UPLOADS
Understanding and Preventing Led Outdoor Accidents Data System

University of the Sunshine Coast
Centre for Human Factors and Sociotechnical Systems

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

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CONTENT

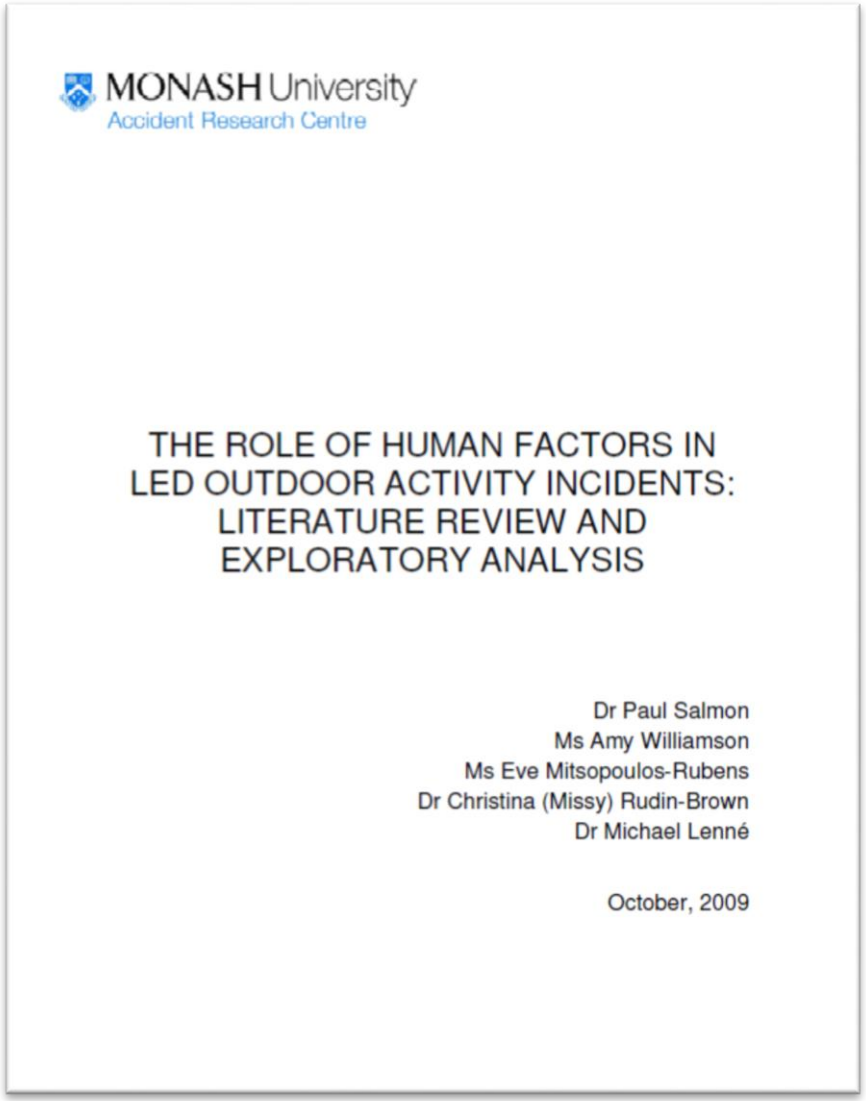
- Background
- Systems thinking in accident and injury prevention
- Incident reporting and learning: *UPLOADS*
- Risk assessment: *NET-HARMS*
- Key take home messages

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

5. Development of a led outdoor activity accident causation model and associated failure taxonomies.

THE UPLOADS PROJECT

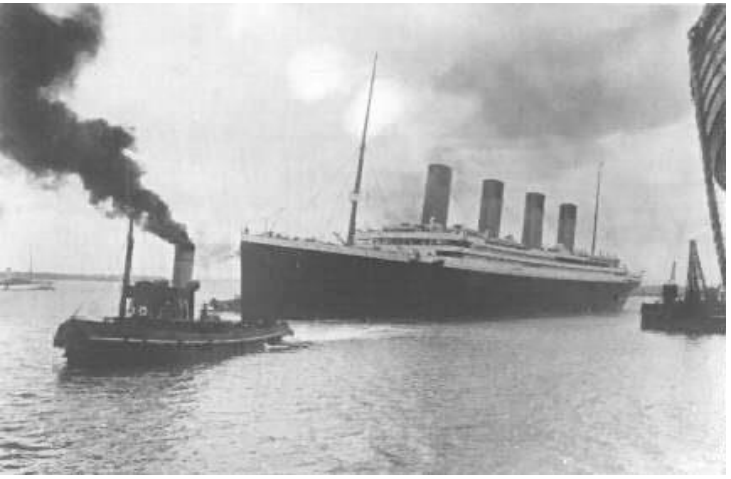
Goal: develop a standardised, national approach to incident reporting and learning for the outdoor education sector in Australia, and a corresponding national incident dataset

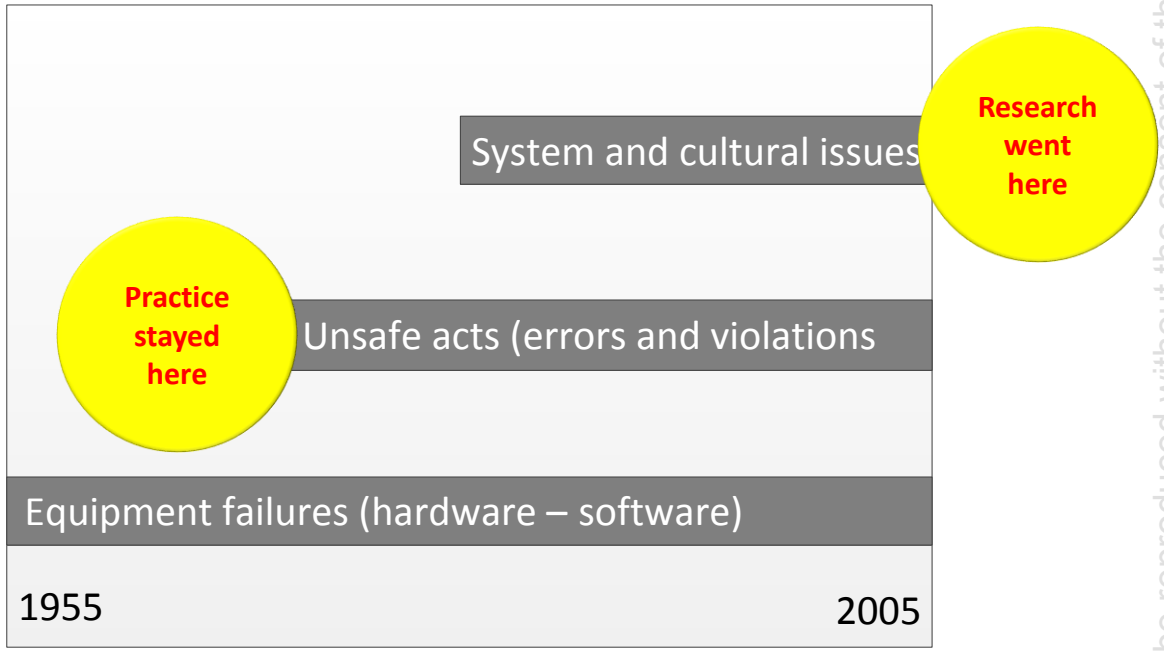
Support:

- 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





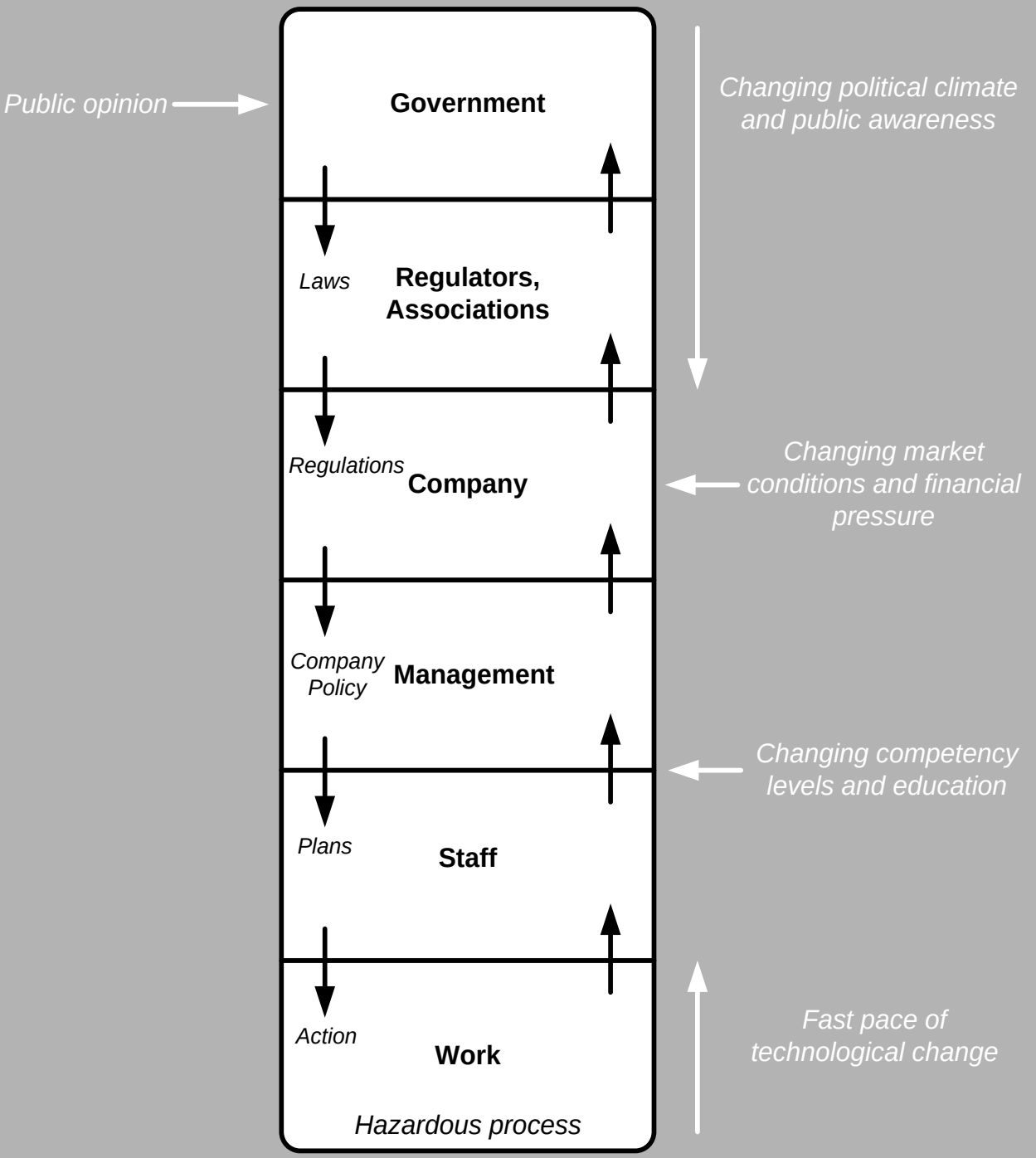
1960s	1970s	1980s	1990s	2000s
Aberfan	Flixborough	Chernobyl	Paddington	Linate
Ibrox	Seveso	Zeebrugge	Long Island	Uberlingen
	Tenerife	Bhopal	Alabama	Columbia
	TMI	Piper Alpha	Estonia	
	MT Erebus	Dryden	Eschede	

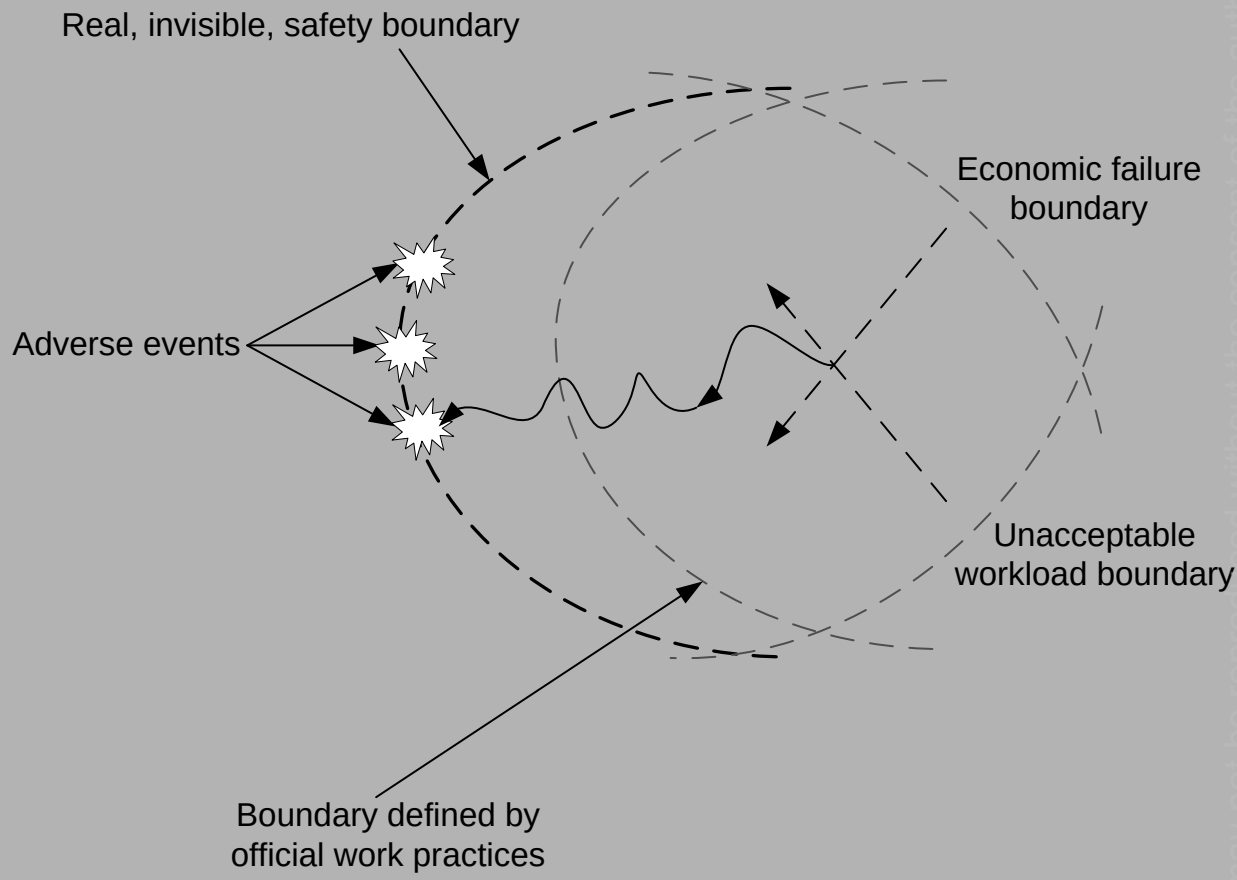
Reason (2008)

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

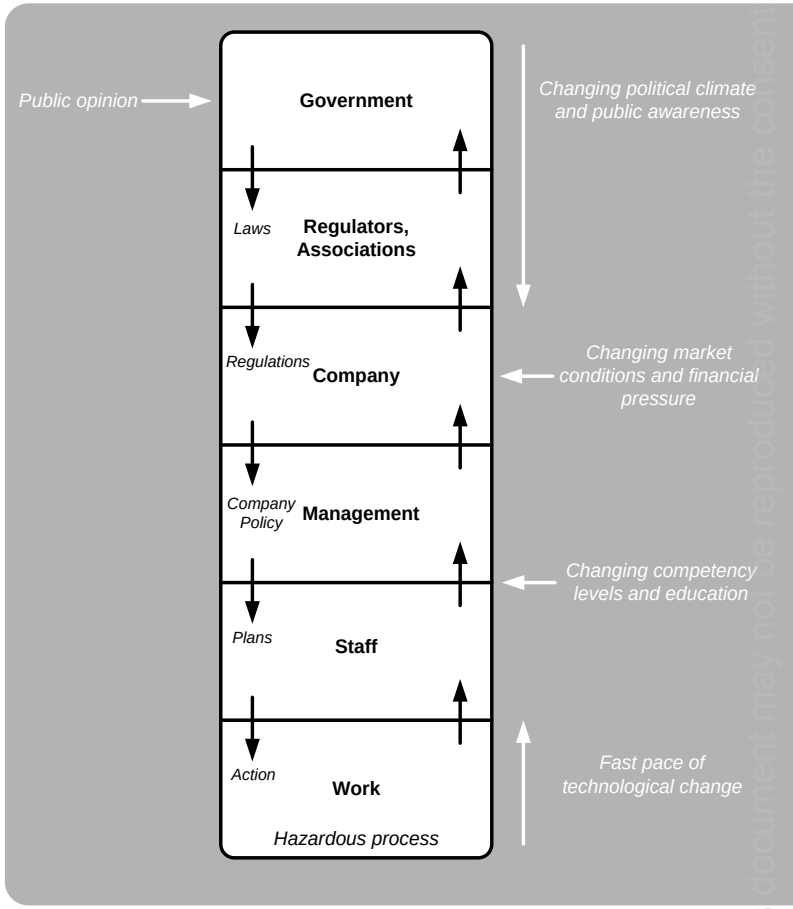
- Human error is a symptom of problems across the system (*it is a consequence not a cause*)
- Incidents caused by multiple interacting factors
- To understand 'failure' look at why people's actions made sense at the time
- Systems are unsafe
- Humans create safety through practices at all levels of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


