff and students</td>
<td>Low Medium High Extreme</td>
<td>Inability for staff to communicate with students while participating in different group activities.</td>
<td>All staff to have all student contact numbers for the duration of the tour. All students to have all staff contact numbers for the duration of the tour. Student phones to be turned on or silent except whilst sleeping.</td>
<td></td>
</tr>
<tr>
<td>Poor E-mail connection</td>
<td>Low Medium High Extreme</td>
<td>Difficult for parents to contact staff in emergency at home.</td>
<td>Staff to regularly check emails for communication from parents or xxxxxxxxxx</td>
<td></td>
</tr>
<tr>
<td>Poor availability of mobile contact between staff and xxxxxx contact person(s)</td>
<td>Low Medium High Extreme</td>
<td>Inability to ask for guidance for behavioural issues, accidents or change of plans</td>
<td>Two xxxxxxxxxx contact persons to be provided. Use email for non urgent contact. Regular reporting to contact person required and prearranged.</td>
<td></td>
</tr>
</tbody>
</table>
Outcome: Hazards across the entire system would be identified, and consequent risks to participant(s) harm assessed and managed.
STUDY 1 – HOW ARE WE CONDUCTING RISK ASSESSMENTS?

- Four outdoor education program risk assessments analysed to assess the extent to which they were underpinned by contemporary systems thinking.
- UPLOADS Accident Analysis Framework and Accimap used to analyse and map hazards and actors.
- 77 Hazards identified
- 8 Actors
- 3 States
- Multiple activities (n=21)
- Camp and Journey Based Programs represented
# ACCIMAP DISPLAYING THE HAZARDS IDENTIFIED IN THE FOUR RISK ASSESSMENTS

<table>
<thead>
<tr>
<th>Government department decisions and actions</th>
<th>Supervisory and management decisions and actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory bodies and associations</td>
<td>Student numbers</td>
</tr>
<tr>
<td>Local area government, schools and parents</td>
<td></td>
</tr>
<tr>
<td>Activity centre management planning and budgeting</td>
<td></td>
</tr>
</tbody>
</table>

### Decisions and actions of leaders, participants and other actors at the scene of the incident

- Limited skill (1)
- Medical conditions (3)
- Exhaustion (1)
- Special needs group (1)
- Abrasions (1)
- Lost student (1)
- Dehydration (1)
- Burns (3)
- Fatigue (1)
- High risk behaviour (1)
- Fractures (2)
- Infection (1)
- Chafing (1)
- Slips and trips (1)
- Strains and sprains (3)
- Abduction (1)
- Injury from arrow (1)
- Negative impact with another group (1)
- Trailer reversing (1)
- Jumping (1)
- Diving (1)
- Falls (3)
- Allergic reaction (3)

### Equipment, environment and meteorological conditions

- Steep terrain (1)
- Sloping ground (1)
- Tree fall (1)
- Temperature hot/cold (3)
- Falling objects (1)
- Sharks (1)
- Bike failure (1)
- Vehicles (1)
- Unknown site (1)
- Environment being harmed by human (1)
- Road hazards (1)
- Weather conditions (2)
- Heights (1)
- Exposure (1)
- Communication device failure (1)
- Jewellery (1)
- Trew campsite (1)
- Wild animals (1)
- Lightning (3)
- Water visibility (1)
- Drowning (3)
- Fire (1)
- Clothing entangled in bike (1)
- Arts and crafts material (allergic reaction to) (1)
- Vehicles (1)
- Cyclist failure (1)
- Exposed ridges/hollows (1)
- Cattle grids (1)
- Animal bites/stings (3)
- Rips (3)
- Water quality (2)
- Sunburn (1)
- Trailer decoupling (1)
- Equipment failure (1)
STUDY 2 - PRACTITIONER SURVEY

• Online and voluntary

• Aims:
  • 1) determine which risk assessment methods and policy guidance are currently used in practice (if any);
  • 2) understand practitioner perspectives around the utility of risk assessments; and,
  • 3) identify perceived challenges and barriers in applying these methods to the LOA context.

• Total sample (n=97)

• All states and territories represented in findings
In general, a picture of confusion and uncertainty in relation to conducting risk assessments, as well as a lack of policy guidance and formal training, was observed.

Do you believe there are any issues regarding the application of risk assessments to the outdoor activity/program context?