Public opinion
Government
Laws
Regulators, Associations
Regulations
Company
Company Policy
Management
Plans
Staff
Action
Work
Hazardous process
Changing political climate and public awareness
Changing market conditions and financial pressure
Changing competency levels and education
Fast pace of technological change

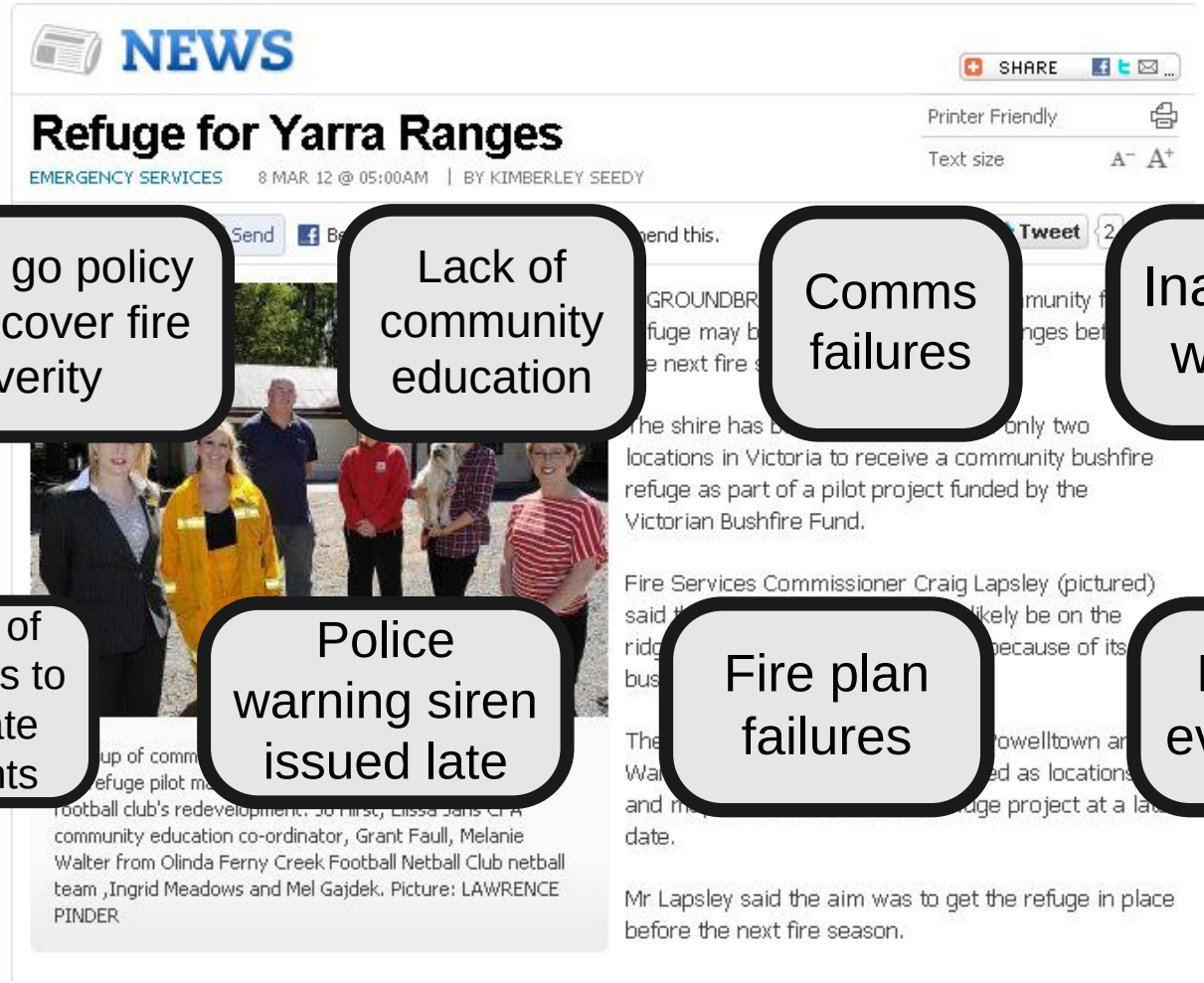

Real, invisible, safety boundary
Economic failure boundary
Adverse events
Unacceptable workload boundary
Boundary defined by official work practices

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).



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

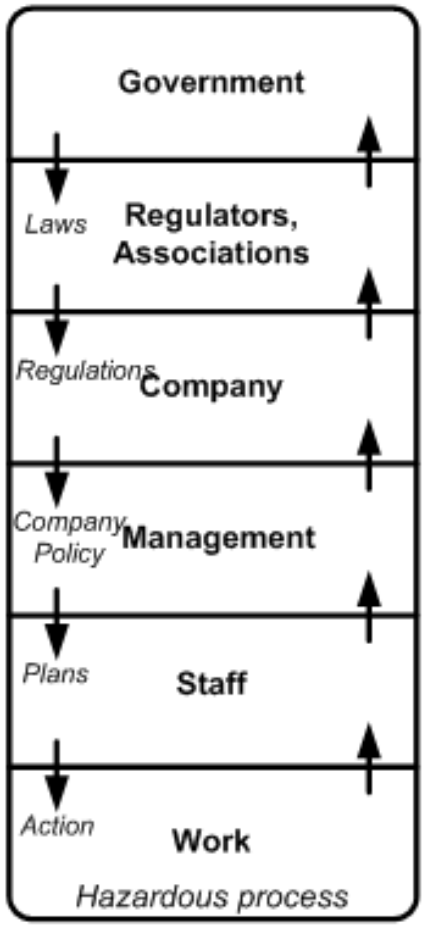
Fire plan failures

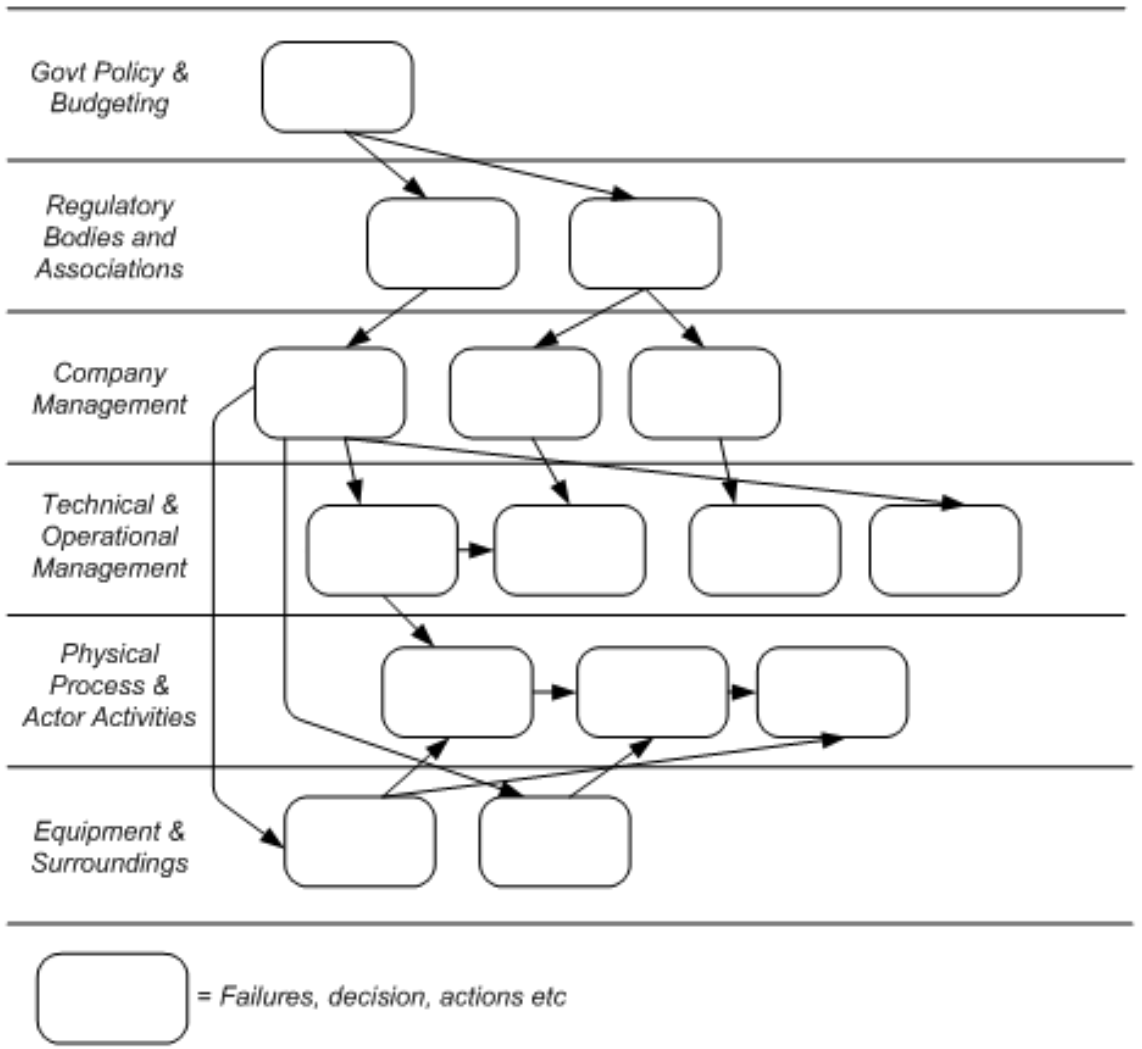
Delayed evacuation

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)

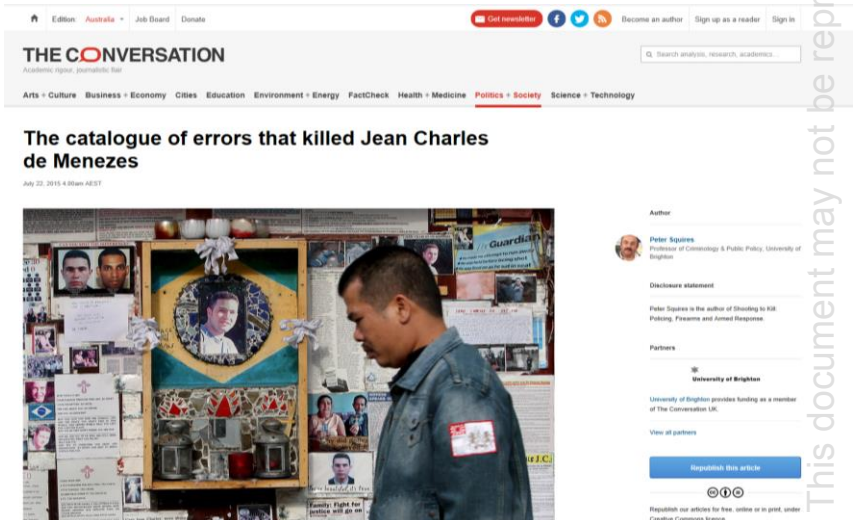
ACCIMAP

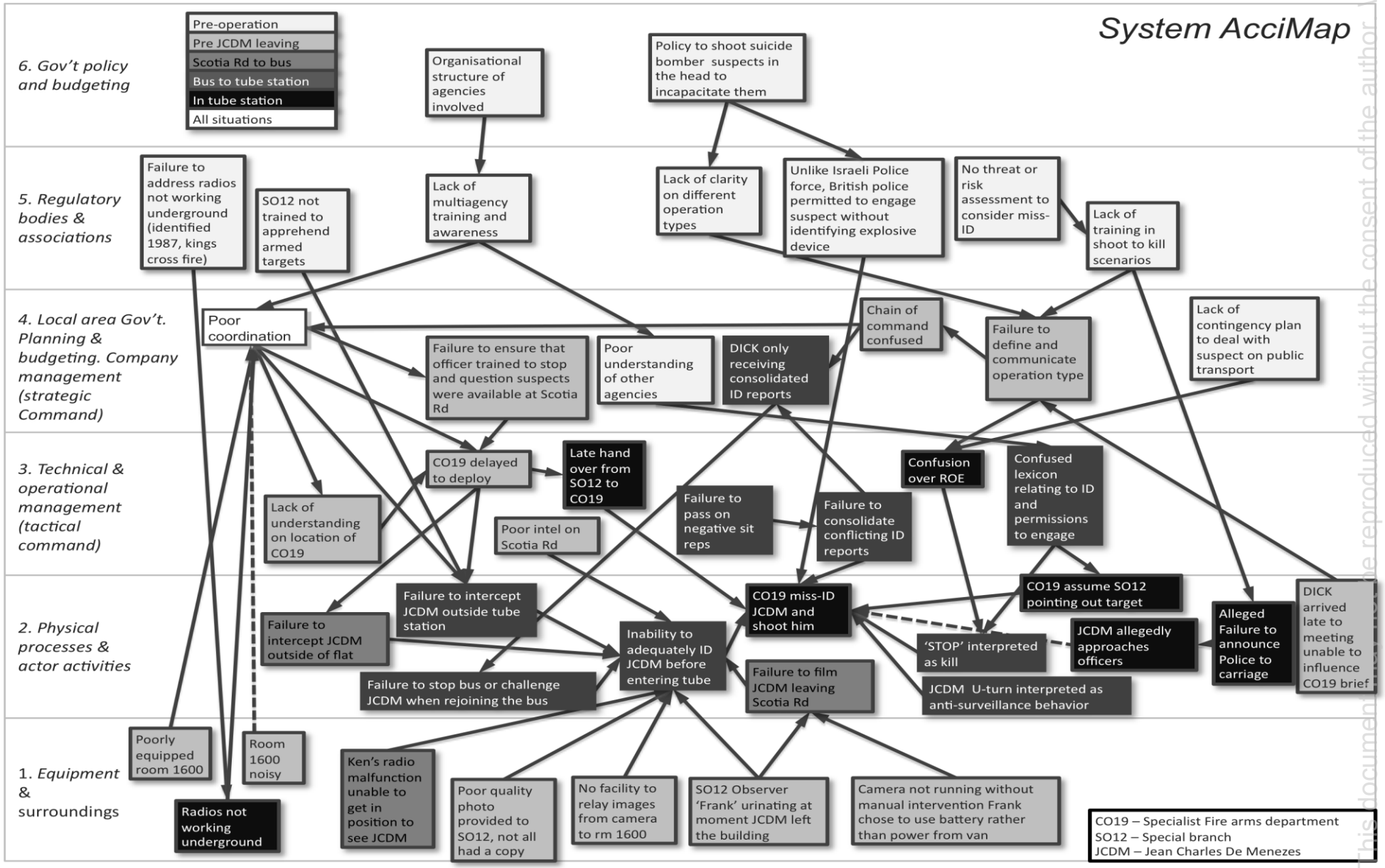




ACCIMAP APPLIED

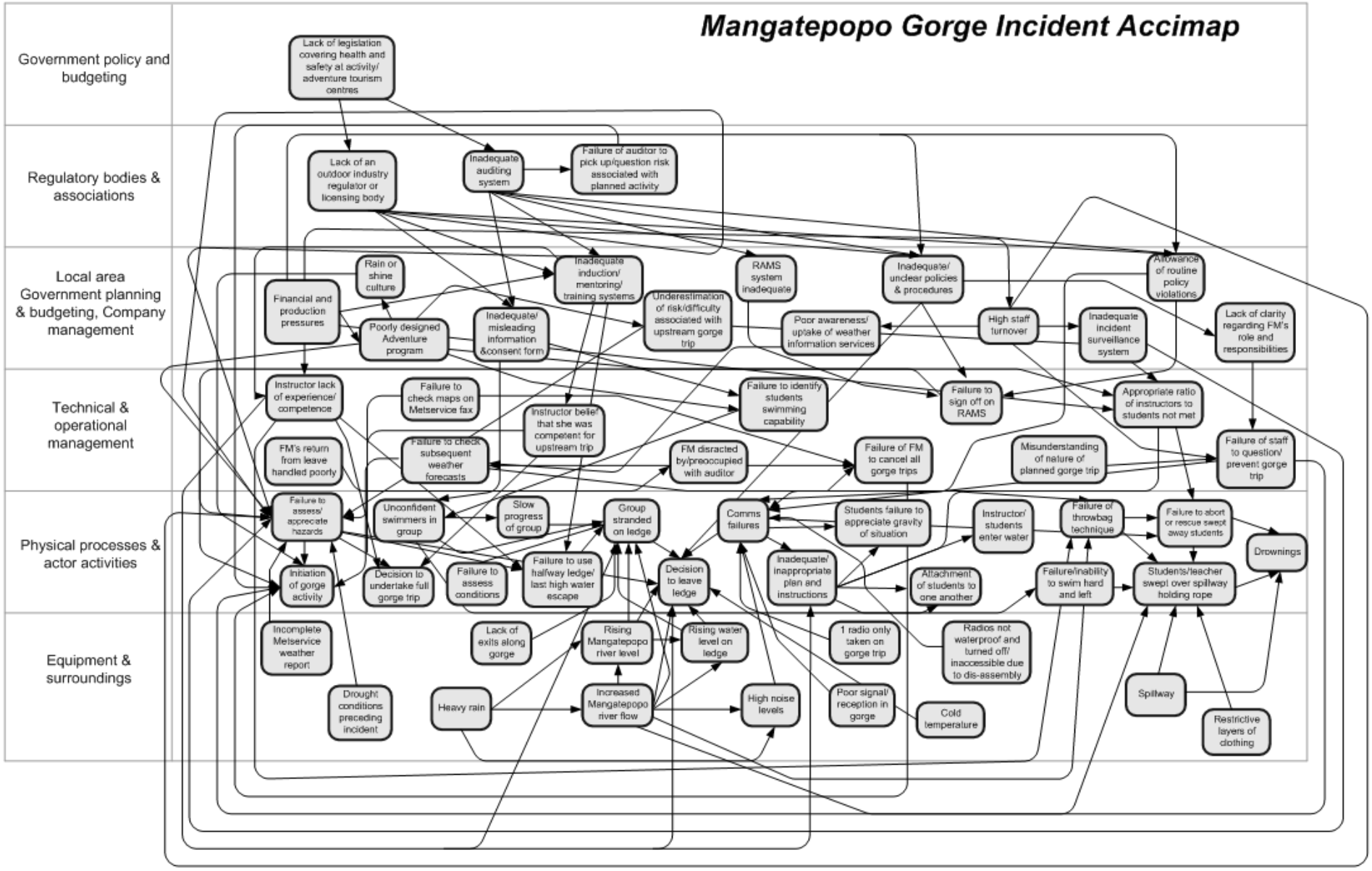
- 22nd July 2005, Stockwell tube station, London, UK
- Jean Charles de Menezes
- Misidentified as one of the fugitives involved in previous days failed bombing attempts





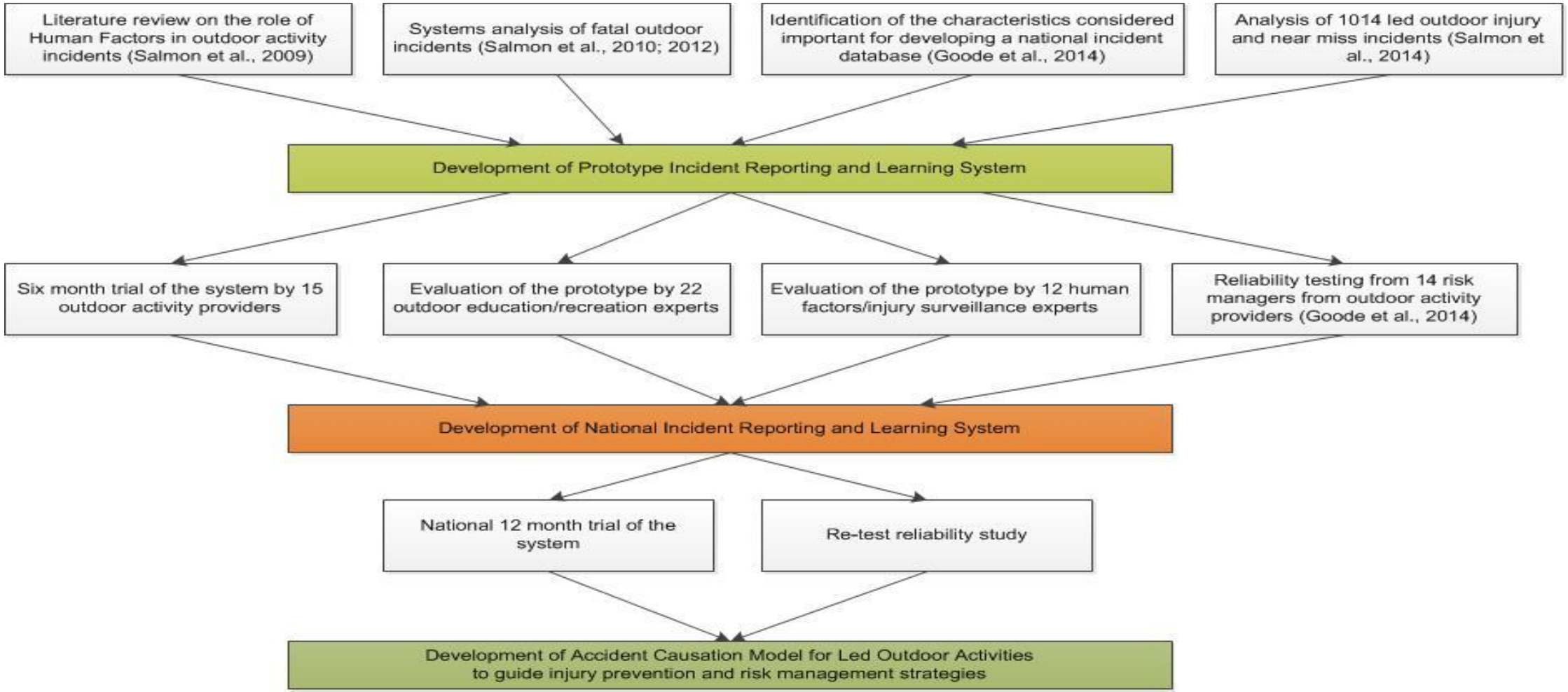
ACCIMAP APPLIED

- Mangatepopo Gorge tragedy, 15th April 2008
- Gorge walking activity
- Group became trapped on ledge in flash flood
- Teacher and six year 12 students drowned



Understanding and Preventing Led Outdoor Accident Data System (UPLOADS)

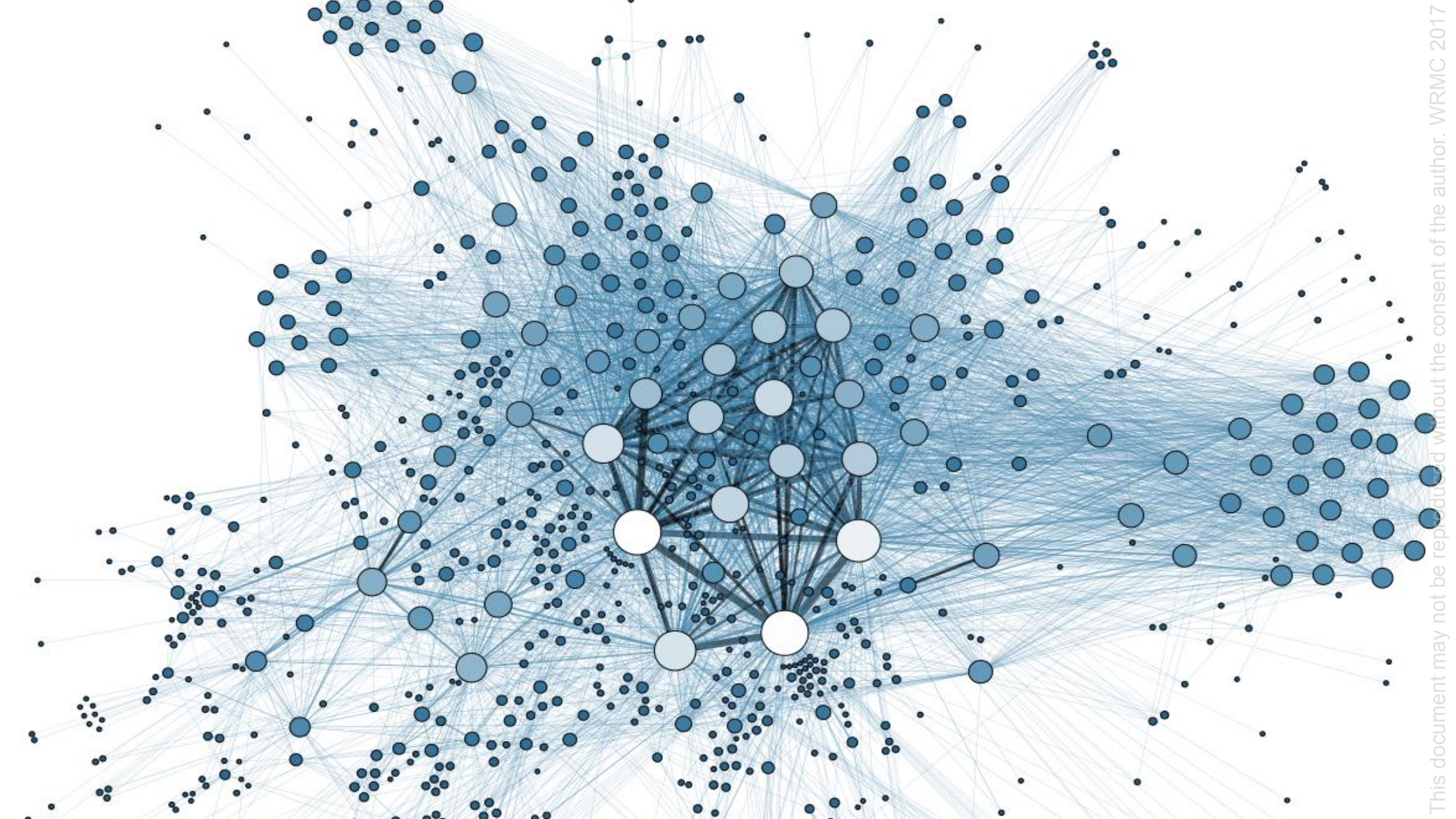
DEVELOPMENT OF UPLOADS



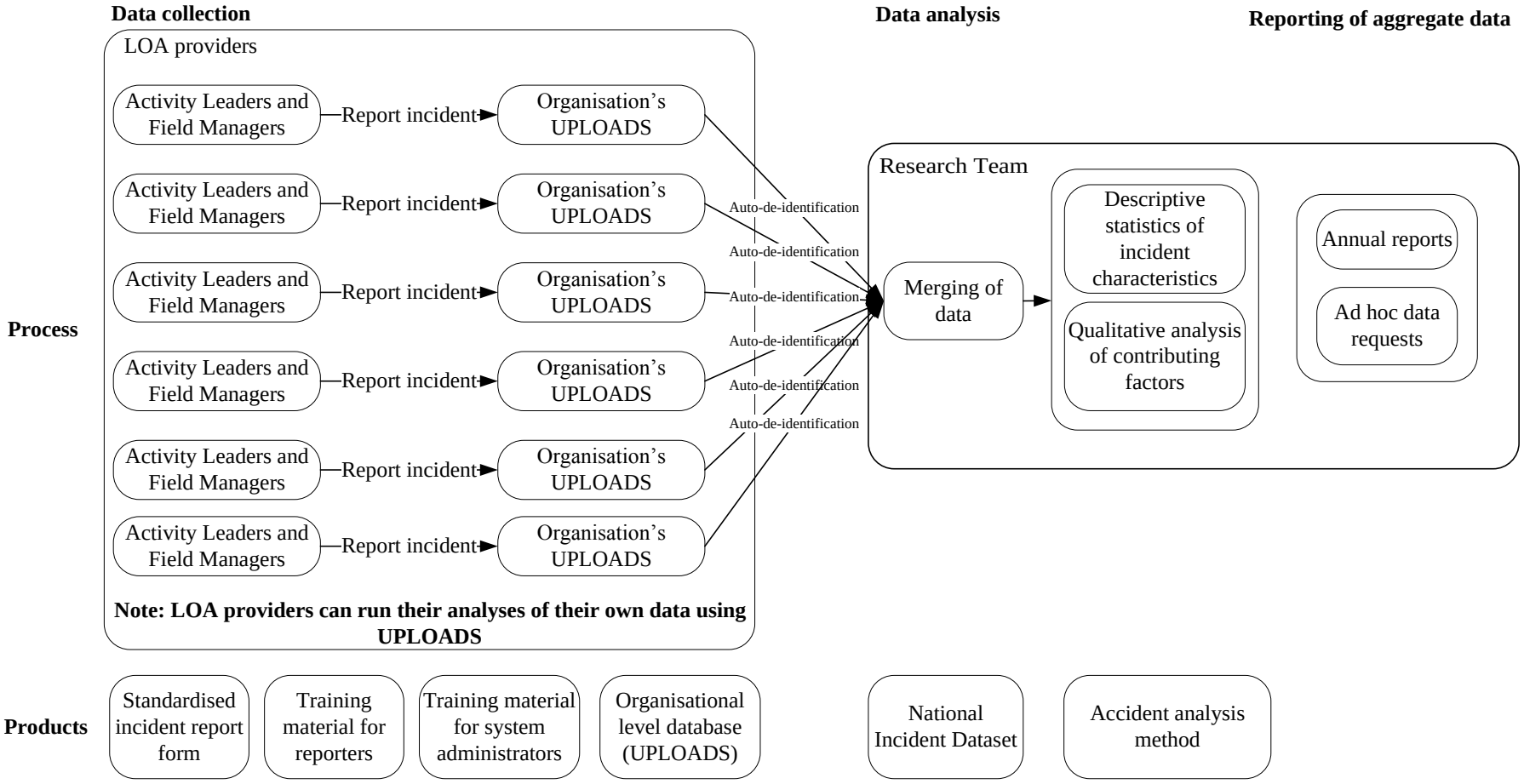
THE OUTDOOR EDUCATION 'SYSTEM'

Led outdoor activity ACTOR-MAP

Government Policy and Budgeting	Government bodies	State Departments of Education e.g. Dept of Education and ECD	State Departments of Land Management e.g. Parks Vic				
Regulatory Bodies and Associations	Regulatory bodies	Accreditation bodies	Auditing bodies	Peak bodies for outdoor recreation, outdoor education, and adventure tourism	Victorian Adventure Activity Standards	Standards Australia	Outdoor Council of Australia (e.g. National outdoor leaders reg scheme)
Local area government, parents, schools and activity centre management, planning and budgeting	Activity centre senior management/ board level	Local Govt & councils	Schools, school principals and school councils	Parents	Emergency services		
Technical and operational management	Supervisors	Managers (e.g. programs, training, risk, teaching)					
Physical processes and instructor/participant activities level	Instructor	Participants	Group				
Physical processes and instructor/participant activities level	Equipment	Physical environment	Meteorological conditions	Ambient conditions			



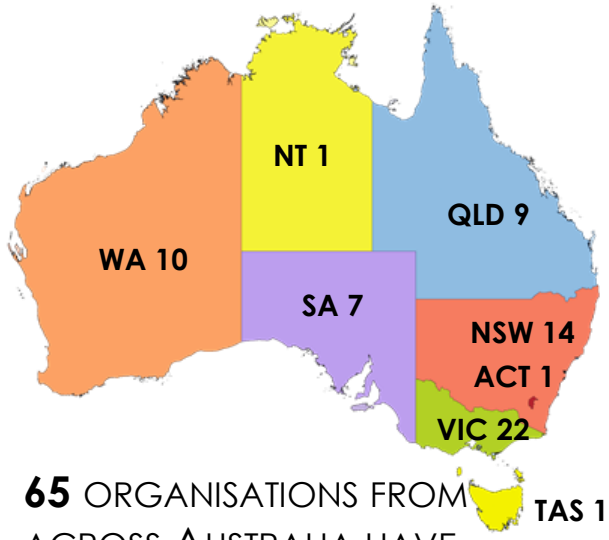
UPLOADS



THE FIRST 3 YEARS (2014 – 2017)

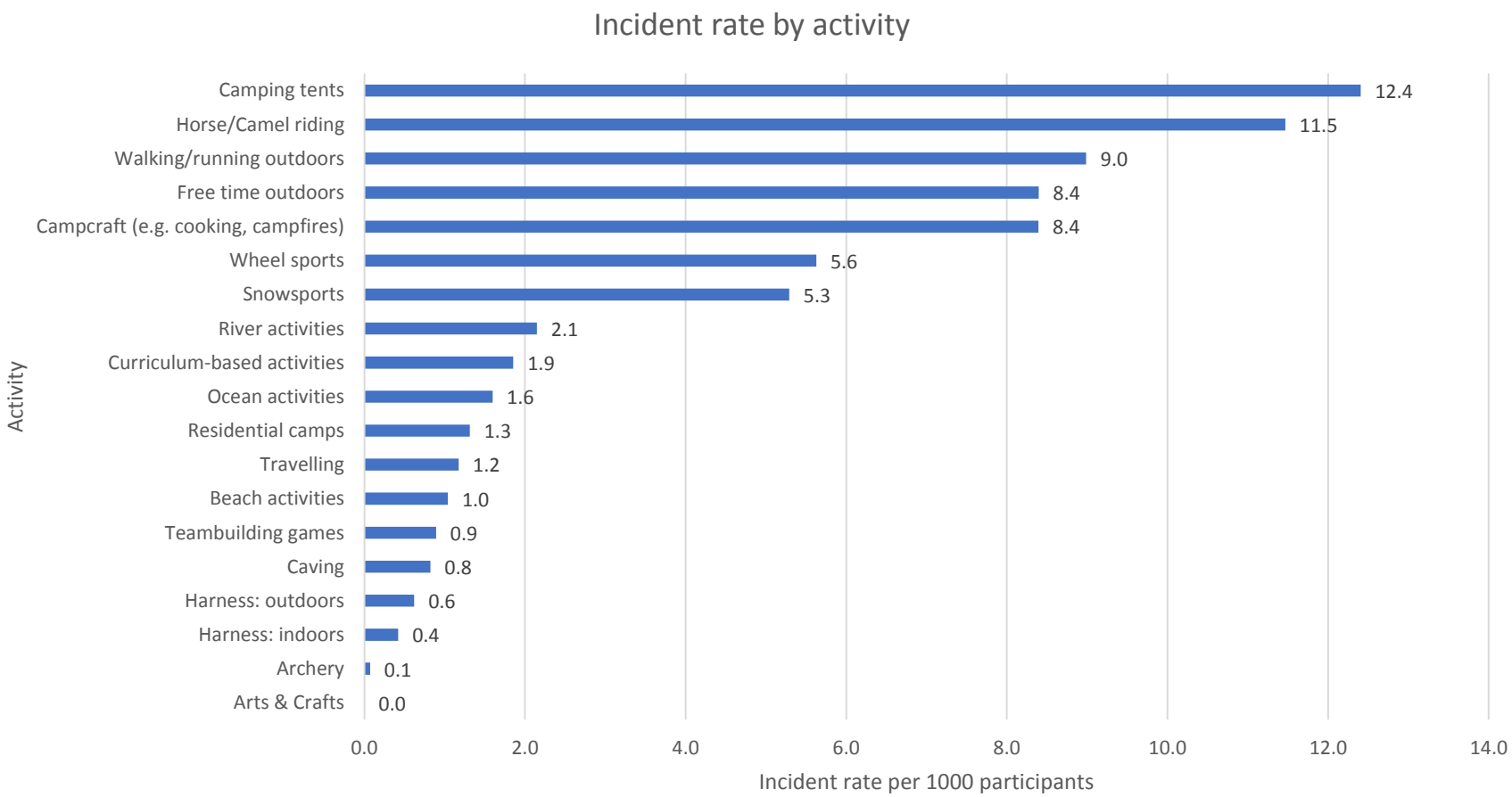
- **2037** incidents have been reported via UPLOADS
  - 1367 injuries
  - 454 illnesses
  - 131 near miss incidents
  - 65 social/psychological incidents, and
  - 20 incidents involving equipment damage