• Yes – 79%
• No – 21%
RISK ASSESSMENT METHODS

Methods used for risk assessment:

- Complete proforma/generic template
- "Identify, assess, rate, control risks"
- Brainstorm/think through activity
- Use experience to determine risks
- Site Visit
- Other
- Reuse past risk assessments
- Use incident history

Percentage n=97
WHAT RISKS ARE YOU ASSESSING?

Figure 5 Accimap representing the LOA system level where the risks identified for assessment reside (adapted from Salmon et al, 2010)

- Activity Centre Management, planning and budgeting
- Supervisory and management decisions and actions
- Equipment, environment and meteorological conditions
- Decisions and actions of leaders, participants and other actors at the scene of the incident
KEY FINDINGS

- Accident causation research demonstrates that factors also related to schools/centers/orgs, organization management, parents, activity leader supervision, risk assessment, and program design.

- 57% of respondents learned organisational risk assessment ‘on the job’;

- 35% use brainstorming or thinking up risks as a method of risk assessment;

- 70% of respondents currently ‘confused’ in relation to organizational risk assessment.

Only a small proportion of the potential risks around LOA program development and delivery are currently being assessed.
Adverse events

Real, invisible, safety boundary

Economic failure boundary

Unacceptable workload boundary

Boundary defined by official work practices

Public opinion

Changing political climate and public awareness

Changing market conditions and financial pressure

Changing competency levels and education

Fast pace of technological change

Government

Regulators, Associations

Company

Management

Company Policy

Staff

Plans

Work

Hazardous process

Laws

Regulations
DOMINANT MODEL OF RISK ASSESSMENT IN THE LED OUTDOOR CONTEXT

• The “People, Equipment and Environment” approach.

• Focuses predominantly at risks/actions at the immediate context of, and within, the confines of the activity.
STUDY 3 – A REVIEW OF THE RISK ASSESSMENT LITERATURE

• 342 methods reviewed
• Multiple ‘safety-critical’ domains – healthcare, nuclear, construction, process
• Some RA underpinned by systems approach (e.g. FRAM, STPA)
• Most RA methods adopt linear, chain-of-event perspective
• Conclusion - risk prediction methods are not aligned with current understanding on accident causation
AN OBVIOUS DISCONNECT

- **Systems approach to Accident Causation**
  - Accidents caused by interacting factors across ‘systems’
  - Error as a consequence of factors residing throughout the system
  - Systems-based strategies and countermeasures
  - Multiple methods to view and analyse accidents through this lens

- **Systems approaches to Risk Assessment**
  - The same factors that are present in accidents must also be present in the system prior
  - Not many methods available to predict and analyse what may occur as a result of multiple, interacting risks
  - Most risk assessment methods are linear, chain-of-event and focus largely on the sharp end of operation (Dallat, Salmon and Goode, 2017a).
NET-HARMS’ DESIGN PRINCIPLES

- Organisational RA Tool
- Can predict emergent risks (the risks that arise when risks interact with each other).
- Used by teachers/planners
- Planning tool ('Proceed or Not')
- WHS Compliant
- Time efficient
- Range of experience levels

- Incorporate existing RA’s
- Identify new hazards/risks
- Identify range of controls
- Could be data-based
- All activity types
- Low cost
- Multiple end users
STEP 1 - HIERARCHICAL TASK ANALYSIS

• Used to anchor identification and assessment of system risks

• A methodology for describing the goals, tasks, operations and plans associated with work systems (Stanton, 2006).

• A useful way of looking at how people interact with equipment and with various aspects of their working environment

• By work systems, we are referring to the human and non-human actors throughout the organisation who influence the design, development and delivery of the outdoor program.
HTA OF A 5-DAY RAFTING AND CAMPING PROGRAM

0. Plan and deliver a five day led outdoor activity program

1. Plan and deliver a five day led outdoor activity program
   Plan O: Do 1, then do 2, then 3, then 4, then 5 then EXIT.

   - 1.1 Establish need
   - 1.2 Select date and activity type
   - 1.3 Determine resources
   - 1.4 Determine program delivery model
   - 1.5 Determine staffing model
   - 1.6 Check insurance
   - 1.7 Determine external guidelines (e.g. DE&T, AAS)
   - 1.8 Work within existing policy/guideline framework

2. Design Program
   Plan 2: Do 2.1 and 2.2. Then do 2.3 – 2.6 in any order, then do 2.7, then 2.8, then EXIT.

   - 2.1 Determine desired outcomes
   - 2.2 Consider/determine participant characteristics
   - 2.3 Choose activities
   - 2.4 Choose location(s)
   - 2.5 Determine resource and staffing requirements
   - 2.6 Conduct compliance/quality checks
   - 2.7 Develop program outline
   - 2.8 Conduct Organisational Risk Assessment

3. Program Planning & Preparation
   Plan 3: Do 3.1 and 3.2, then do 3.3, then 3.4 to 3.8 in any order. Then do 3.9 and 3.10.