- **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 8.0% (n = 109)
- Superficial injury(47)
- Other / unspecified effects of external causes (33)
- Open wound (10)
- Effects of foreign body entering through natural orifice(8)
- Injury to muscle, fascia and tendon (4)
- Burns & corrosions(4)
- Crushing injury(3)

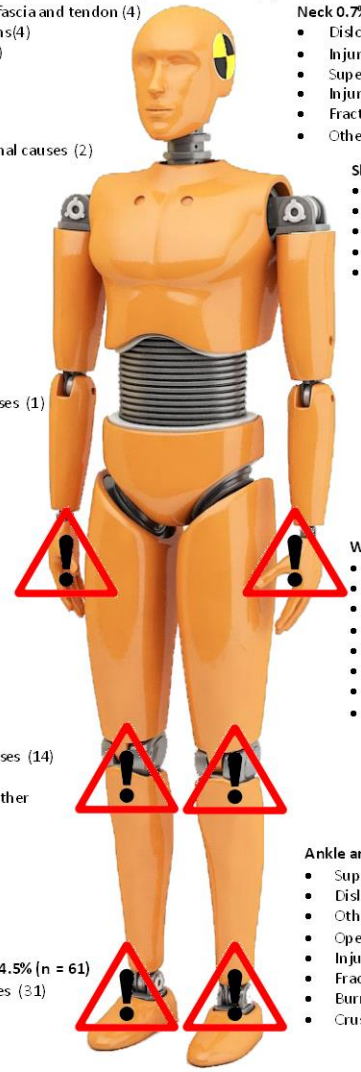
Neck 0.7% (n = 14)
- Dislocation sprain and strain (4)
- Injury to nerves or spinal cord(3)
- Superficial injury(3)
- Injury to muscle, fascia and tendon (2)
- Fracture (1)
- Other / unspecified effects of external causes (1)

Chest/Thorax 0.4% (n = 5)
- Other / unspecified effects of external causes (2)
- Dislocation sprain and strain (1)
- Crushing injury(1)
- Superficial injury(1)

Shoulder and upper arm 2.8% (n = 38)
- Dislocation, sprain and strain (21)
- Superficial injury(11)
- Injury to muscle, fascia and tendon (3)
- Other / unspecified effects of external causes (2)
- Open wound (1)

Elbow and forearm 3.4% (n = 46)
- Superficial injury(27)
- Dislocation sprain and strain (9)
- Fracture (4)
- Injury to muscle, fascia and tendon (3)
- Burns and corrosions(2)
- Other / unspecified effects of external causes (1)

Abdomen, lower back, lumbar spine and pelvis 3.3% (n = 45)
- Superficial injury(19)
- Dislocation sprain and strain (11)
- Injury to muscle, fascia and tendon (7)
- Injury to nerves or spinal cord (3)
- Other / unspecified effects of external causes (3)
- Crushing injury(2)



Hip and thigh 4.5% (n = 62)
- Superficial injury(41)
- Dislocation sprain and strain (8)
- Injury to muscle, fascia and tendon (6)
- Burns and corrosions(3)
- Crushing injury(1)
- Open wound (1)

Wrist and hand 18.1% (n = 247)
- Superficial injury(122)
- Burns and corrosions(36)
- Open wound (33)
- Dislocation sprain and strain (29)
- Fracture (10)
- Crushing injury(6)
- Injury to muscle, fascia and tendon (5)
- Other / unspecified effects of external causes (6)

Knee and lower leg 17.3% (n = 237)
- Superficial injury(124)
- Dislocation sprain and strain (41)
- Open wound (27)
- Injury to muscle, fascia and tendon (16)
- Other / unspecified effects of external causes (14)
- Burns and corrosions(11)
- Sequelae of injuries, of poisoning and of other consequences of external causes (2)
- Injury to nerves or spinal cord(1)
- Crushing injury(1)

Ankle and foot 27.9% (n = 381)
- Superficial injury(201)
- Dislocation, sprain and strain (138)
- Other / unspecified effects of external causes (13)
- Open wound (11)
- Injury to muscle, fascia and tendon (6)
- Fracture (4)
- Burns and corrosions(4)
- Crushing injury(4)

Unspecified part of trunk, limb or body region 4.5% (n = 61)
- Other / unspecified effects of external causes (31)
- Superficial injury(20)
- Burns and corrosions(3)
- Dislocation, sprain and strain (3)
- Injury to muscle, fascia and tendon (1)
- Effects of foreign body entering through natural orifice (1)
- Injury to internal organs(1)
- Open wound (1)

Multiple body regions 3.4% (n = 46)
- Superficial injury(27)
- Other / unspecified effects of external causes (8)
- Open wound (4)
- Dislocation sprain and strain (3)
- Burns and corrosions(2)
- Injury to muscle, fascia and tendon (1)
- Injury to nerves or spinal cord(1)

Most frequent factors at each level are shaded in grey

State and Federal Government

Government Department Decisions / Actions

Communication	Funding / Budgets	Infrastructure and Land Management	Policies / Legislation	Other
0.0% (1)	0.0% (0)	0.0% (1)	0.0% (0)	0.0% (0)

Regulatory Bodies / Associations

Regulatory Bodies & Professional Associations

Accreditation / Licensing	Auditing	Communication	Curriculum of Outdoor Education, Recreation Qualifications	Funding and Budgets	Interactions with Government	Standards and Code of Practice	Other
0.0% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)

Local Area Government, Schools, Parents, Activity Centre Management Planning and Budgeting

Parents / Carers

Communication	Dropping Off / Picking Up Participants	Judgement & Decision-making	Legal Responsibility for Safety of Child	Planning & Preparation for Activity/Trip	Other
1.8% (37)	0.0% (0)	0.3% (7)	0.0% (0)	0.2% (5)	0.1% (2)

Schools

Communication	Dropping Off / Picking Up Participants	Judgement & Decision-making	Legal Responsibility for Safety of Staff & Students	Planning & Preparation for Activity/Trip	Policies / Procedures	Other
0.2% (4)	0.0% (0)	0.0% (0)	0.0% (0)	0.1% (2)	0.0% (0)	0.0% (0)

Local Area Gov't

Auditing	Communication	Funding / Budgets	Legal Responsibility within the Council Area	Policies / Procedures	Other
0.0% (0)	0.0% (1)	0.0% (0)	0.2% (4)	0.1% (3)	0.0% (0)

Higher-level Management

Communication	Financial Constraints	Judgement & Decision-making	Organisational Culture	Policies & Procedures for Activities / Emergencies	Risk Assessment & Management	Staffing & Recruitment	Supervision of Staff	Supervision of Activities / Programs	Training & Evaluation of Staff	Other
0.0% (1)	0.1% (3)	0.0% (0)	0.1% (2)	0.4% (8)	0.6% (12)	0.0% (1)	0.0% (0)	0.0% (1)	0.5% (11)	0.0% (0)

Supervisors / Management

Supervisors / Field Managers

Communication	Compliance with Procedures / Violations / Unsafe Acts	Experience, Qualifications, and/or Competence	Judgement & Decision-making	Mental & Physical Condition	Situation Awareness	Other
0.0% (1)	0.1% (3)	0.0% (0)	0.0% (0)	0.0% (0)	0.1% (2)	0.0% (0)

Decisions and Actions of Leaders, Participants and other Actors at the Scene of the Incident

Other People in Activity Environment (Not Activity Group)

Communication & Following Instructions	Compliance with Procedures / Violations / Unsafe Acts	Experience & Competence	Judgement & Decision-making	Mental & Physical Condition	Planning & Preparation for Activity/Trip	Situation Awareness	Other
0.0% (1)	0.1% (3)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	0.1% (2)	0.0% (0)

Activity Group Factors

Communication within Group	Group Composition	Group Dynamics	Group Size	Late Arrival of Group	Teamwork	Time Pressure	Other
0.5% (11)	0.9% (19)	1.3% (26)	0.2% (4)	0.0% (0)	0.1% (2)	0.1% (2)	0.2% (5)

Other People in Activity Group (Not Participating)

Communication & Following Instructions	Compliance with Procedures / Violations / Unsafe Acts	Experience, Qualifications, and/or Competence	Judgement & Decision-making	Mental & Physical Condition	Planning & Preparation for Activity/Trip	Situation Awareness	Supervision of Activity	Other
0.2% (4)	0.2% (4)	0.3% (6)	0.2% (4)	0.2% (4)	0.0% (1)	0.4% (8)	0.2% (5)	0.0% (0)

Activity Leader

Communication, Instruction/ Demonstration	Compliance with Procedures	Experience, Qualifications, and/or Competence	Judgement & Decision-making	Mental & Physical Condition	Planning & Preparation for Activity or Trip	Situation Awareness	Supervision & Leadership of Activity	Other
3.3% (67)	0.8% (17)	0.6% (13)	2.3% (46)	0.4% (9)	0.7% (14)	0.9% (19)	3.2% (66)	0.2% (5)

Activity Participant

Communication & Following Instructions	Compliance with Procedures / Violations / Unsafe Acts	Experience & Competence	Judgement & Decision-making	Mental & Physical Condition	Planning & Preparation for Activity/Trip	Situation Awareness	Other
7.2% (147)	4.2% (86)	14.0% (286)	11.6% (236)	22.6% (461)	1.2% (25)	10.3% (210)	3.3% (67)

Equipment, Environment and Meteorological Conditions

Activity Equipment & Resources

Documentation	Equipment, Clothing & Personal Protective Equipment	Food & Drink	Medication	Other
2.0% (40)	17.3% (352)	4.1% (84)	1.1% (23)	0.2% (4)

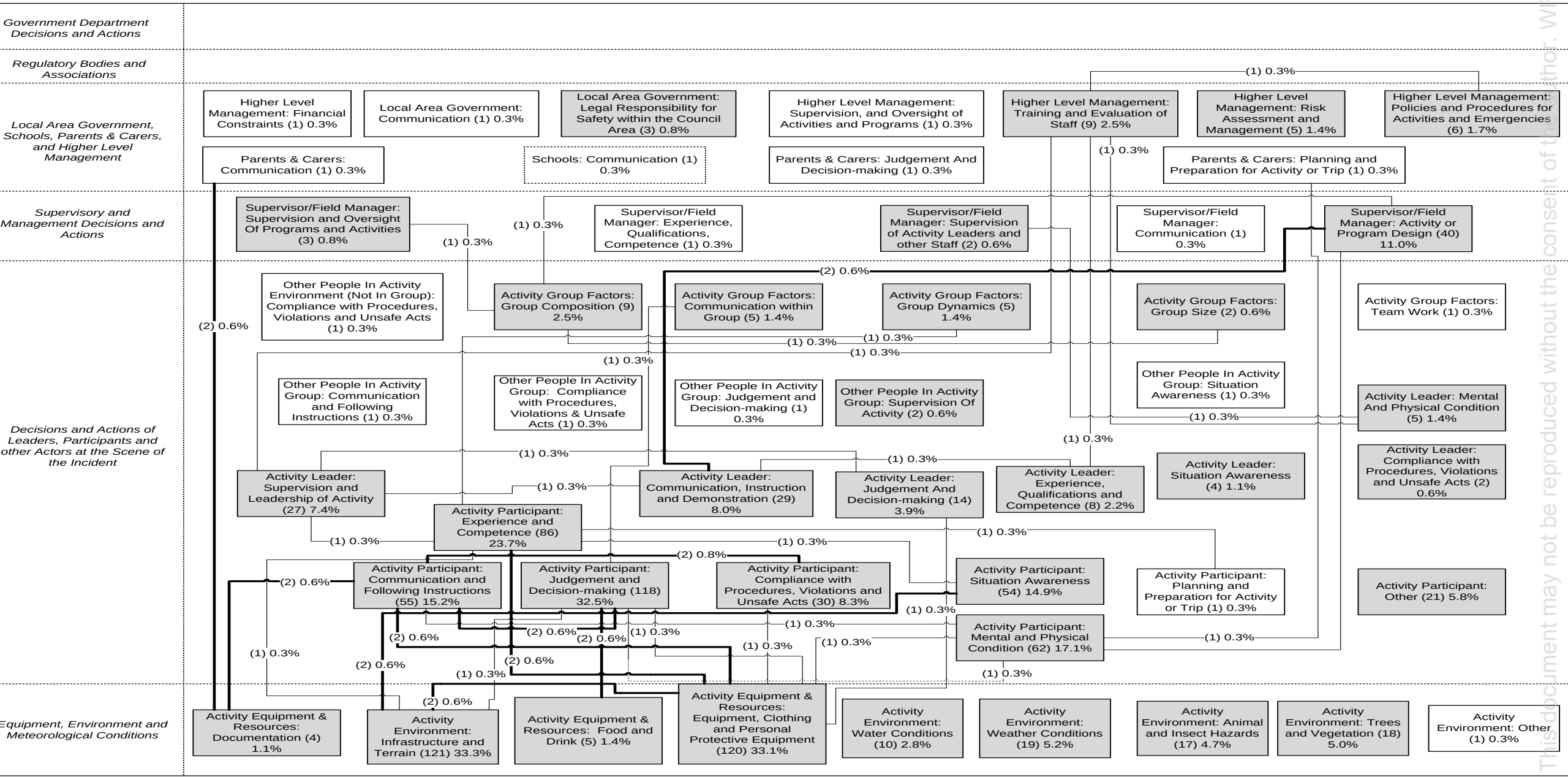
Activity Environment

Animal & Insect Hazards	Infrastructure & Terrain	Trees & Vegetation	Water Conditions	Weather Conditions	Other
4.4% (89)	16.5% (336)	3.6% (74)	2.1% (42)	5.3% (107)	0.1% (3)

Most frequent factors overall are shaded in red

State and Federal Government	Government Department Decisions / Actions	Communication 0.0% (1)	Funding / Budgets 0.0% (0)	Infrastructure and Land Management 0.0% (1)	Policies / Legislation 0.0% (0)	Other 0.0% (0)						
Regulatory Bodies / Associations	Regulatory Bodies & Professional Associations	Accreditation / Licensing 0.0% (1)	Auditing 0.0% (0)	Communication 0.0% (0)	Curriculum of Outdoor Education, Recreation Qualifications 0.0% (0)	Funding and Budgets 0.0% (0)	Interactions with Government 0.0% (0)	Standards and Code of Practice 0.0% (0)	Other 0.0% (0)			
Local Area Government, Schools, Parents, Activity Centre Management Planning and Budgeting	Parents / Carers	Communication 1.8% (37)	Dropping Off / Picking Up Participants 0.0% (0)	Judgement & Decision-making 0.3% (7)	Legal Responsibility for Safety of Child 0.0% (0)	Planning & Preparation for Activity/Trip 0.2% (5)	Other 0.1% (2)					
	Schools	Communication 0.2% (4)	Dropping Off / Picking Up Participants 0.0% (0)	Judgement & Decision-making 0.0% (0)	Legal Responsibility for Safety of Staff & Students 0.0% (0)	Planning & Preparation for Activity/Trip 0.1% (2)	Policies / Procedures 0.0% (0)	Other 0.0% (0)				
	Local Area Gov't	Auditing 0.0% (0)	Communication 0.0% (1)	Funding / Budgets 0.0% (0)	Legal Responsibility within the Council Area 0.2% (4)	Policies / Procedures 0.1% (3)	Other 0.0% (0)					
	Higher-level Management	Communication 0.0% (1)	Financial Constraints 0.1% (3)	Judgement & Decision-making 0.0% (0)	Organisational Culture 0.1% (2)	Policies & Procedures for Activities / Emergencies 0.4% (8)	Risk Assessment & Management 0.6% (12)	Staffing & Recruitment 0.0% (1)	Supervision of Staff 0.0% (0)	Supervision of Activities / Programs 0.0% (1)	Training & Evaluation of Staff 0.5% (11)	Other 0.0% (0)
Supervisors / Management	Supervisors / Field Managers	Communication 0.0% (1)	Compliance with Procedures / Violations / Unsafe Acts 0.1% (3)	Experience, Qualifications, and/or Competence 0.0% (0)	Judgement & Decision-making 0.0% (0)	Mental & Physical Condition 0.0% (0)	Situation Awareness 0.1% (2)	Other 0.0% (0)				
Decisions and Actions of Leaders, Participants and other Actors at the Scene of the Incident	Other People in Activity Environment (not Activity Group)	Communication & Following Instructions 0.0% (1)	Compliance with Procedures / Violations / Unsafe Acts 0.1% (3)	Experience & Competence 0.0% (0)	Judgement & Decision-making 0.0% (0)	Mental & Physical Condition 0.0% (0)	Planning & Preparation for Activity/Trip 0.0% (0)	Situation Awareness 0.1% (2)	Other 0.0% (0)			
	Activity Group Factors	Communication within Group 0.5% (11)	Group Composition 0.9% (19)	Group Dynamics 1.3% (26)	Group Size 0.2% (4)	Late Arrival of Group 0.0% (0)	Teamwork 0.1% (2)	Time Pressure 0.1% (2)	Other 0.2% (5)			
	Other People in Activity Group (not Participating)	Communication & Following Instructions 0.2% (4)	Compliance with Procedures / Violations / Unsafe Acts 0.2% (4)	Experience, Qualifications, and/or Competence 0.3% (6)	Judgement & Decision-making 0.2% (4)	Mental & Physical Condition 0.2% (4)	Planning & Preparation for Activity/Trip 0.0% (1)	Situation Awareness 0.4% (8)	Supervision of Activity 0.2% (5)	Other 0.0% (0)		
	Activity Leader	Communication, Instruction/ Demonstration 3.3% (67)	Compliance with Procedures 0.8% (17)	Experience, Qualifications, and/or Competence 0.6% (13)	Judgement & Decision-making 2.3% (46)	Mental & Physical Condition 0.4% (9)	Planning & Preparation for Activity or Trip 0.7% (14)	Situation Awareness 0.9% (19)	Supervision & Leadership of Activity 3.2% (66)	Other 0.2% (5)		
	Activity Participant	Communication & Following Instructions 7.2% (147)	Compliance with Procedures / Violations / Unsafe Acts 4.2% (86)	Experience & Competence 14.0% (286)	Judgement & Decision-making 11.6% (236)	Mental & Physical Condition 22.6% (461)	Planning & Preparation for Activity/Trip 1.2% (25)	Situation Awareness 10.3% (210)	Other 3.3% (67)			
Equipment, Environment and Meteorological Conditions	Activity Equipment & Resources	Documentation 2.0% (40)	Equipment, Clothing & Personal Protective Equipment 17.3% (352)	Food & Drink 4.1% (84)	Medication 1.1% (23)	Other 0.2% (4)						
	Activity Environment	Animal & Insect Hazards 4.4% (89)	Infrastructure & Terrain 16.5% (336)	Trees & Vegetation 3.6% (74)	Water Conditions 2.1% (42)	Weather Conditions 5.3% (107)	Other 0.1% (3)					

Contributory factors 2015/2016 - Injury-causing incidents (*n=363*)



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

UPLOADS 2

- 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

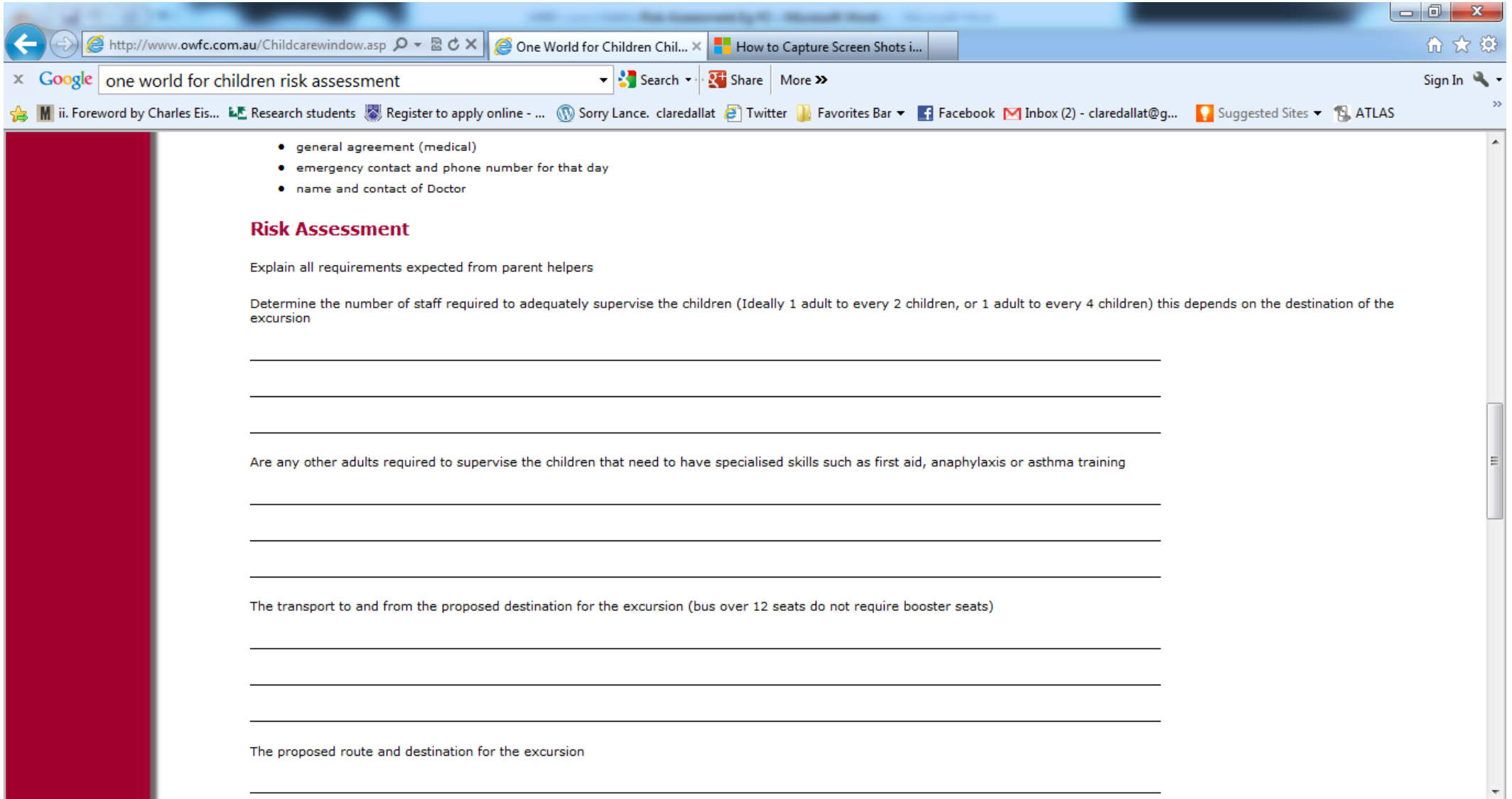
- Inadequate risk assessment highlighted as contributing factor in injuries and deaths on led outdoor activities (LOA)

- 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



- general agreement (medical)
- emergency contact and phone number for that day
- name and contact of Doctor

Risk Assessment

Explain all requirements expected from parent helpers

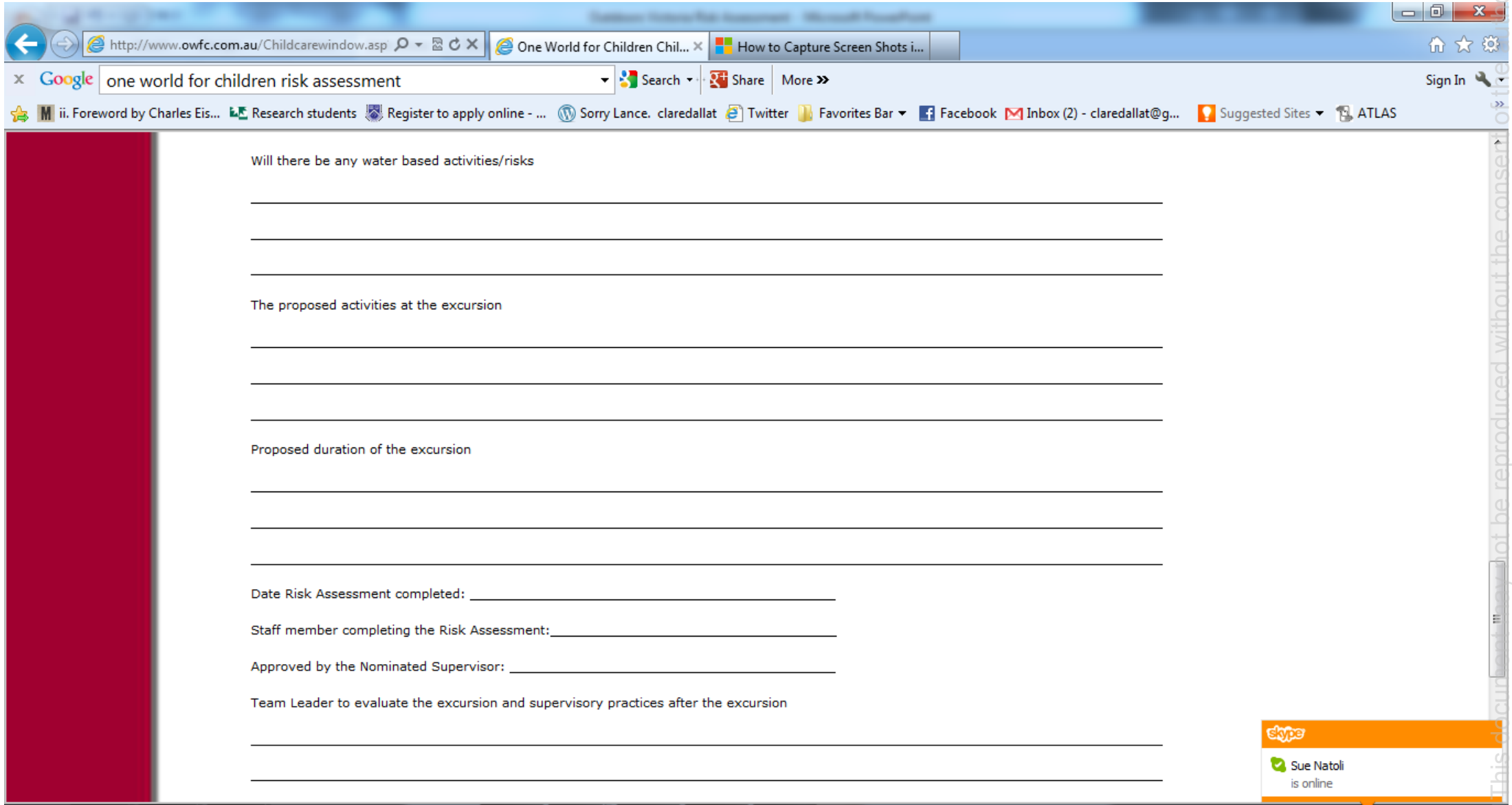
Determine the number of staff required to adequately supervise the children (Ideally 1 adult to every 2 children, or 1 adult to every 4 children) this depends on the destination of the excursion

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

The transport to and from the proposed destination for the excursion (bus over 12 seats do not require booster seats)

The proposed route and destination for the excursion

EXAMPLE 1 CONT'D.



Will there be any water based activities/risks

The proposed activities at the excursion

Proposed duration of the excursion

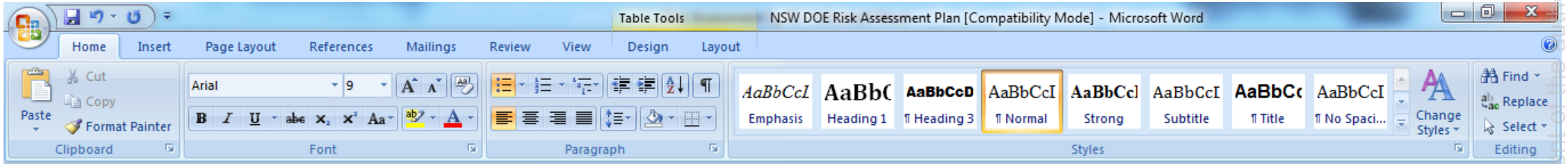
Date Risk Assessment completed: _____

Staff member completing the Risk Assessment:_____

Approved by the Nominated Supervisor: _____

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

EXAMPLE 2



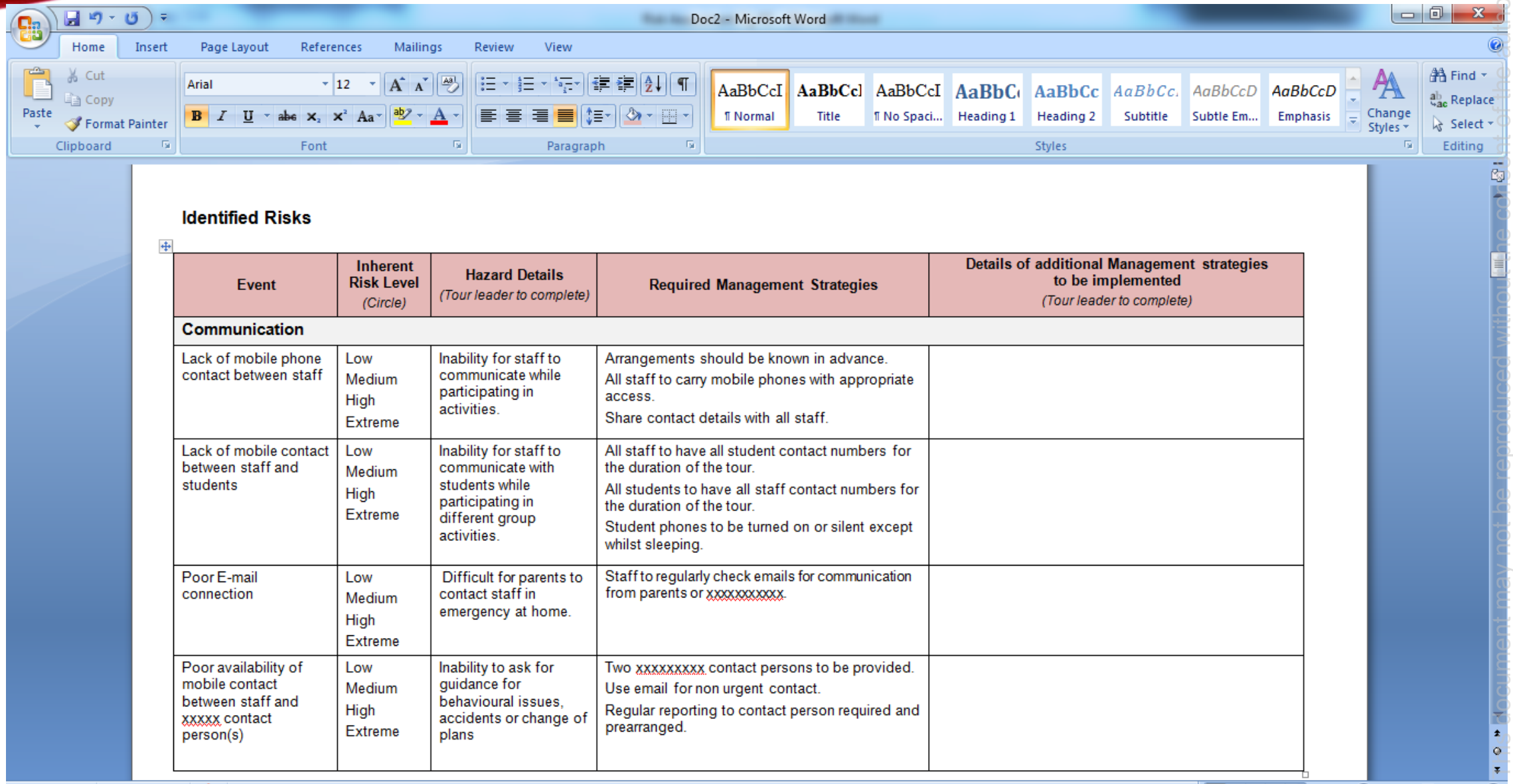
Sample Risk Management Plan: Excursion

Name of school: Excursion Plus High School
Name of principal: J Citizen
Description and location of excursion: Bushwalk in National Park
Date of excursion: 18 October
Group/class: 6S and 6G

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

Task/Activity	Hazard Identification & Associated Risk Type/Cause	Assess Risk* use matrix	Elimination or Control Measures	Who	When
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 3 3 5	- 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/treatment is 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 Supervisors " All " Teachers " Excursion Coordinator Teachers " " "	Prior to walk On walk Prior to walk

EXAMPLE 3



Identified Risks

Event	Inherent Risk Level *(Circle)*	Hazard Details *(Tour leader to complete)*	Required Management Strategies	Details of additional Management strategies to be implemented *(Tour leader to complete)*
Communication				
Lack of mobile phone contact between staff	Low Medium High Extreme	Inability for staff to communicate while participating in activities.	Arrangements should be known in advance. All staff to carry mobile phones with appropriate access. Share contact details with all staff.	
Lack of mobile contact between staff and students	Low Medium High Extreme	Inability for staff to communicate with students while participating in different group activities.	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.	
Poor E-mail connection	Low Medium High Extreme	Difficult for parents to contact staff in emergency at home.	Staff to regularly check emails for communication from parents or xxxxxxxxxx.	
Poor availability of mobile contact between staff and xxxxx contact person(s)	Low Medium High Extreme	Inability to ask for guidance for behavioural issues, accidents or change of plans	Two xxxxxxxxx contact persons to be provided. Use email for non urgent contact. Regular reporting to contact person required and prearranged.	

RISK ASSESSMENT USING A SYSTEMS APPROACH

Outcome: Hazards across the **entire** system would be identified, and consequent risks to participant (s) harm assessed and managed.