   - 3.1 Provide/exchange information w/participants/parents (e.g. medical)
   - 3.2 Provide info to participants/parents (e.g. clothing, logistics)
   - 3.3 Establish parent consent
   - 3.4 Recruit staff
   - 3.5 Plan resources
   - 3.6 Establish venue specific information & limitations
   - 3.7 Gain appropriate permits
   - 3.8 Confirm venue/accommodation & catering details
   - 3.9 Prepare program information pack (for staff)
   - 3.10 Staff Briefing

4. Delivery
   Plan 4: Do 4.1, then 4.2, then 4.3, then 4.4, then 4.5. If equipment required, then do 4.6, then 4.7 and 4.8 and then do 4.9. Then do 4.10 to 4.14 continuously, if incident occurs, then do 4.15. When activity completed, then do 4.16, then do 4.17, then do 4.18, then do 4.19, then EXIT.

   - 4.1 Final staff attending program review and confirmation
   - 4.2 Travel to program location
   - 4.3 Unpack equipment and set-up
   - 4.4 Meet & greet
   - 4.5 Initial program briefing (program, emergency information)
   - 4.6 Equipment issue
   - 4.7 Supervisory team discuss expectations & working relationship
   - 4.8 Review pre-existing medical/dietary needs
   - 4.9 Activity briefing & demo
   - 4.10 Dynamic ex-program risk assessment
   - 4.11 Commence and complete activity
   - 4.12 Food prep & management
   - 4.13 Water management
   - 4.14 Site management
   - 4.15 Incident response
   - 4.16 Pack up & equip de-issue
   - 4.17 Participant transportation home
   - 4.18 Staff transportation home
   - 4.19 Unload equipment at home base

5. Post Program Review
   Plan 5: If incident occurred, do 5.1, then do 5.2, then 5.3, then 5.4, then EXIT. If no incident occurred, do 5.2, then do 5.3, then do 5.4, then EXIT.

   - 5.1 Review Incident reports
   - 5.2 Debrief & evaluation w/participants and staff
   - 5.3 Review and update risk assessment
   - 5.4 Budget analysis and reconciliation
   - 5.5 Review incident reports
   - 5.6 Debrief & evaluation w/participants and staff
   - 5.7 Review and update risk assessment
   - 5.8 Budget analysis and reconciliation

Plan 1: Do 1.1 then 1.2 to 1.6 in any order, then do 1.7 and 1.8, then EXIT.
EXCERPT - PROGRAM PLANNING AND PREPARATION

0. Plan and deliver a five day led outdoor activity program

3. Program Planning and Prep

3.1 Provide/exchange info with parents (e.g. medical)
3.2 Provide info to participants/parents (e.g. clothing, logistics)
3.3 Establish parent consent
3.4 Recruit staff
3.5 Plan resources
3.6 Establish venue specific info & familiarization
3.7 Gain appropriate permits
3.8 Confirm venue/accom/catering details
3.9 Prepare program info pack (for staff)
3.10 Staff Briefing
3.11 Participant prep activities
3.12 Pre-program dynamic risk assessment
3.13 Determine contingencies
3.14 Plan crisis management
3.15 Plan on-program communications
0. Plan and deliver a five day led outdoor activity program

2. Design Program

- 2.1 Determine desired outcomes
- 2.2 Consider/determine participant characteristics
- 2.3 Choose activity(ies)
- 2.4 Choose location(s)
- 2.5 Determine resource and staffing requirements
- 2.6 Conduct compliance/quality checks
- 2.7 Develop program outline
- 2.8 Conduct Organisational Risk Assessment

Plan 2: Do 2.1 and 2.2. Then do 2.3 – 2.6 in any order, then do 2.7, then 2.8, then EXIT.