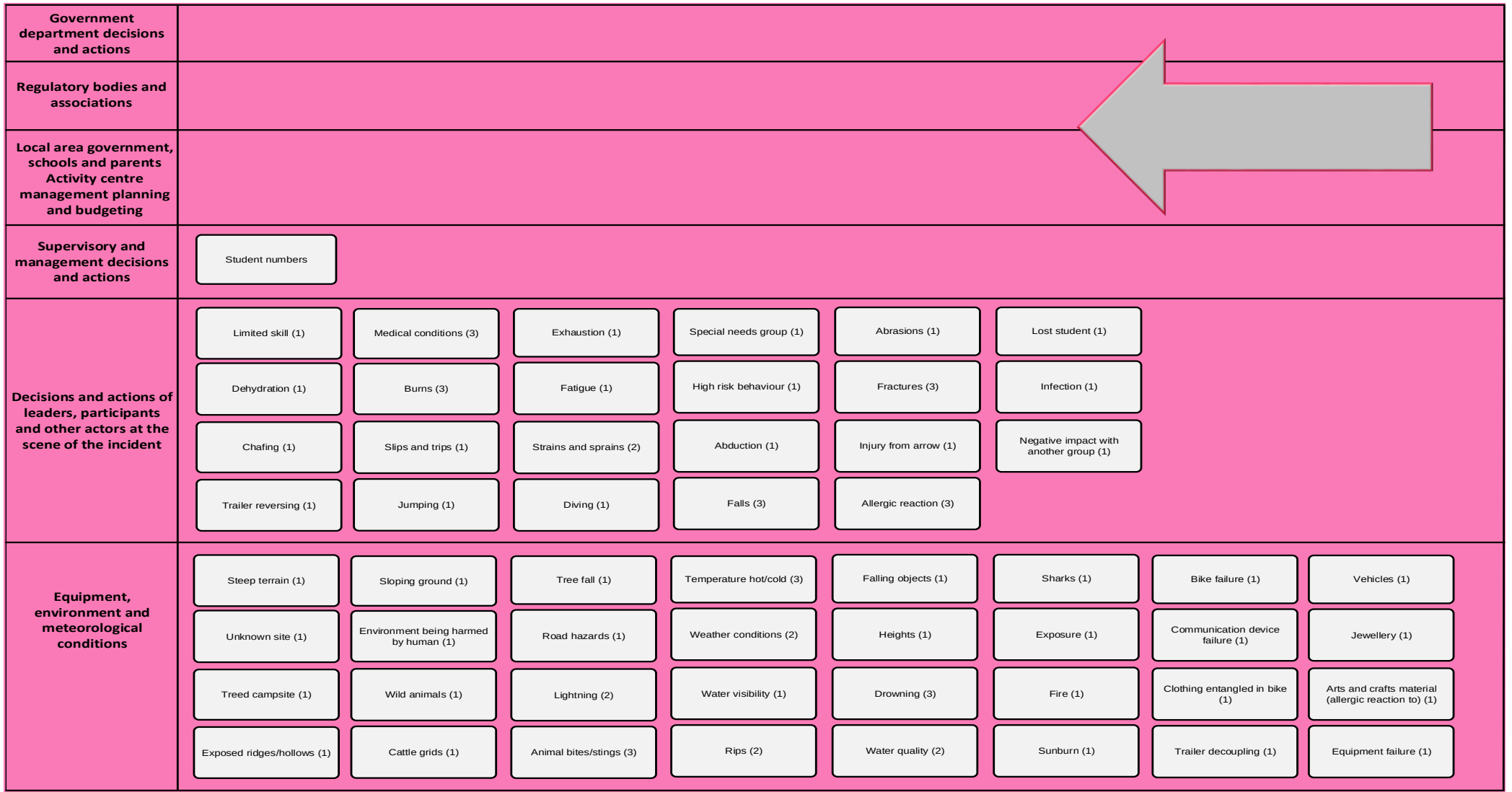
STUDY 1 – HOW ARE WE CONDUCTING RISK ASSESSMENTS?

- 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



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

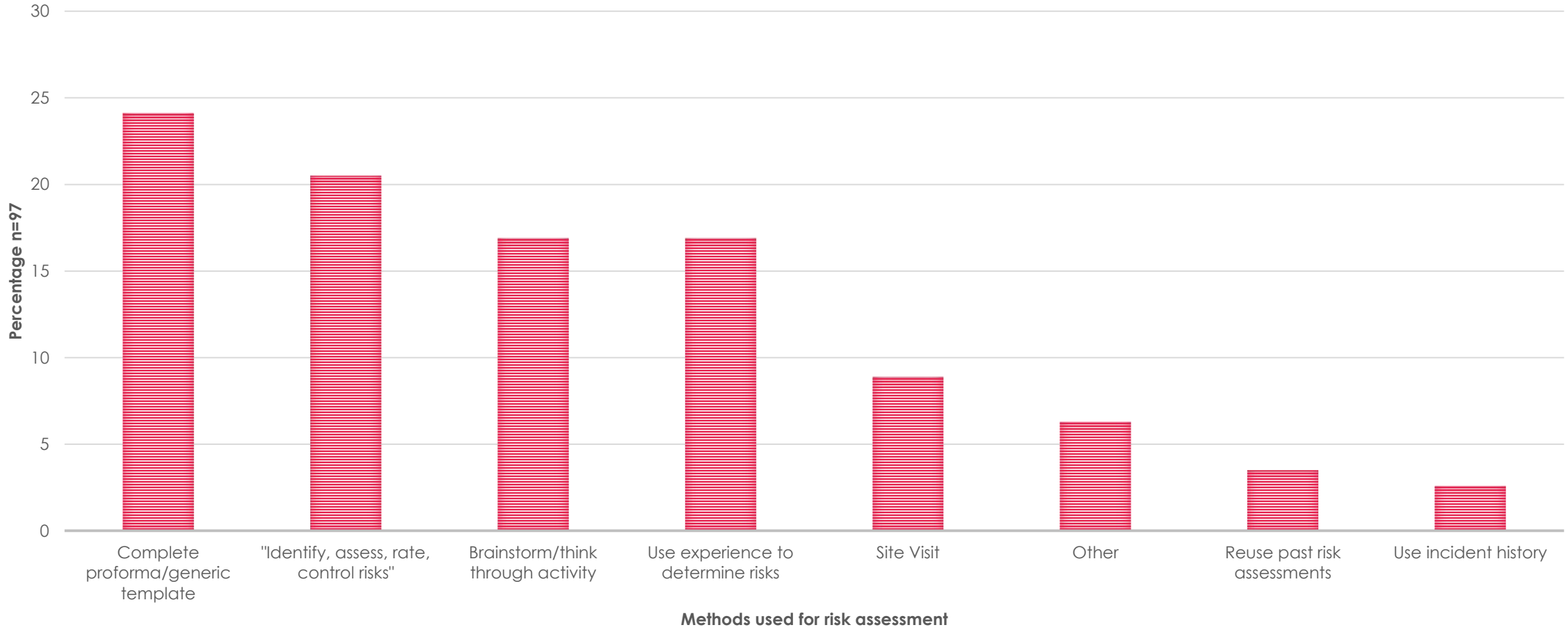
FINDINGS

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?

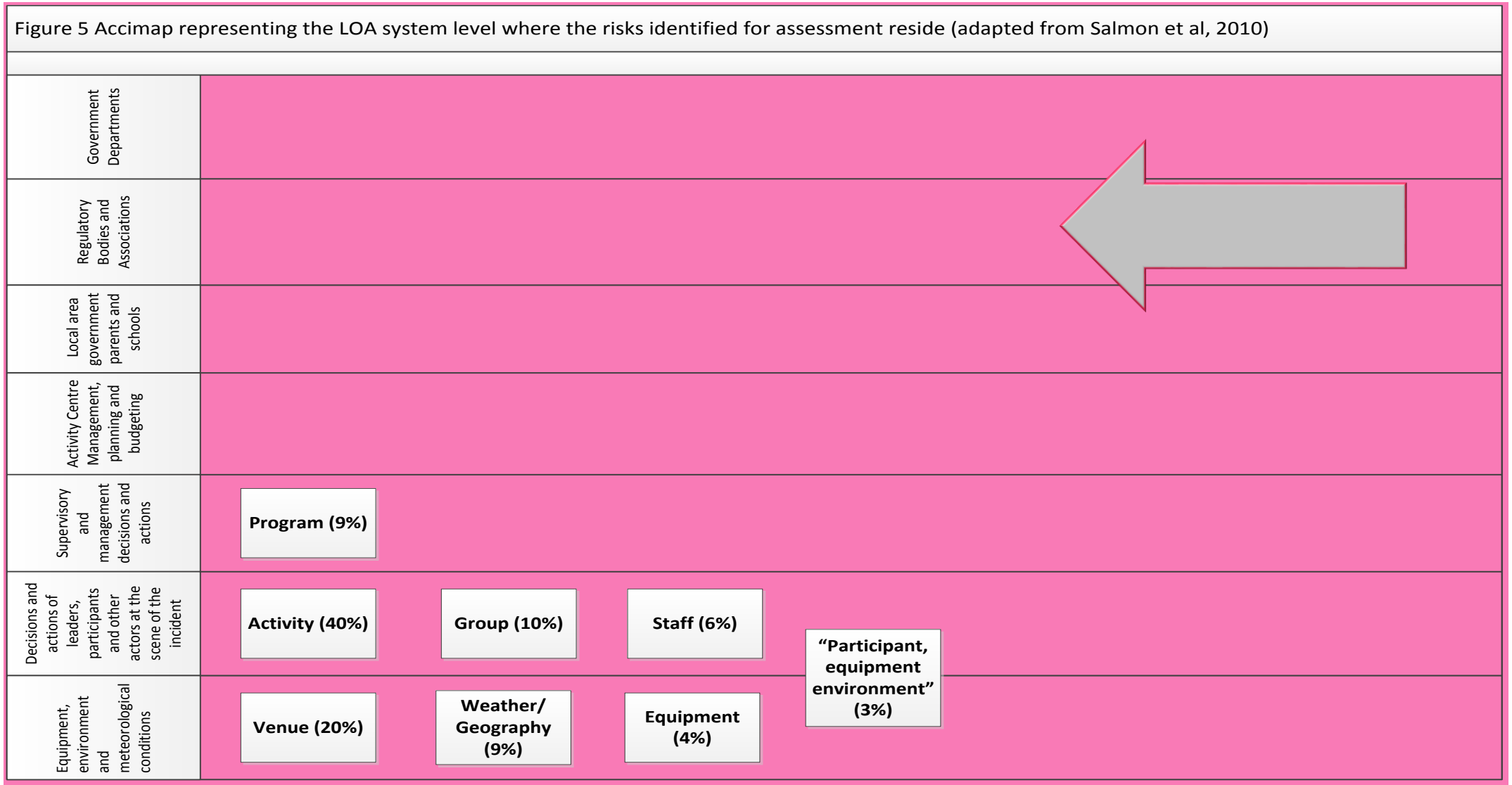
- **Yes – 79%**
- No – 21%

RISK ASSESSMENT METHODS



WHAT RISKS ARE YOU ASSESSING?

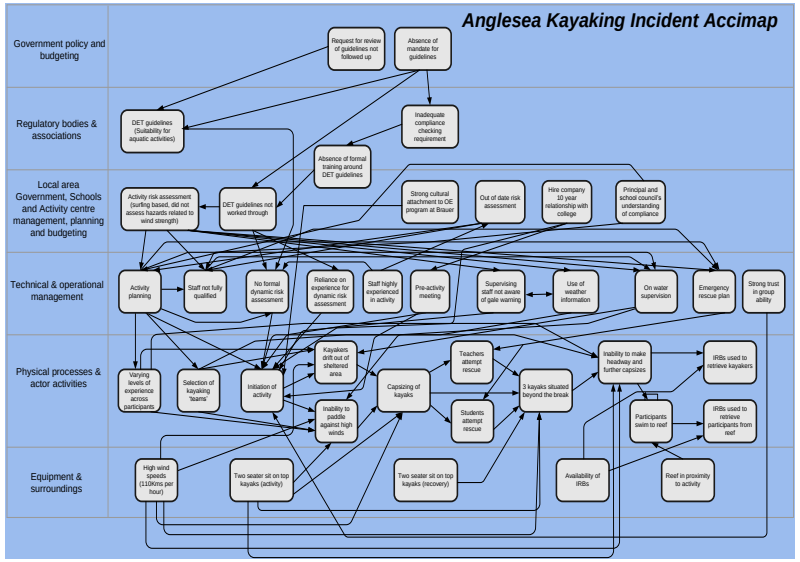
Figure 5 Accimap representing the LOA system level where the risks identified for assessment reside (adapted from Salmon et al, 2010)

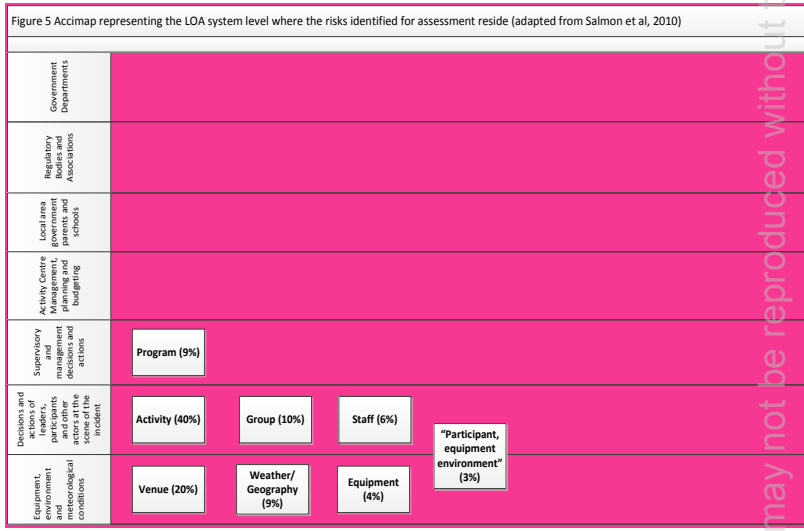


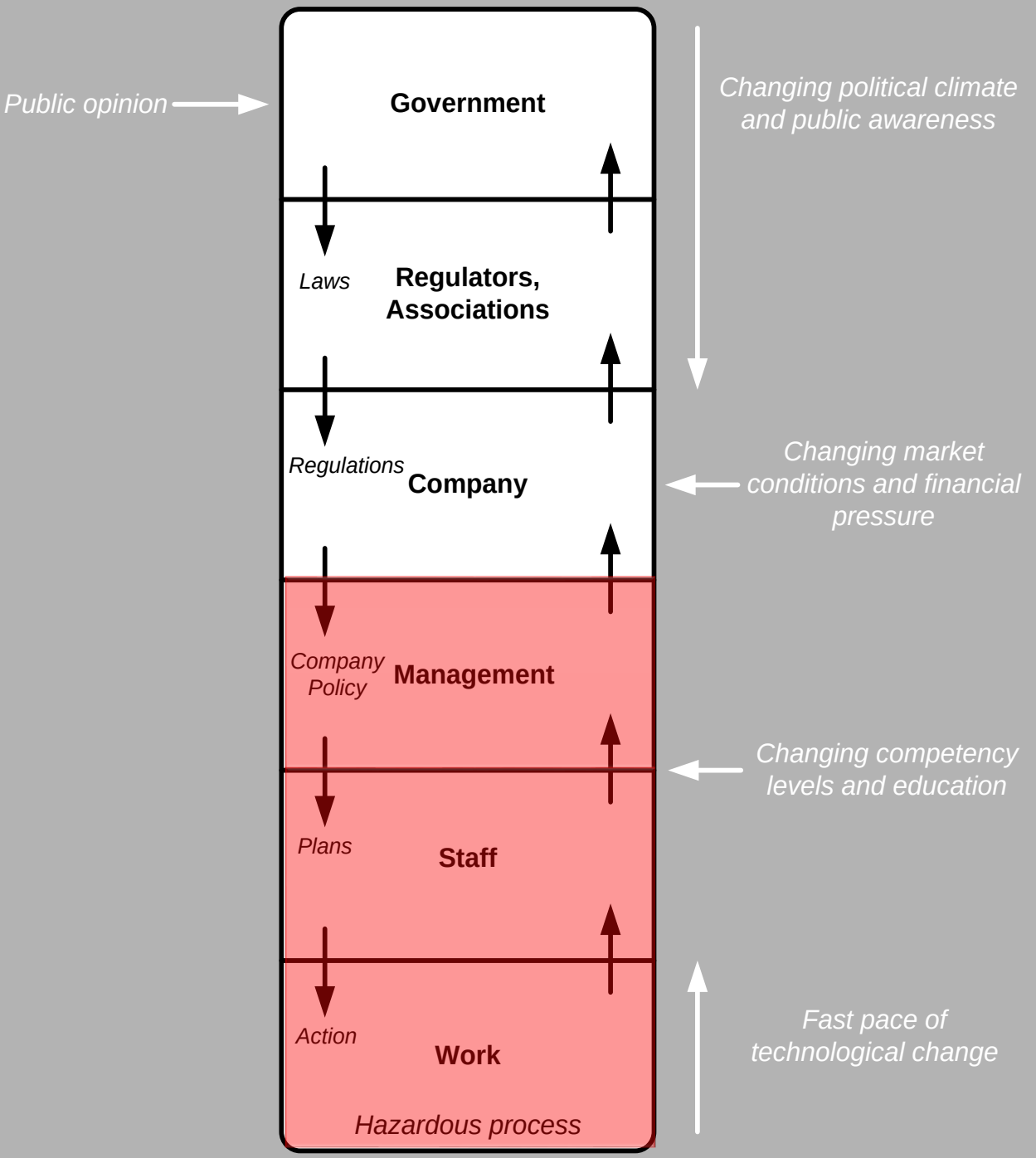
KEY FINDINGS

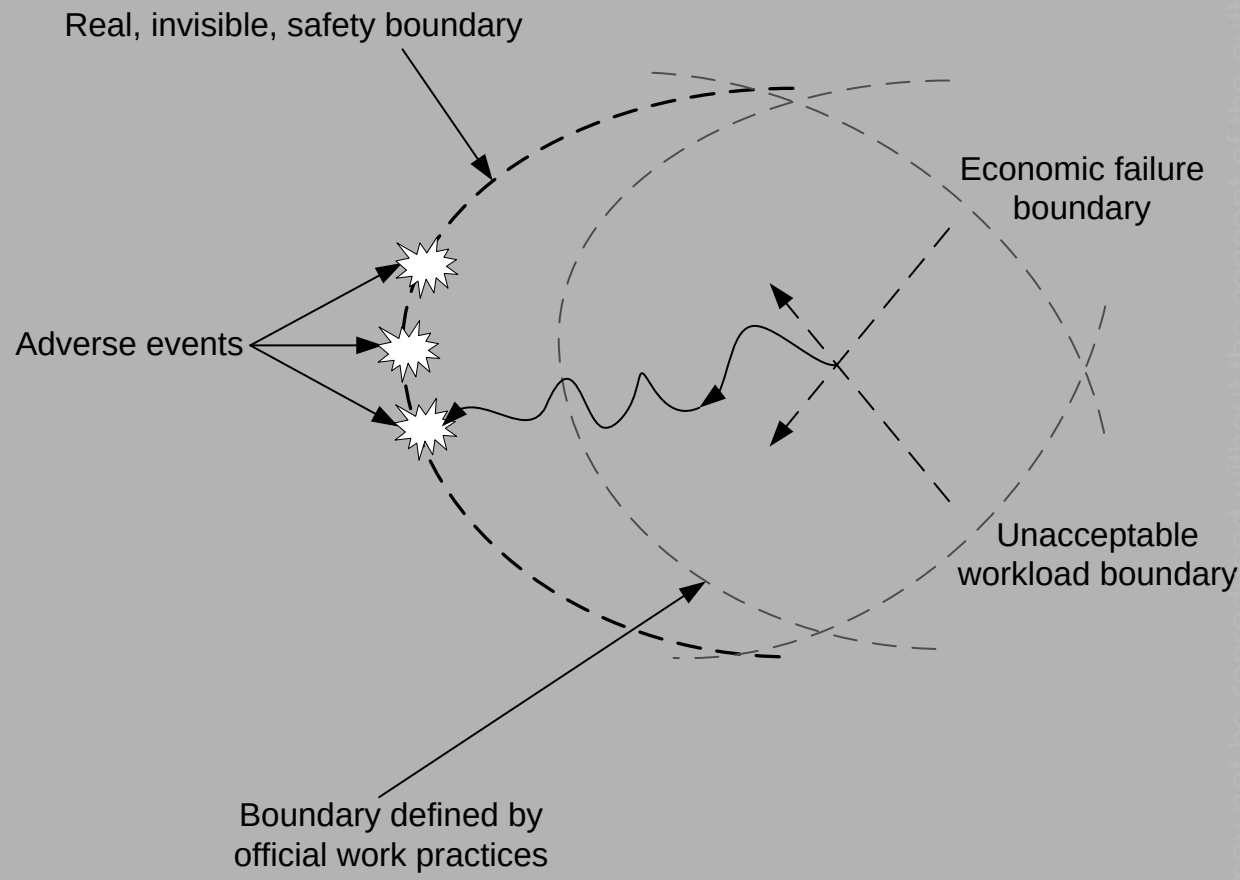
- Accident causation research demonstrates that factors also related to schools/centers/orgs, organization management, parents, activity leader supervision, risk assessment, and program design.
- 57% of respondents learned organisational risk assessment ‘on the job’;
- 35% use brainstorming or thinking 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.






Public opinion
Government
Changing political climate and public awareness
Laws
Regulators, Associations
Regulations
Company
Changing market conditions and financial pressure
Company Policy
Management
Changing competency levels and education
Plans
Staff
Action
Work
Hazardous process
Fast pace of technological change


Real, invisible, safety boundary
Economic failure boundary
Adverse events
Unacceptable workload boundary
Boundary defined by official work practices

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

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Identifying risks and emergent risks across sociotechnical systems: the NETworked hazard analysis and risk management system (NET-HARMS)

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ABSTRACT

Accidents are a systems phenomenon and multiple methods are available to enable retrospective analysis of accidents through this lens. However, the same cannot be said for the methods available for forecasting risk and accidents. This paper describes a new systems-based risk assessment method, the NETworked hazard analysis and risk management system (NET-HARMS), that was designed to support practitioners in identifying (1) risks across overall work systems, and (2) emergent risks that are created when risks across the system interact with one another. An overview of NET-HARMS is provided and demonstrated through a case study application. An initial test of the method is provided by comparing case study outcomes (i.e. predicted risks) with accident data (i.e. actual risks) from the domain in question. Findings show that NET-HARMS is capable of forecasting systemic and emergent risks and that it could identify almost all risks that featured in the accidents in the comparison data-set.

ARTICLE HISTORY
Received 21 May 2017
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KEYWORDS
Systems thinking; risk assessment; emergence; risk decision-making; risk practitioner

Relevance to human factors/ergonomics theory

Methods which both support and enable application of a systems theoretical perspective to risk assessment are extremely limited. This paper outlines the development of a risk assessment method both underpinned by systems thinking and that was consciously designed to facilitate ease of use and application by the risk management practitioner.

Introduction

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

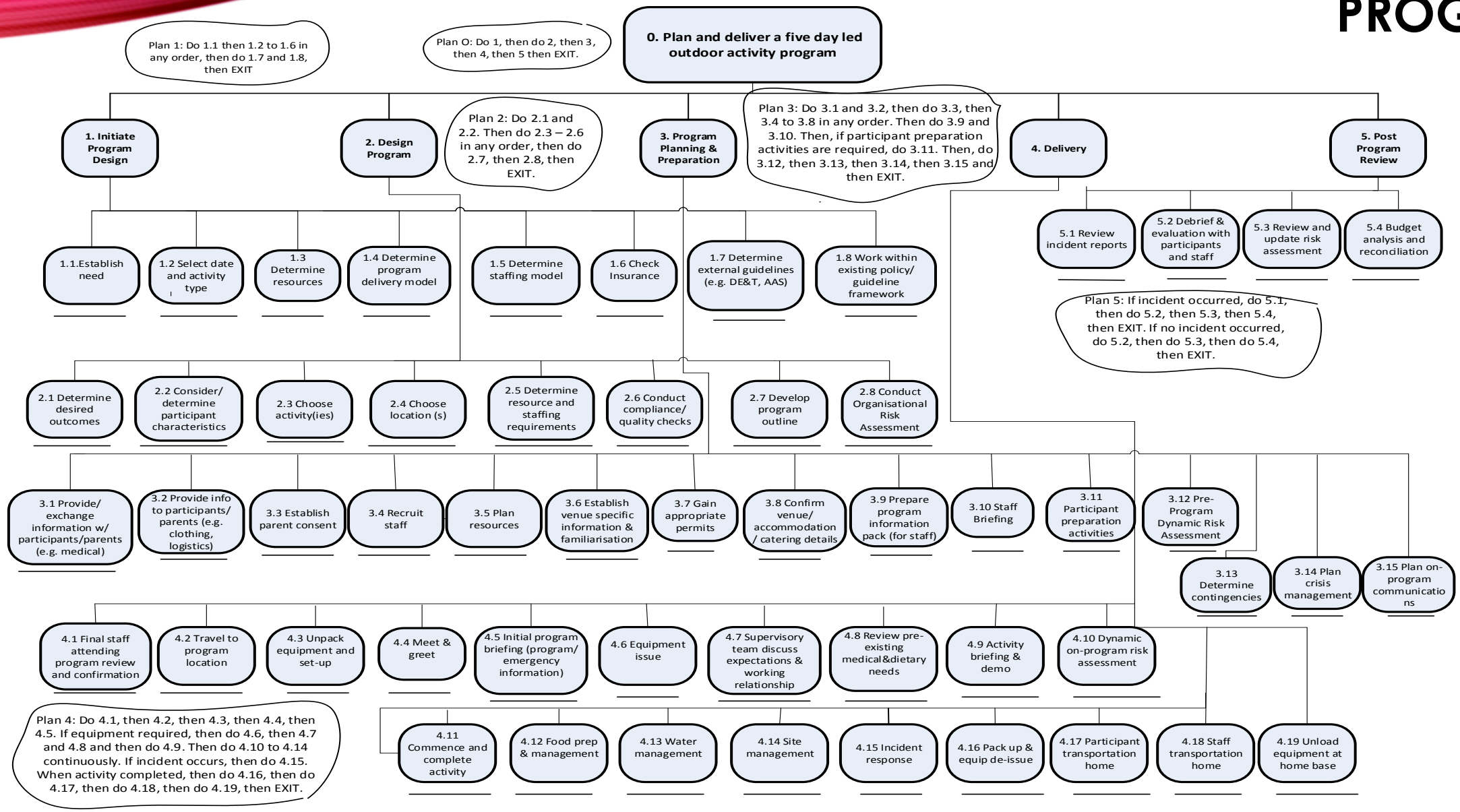
- Organisational RA Tool
- Can predict emergent risks (the risks that arise when risks interact with each other).
- Used by teachers/planners
- Planning tool ('Proceed or Not')
- WHS Compliant
- Time efficient
- Range of experience levels

- Incorporate existing RA's
- Identify new hazards/risks
- Identify range of controls
- Could be data-based
- All activity types
- Low cost
- Multiple end users

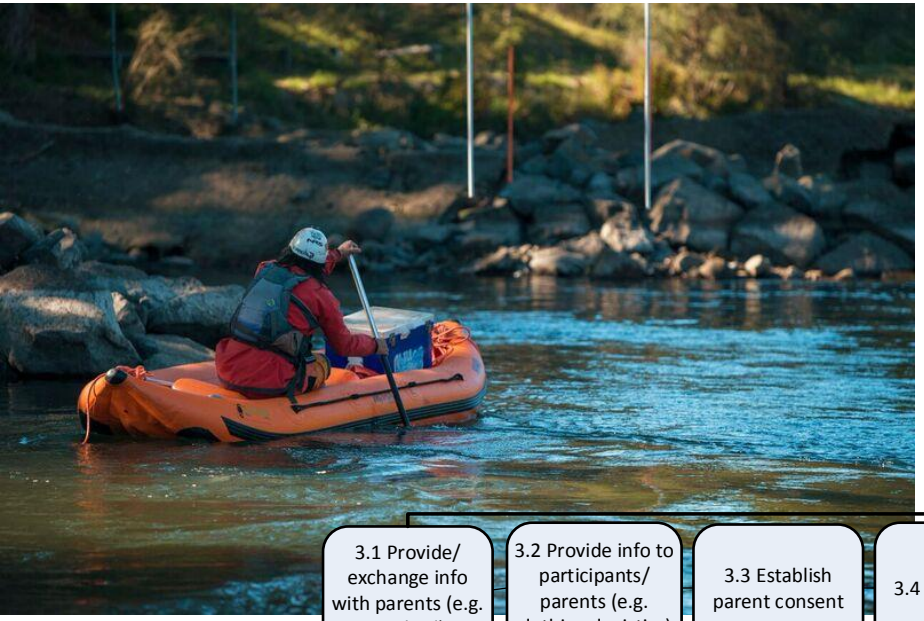
STEP 1 - HIERARCHICAL TASK ANALYSIS

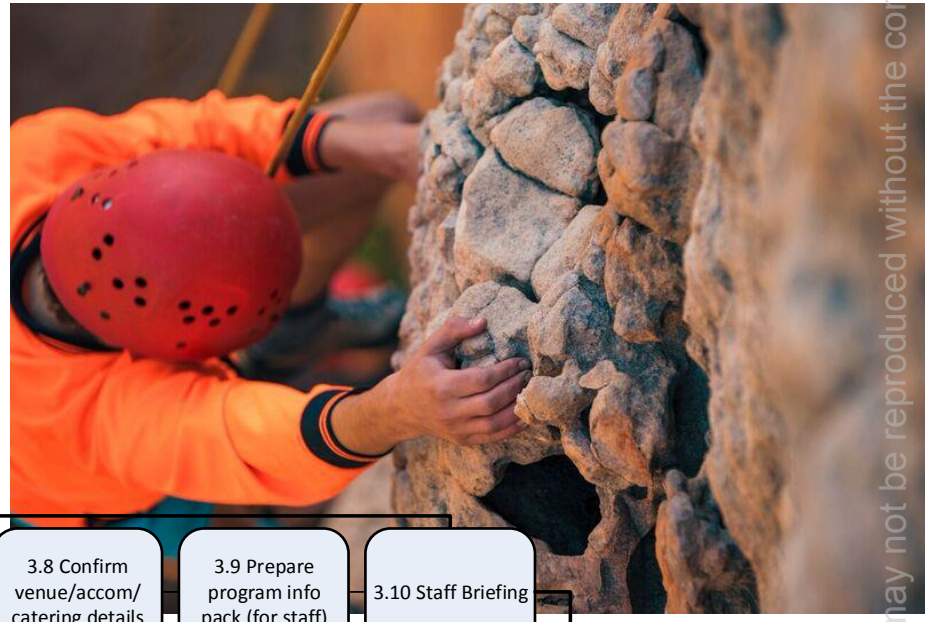
- Used to anchor identification and assessment of system risks
- A methodology for describing the goals, tasks, operations and plans associated with work systems (Stanton, 2006).
- A useful way of looking at how people interact with equipment and with various aspects of their working environment
- By 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



EXCERPT - PROGRAM PLANNING AND PREPARATION



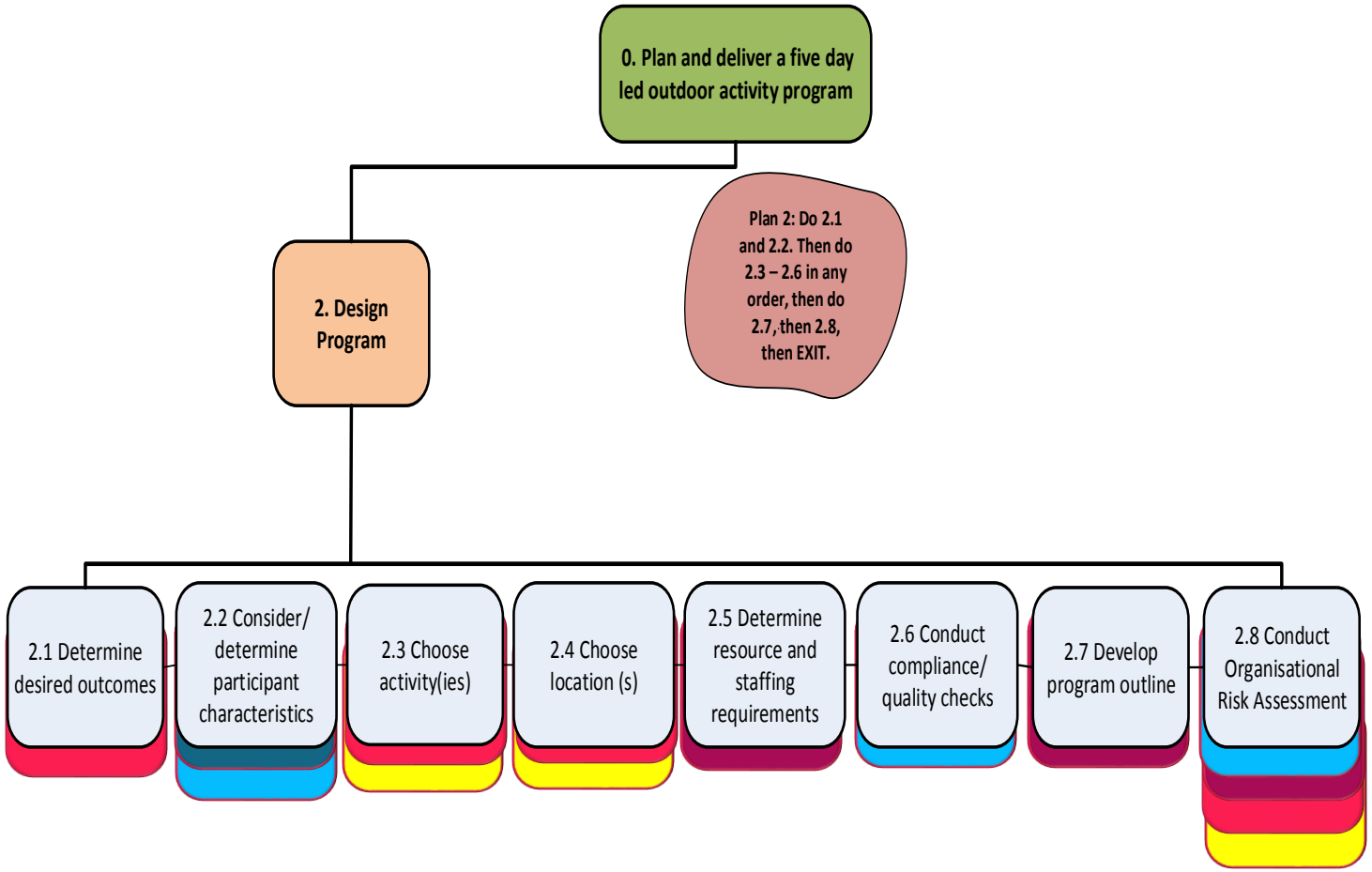


0. Plan and deliver a five day led outdoor activity program

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

EXCERPT - PROGRAM DESIGN



School Coord
Client Mgr
Risk Mgr
Program Mgr
Nurse

STEP 2 – NET-HARMS TAXONOMY

TASK STEP FROM HTA

Behaviour	Risk Modes
Task	T1 – Task mistimed T2 – Task omitted T3 – Task completed inadequately T4 – Inadequate task object T5 – Inappropriate task
Communication	C1 – Information not communicated C2 – Wrong information communicated C3 – Inadequate information communicated C4 – Communication mistimed
Environmental	E1 – Adverse environmental conditions