2.8 Conduct Organisational Risk Assessment

- School Coord
- Client Mgr
- Risk Mgr
- Program Mgr
- Nurse

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STEP 2 – NET-HARMS TAXONOMY

Based on SHERPA (Embrey, 1986)

The taxonomy is the consistent filter through which we identify and assess risks
## Predicting Task Risks – Examples

<table>
<thead>
<tr>
<th>HTA Task</th>
<th>Risk mode</th>
<th>Risk description</th>
<th>Risk consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6 check insurance</td>
<td>T3</td>
<td>Insurance of sub-contractors not checked</td>
<td>Inadequate/no insurance/risk of harm/liability claim</td>
</tr>
<tr>
<td>2.3 choose activities</td>
<td>T3</td>
<td>Activities are selected with lack of detail - eg. Distances of day/rapid ratings etc</td>
<td>Injury from too high challenge level</td>
</tr>
<tr>
<td>2.3 choose activities</td>
<td>T5</td>
<td>Coordinator chooses route due to strong personal preference</td>
<td>Group of students lost or injured</td>
</tr>
<tr>
<td>3.10 Staff Briefing</td>
<td>T1</td>
<td>Staff briefing undertaken late (e.g. on the bus, immediately before program)</td>
<td>Staff member may miss important aspects of briefing relevant to management of risk</td>
</tr>
<tr>
<td>3.9. Prepare program information pack (for staff member)</td>
<td>T1</td>
<td>Information pack prepared and delivered too late</td>
<td>Field program leadership does not have sufficient time to review and ensure familiarity with complete program information e.g. emergency phone no’s, participant information</td>
</tr>
<tr>
<td>4.7. Supervisory team discuss expectations and working relationship</td>
<td>T2</td>
<td>Expectations and working relationship not discussed</td>
<td>Potential for key information not to be communicated prior to activity (e.g. how to use satellite phone, behavior expectations, group communication methods, where first aid kit is, epi pen locations)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mismatch in expectations e.g. between provider and school</td>
</tr>
</tbody>
</table>
### ‘PLAN CRISIS MANAGEMENT’ TASK RISKS

<table>
<thead>
<tr>
<th>HTA Task</th>
<th>Risk Mode</th>
<th>Task Risk Description</th>
<th>Risk Consequence(s)</th>
</tr>
</thead>
</table>
| 3.14. Plan crisis management | T1        | Crisis management planning is conducted too late                                       | - Ineffective/inappropriate crisis management plan leading to further risks/harm  
- Position becomes forced and reactive                                                                  |
|                          | T2        | Crisis management planning is not conducted                                           | - No crisis management plan in place  
- Staff in field are not supported leading to likely escalation of situation due to resource scarcity  
- Ineffective/inappropriate crisis management plan leading to further risks/harm  
- Position becomes forced and reactive                                                                |
|                          | T3        | Crisis management plan is inadequate                                                  | - Ineffective/inappropriate crisis management plan leading to further risks/harm                         |
|                          | T4        | Crisis management tool is inadequate for the planned context (e.g. off the shelf, untested, administrative plan not designed for potential remote, overseas, communications-challenged environments) | - Ineffective/inappropriate crisis management plan leading to further risks/harm                         |
|                          | C3        | Inadequate communication of crisis management plan                                    | - Not all staff aware of crisis management plan  
- Sub-optimal enactment of crisis management plan                                                        |
|                          | C1        | Crisis management plan not communicated to all staff                                   | - Not all staff aware of crisis management plan  
- Sub-optimal enactment of crisis management plan                                                         |
STEP 3 – EMERGENT RISK PREDICTION

• Remember how a systems approach to accident causation considers that multiple factors and interactions are integral?

• This next step helps us identify and assess the impact of those interactions in a risk prediction context.
Plan 1: Do 1.1 then 1.2 to 1.6 in any order, then do 1.7 and 1.8, then EXIT.

Plan O: Do 1, then do 2, then 3, then 4, then 5 then EXIT.

Plan 2: Do 2.1 and 2.2. Then do 2.3 – 2.6 in any order, then do 2.7, then 2.8, then EXIT.

Plan 3: Do 3.1 and 3.2, then do 3.3, then 3.4 to 3.8 in any order. Then do 3.9 and 3.10. Then, if participant preparation activities are required, do 3.11. Then, do 3.12, then 3.13, then 3.14, then 3.15 and then EXIT.

Plan 4: Do 4.1, then 4.2, then 4.3, then 4.4, then 4.5. If equipment required, then do 4.6, then 4.7 and 4.8 and then do 4.9. Then do 4.10 to 4.14 continuously. If incident occurs, then do 4.15. When activity completed, then do 4.16, then do 4.17, then do 4.18, then do 4.19, then EXIT.

Plan 5: If incident occurred, do 5.1, then do 5.2, then 5.3, then 5.4, then EXIT. If no incident occurred, do 5.2, then do 5.3, then do 5.4, then EXIT.
RELATIONSHIPS BETWEEN TASKS
PREDICTING EMERGENT RISKS

Emergent behaviours are they key to understanding accident causation

We want to identify what is the likely impact on linked tasks if the initial one is done badly, not at all, too early/too late etc.

Why is this important?

It helps us identify the tasks associated at all stages throughout the work system – design, development, planning and delivery – that are critical to manage risk and achieve optimal outcomes.
### LINKED TASKS – 2.4 CHOOSE LOCATION

<table>
<thead>
<tr>
<th>Task</th>
<th>T2</th>
<th>Location choice is not considered in the design phase</th>
<th>Location choice may not be suitable for the program.</th>
</tr>
</thead>
</table>

#### Emergent Risk Prediction

Because the ‘location choice was not considered in the design phase’, **is it possible that the task of:**

**could be conducted**...
**EMERGENT RISK EXAMPLES**

<table>
<thead>
<tr>
<th>HTA Task</th>
<th>Task risk</th>
<th>Linked task</th>
<th>Emergent risk mode</th>
<th>Emergent risk description</th>
<th>Emergent risk consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.5 Plan resources</td>
<td>Resource planning is inadequate (e.g. not enough, incorrect)</td>
<td>4.12 Food preparation and management</td>
<td>T3</td>
<td>Food preparation/ ordering is done poorly / inadequately as planning was also inadequate</td>
<td>Program food is inappropriate in content/quantity</td>
</tr>
<tr>
<td>2.7 Develop program outline</td>
<td>Program outline communication is inadequate e.g. doesn't give full overview of program</td>
<td>4.11 commence and complete activity</td>
<td>T1</td>
<td>Poor outline information lead to mistimed activity start - rafting finishes in the dark</td>
<td>Student become hypothermic from being wet on river as temps drop</td>
</tr>
<tr>
<td>2.2. Consider/determine participants characteristics</td>
<td>Consideration of participant characteristics is inadequate in the design phase of the program (e.g. with no consideration given to participants with specific needs)</td>
<td>2.3 choose activities</td>
<td>T1</td>
<td>Activities are chosen without consideration of participant characteristics</td>
<td>Activities are inappropriate for this participant cohort</td>
</tr>
<tr>
<td>4.8 On program review of pre-existing medical and dietary needs</td>
<td>Review of pre-existing dietary and medical conditions is inadequate (e.g. rushed, missing information, group leadership change)</td>
<td>4.11 complete and commence activity</td>
<td>E1</td>
<td>Inadequate review leads to inadequate program environment being chosen</td>
<td>Unhealthy learning environment puts students off outdoor experiences in future. Dangerous environment for impacted students not realised</td>
</tr>
</tbody>
</table>
Study showed that:

- 141 task risks were predicted in the design, planning and review stages (Sections 1, 2, 3 and 5) of the HTA. Tasks at the program delivery of the program, (Section 4 of the HTA), had 91 predicted task risks.

- NET-HARMS identified 1131 emergent risks associated with the design, planning and review tasks (Sections 1, 2, 3 and 5 of the HTA), whereas in the program delivery tasks (Section 4 of the HTA), 232 emergent risks were predicted.

- The largest number of emergent risks reside within the tasks not associated with delivery of the activity.

- Overall, the study demonstrated the existence of 5.8 times more emergent risks in the system than task risks.
TRANSLATION INTO PRACTICE
VALIDATING NET-HARMS

**Participant’s individual and pooled Time 1 & Time 2 hitrate for Task risks**

**Participant’s individual and pooled Time 1 & Time 2 Hitrate for Emergent risks**
SUMMARY

• Systems thinking approach required for safety management; anything else limits impact and learnings

• Accident analysis/investigation should always be blame free and go up and out

• Injury incidents always have multiple contributory factors spanning the entire outdoor education system

• Risk in outdoor education activities is low

• Sector good at managing overtly risky activities – less overtly risky activities are an issue (e.g. free time, campcraft)

• Risk assessment needs to look at risks across the system as well as emergent risks that arise when different issues interact with one another

• NET-HARMS is a new risk assessment method that supports this view
The UPLOADS Project

UPLOADS: An incident reporting and learning system for the outdoor education, recreation and adventure sector in Australia.

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Home  Outputs  UPLOADS features in Australian Research Council's new 'Making a Difference' publication

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Upcoming Events

No upcoming events

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