- Based on SHERPA (Embrey, 1986)
- The taxonomy is the consistent filter through which we identify and assess risks

PREDICTING TASK RISKS – EXAMPLES

HTA Task	Risk mode	Risk description	Risk consequence
1.6 check insurance	T3	Insurance of sub-contractors not checked	inadequate/ no insurance /risk of harm/liability claim
2.3 choose activities	T3	Activities are selected with lack of detail - eg. Distances of day/ rapid ratings etc	Injury from too high challenge level
2.3 choose activities	T5	Coordinator chooses route due to strong personal preference	Group of students lost or injured
3.3 establish parent consent	E1	Room too noisy/ env unsuitable/ too much info/ parents busy/ distracted	Incomplete info. Not fully informed. Not understood. Not full consent.
3.10 Staff Briefing	T1	Staff briefing undertaken late (e.g. on the bus, immediately before program)	Staff member may miss important aspects of briefing relevant to management of risk Staff members do not have time to develop/evaluate appropriate risk controls
3.9. Prepare program information pack (for staff member)	T1	Information pack prepared and delivered too late	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
4.7. Supervisory team discuss expectations and working relationship	T2	Expectations and working relationship not discussed	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) Mismatch in expectations e.g. between provider and school

‘PLAN CRISIS MANAGEMENT’ TASK RISKS

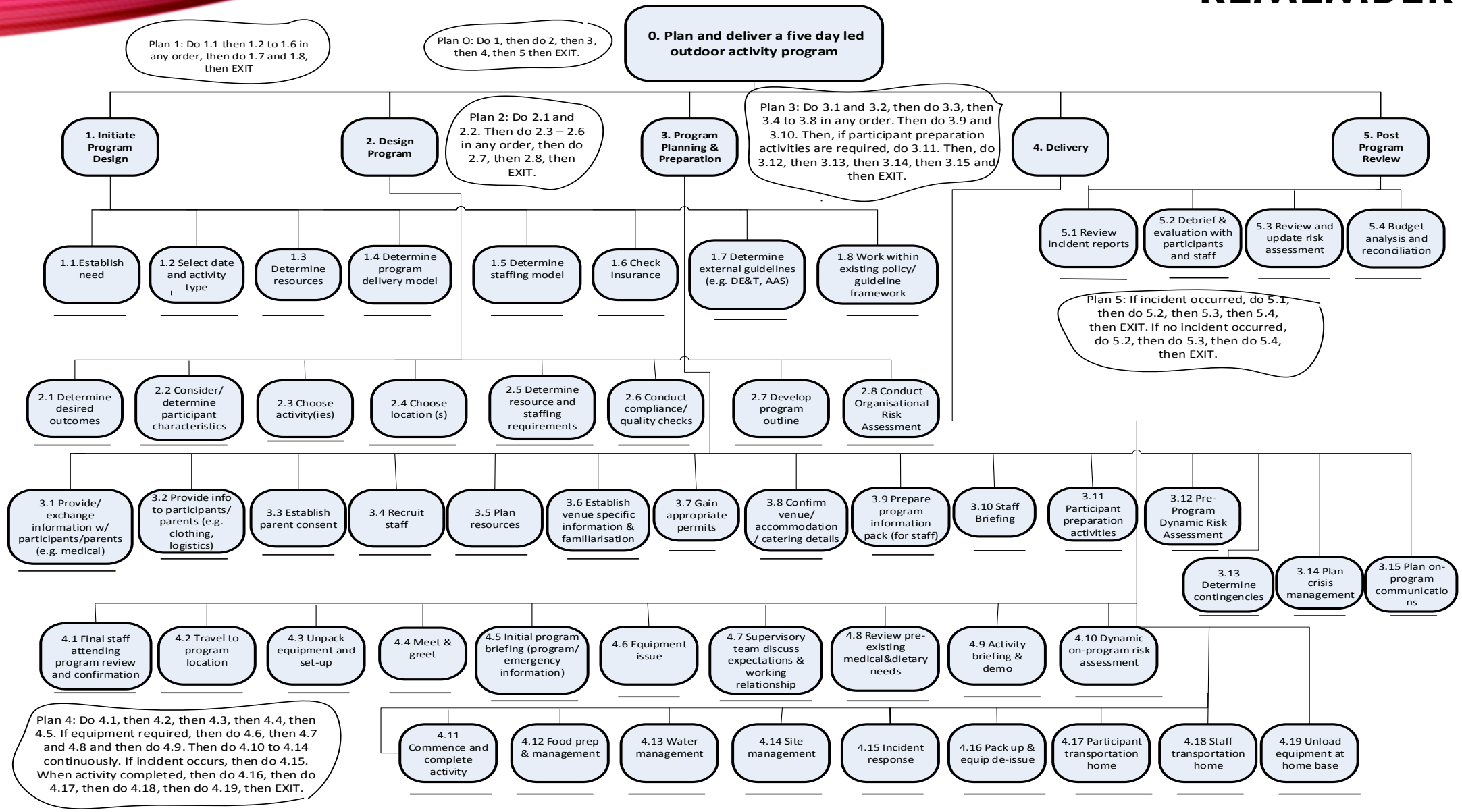
HTA Task	Risk Mode	Task Risk Description	Risk Consequence(s)
3.14. Plan crisis management	T1	Crisis management planning is conducted too late	- Ineffective/inappropriate crisis management plan leading to further risks/harm - Position becomes forced and reactive
	T2	Crisis management planning is not conducted	- 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

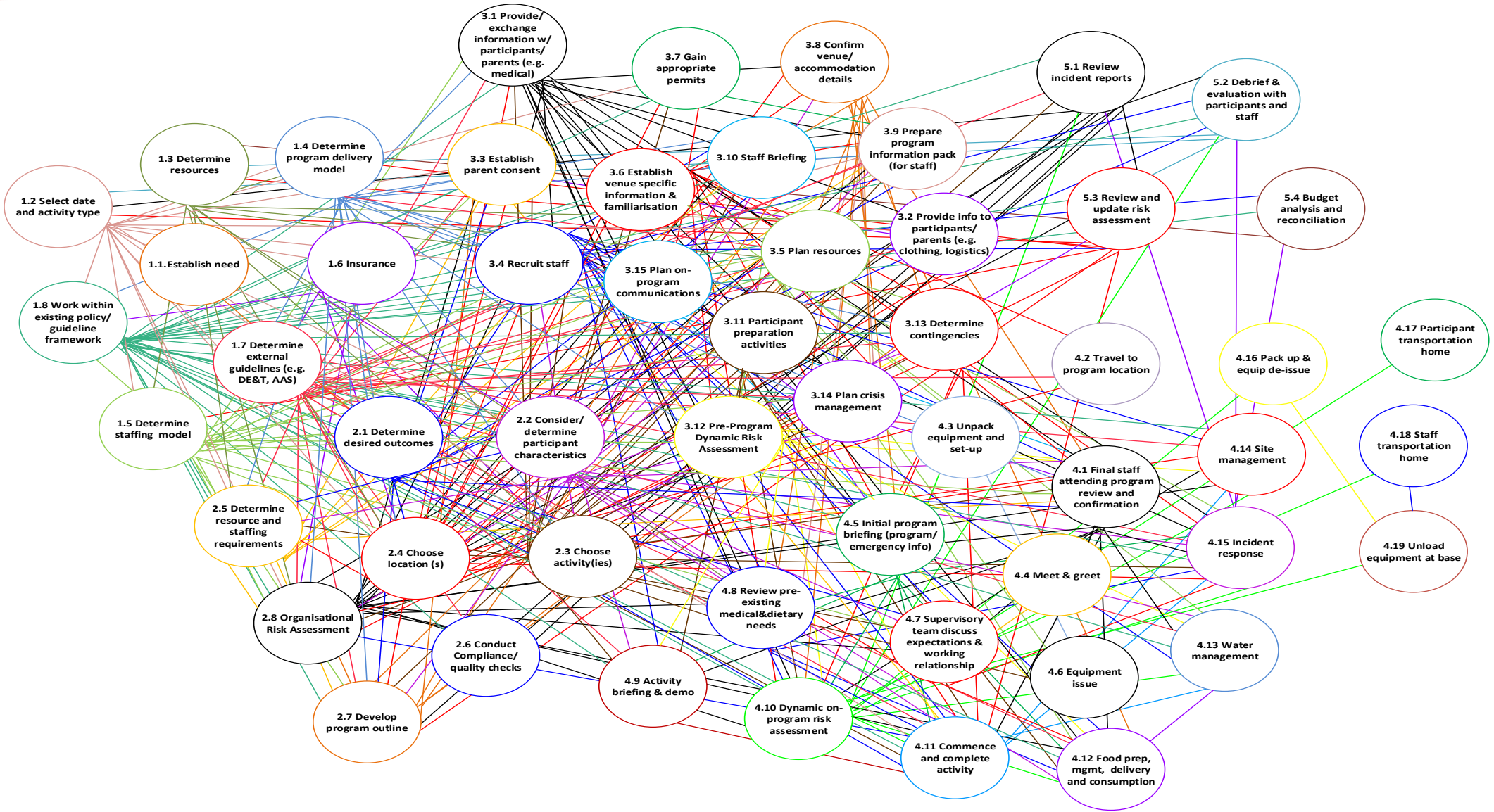
- Remember how a systems approach to accident causation considers that multiple factors and interactions are integral?

- This next step helps us identify and assess the impact of those interactions in a risk prediction context.

REMEMBER THIS?



RELATIONSHIPS BETWEEN TASKS



PREDICTING EMERGENT RISKS

Emergent behaviours are they key to understanding accident causation

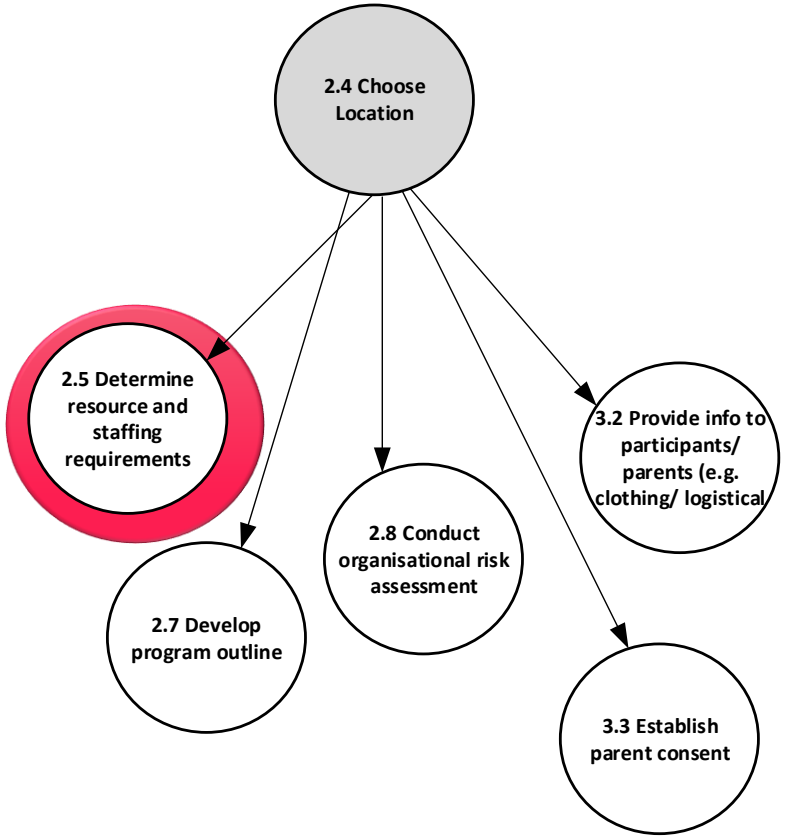
We want to identify what is the likely impact on linked tasks if the initial one is done badly, not at all, too early/too late etc.

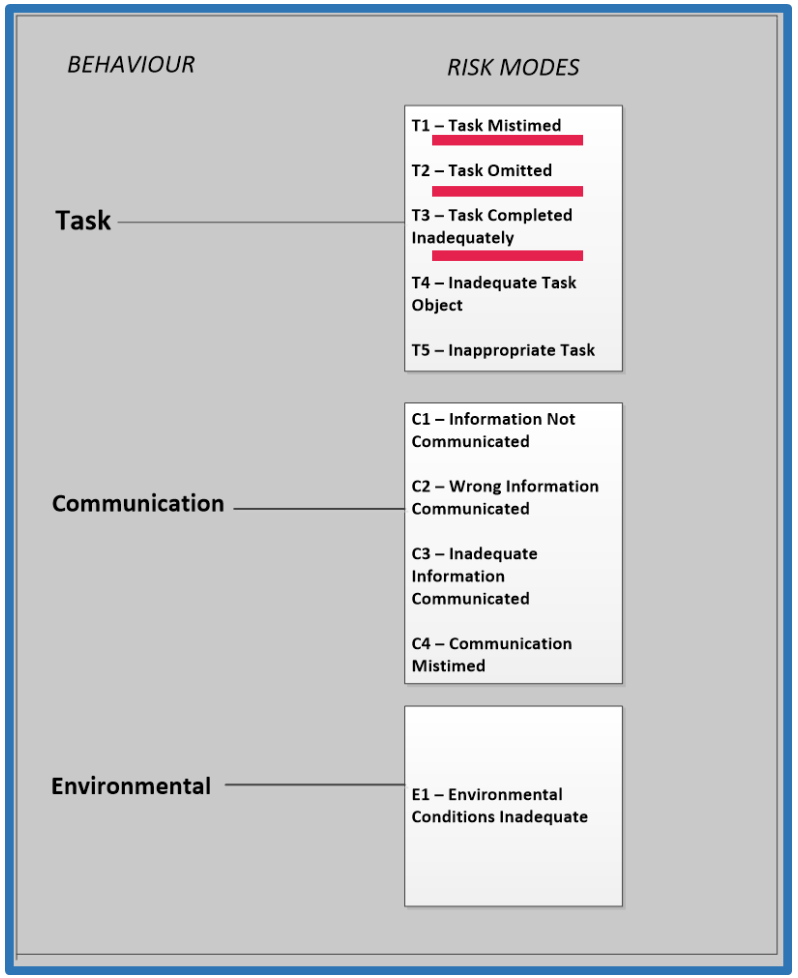
Why is this important?

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

3.4 Choose Location	T2	Location choice is not considered in the design phase	Location choice may not be suitable for the program.





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

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

WHAT DOES THIS TELL US?

Study showed that:

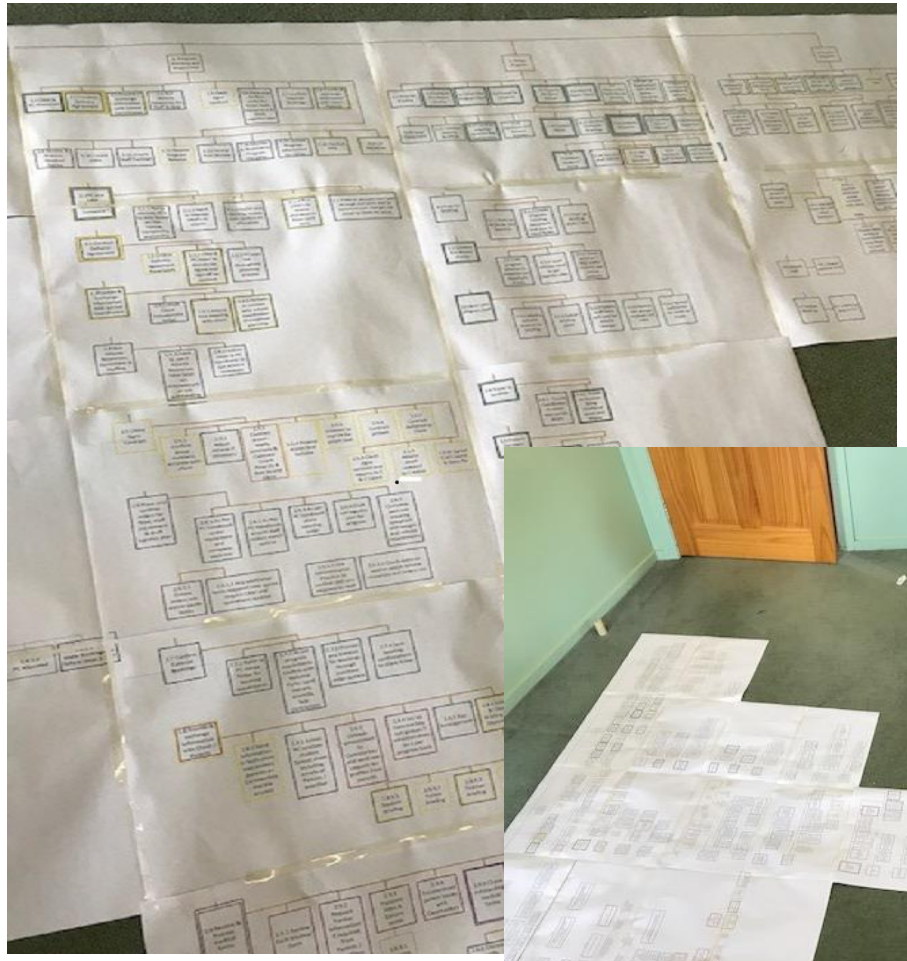
- 141 task risks were predicted in the design, planning and review stages (Sections 1, 2, 3 and 5) of the HTA. Tasks at the program delivery of the program, (Section 4 of the HTA), had 91 predicted task risks.

- 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.

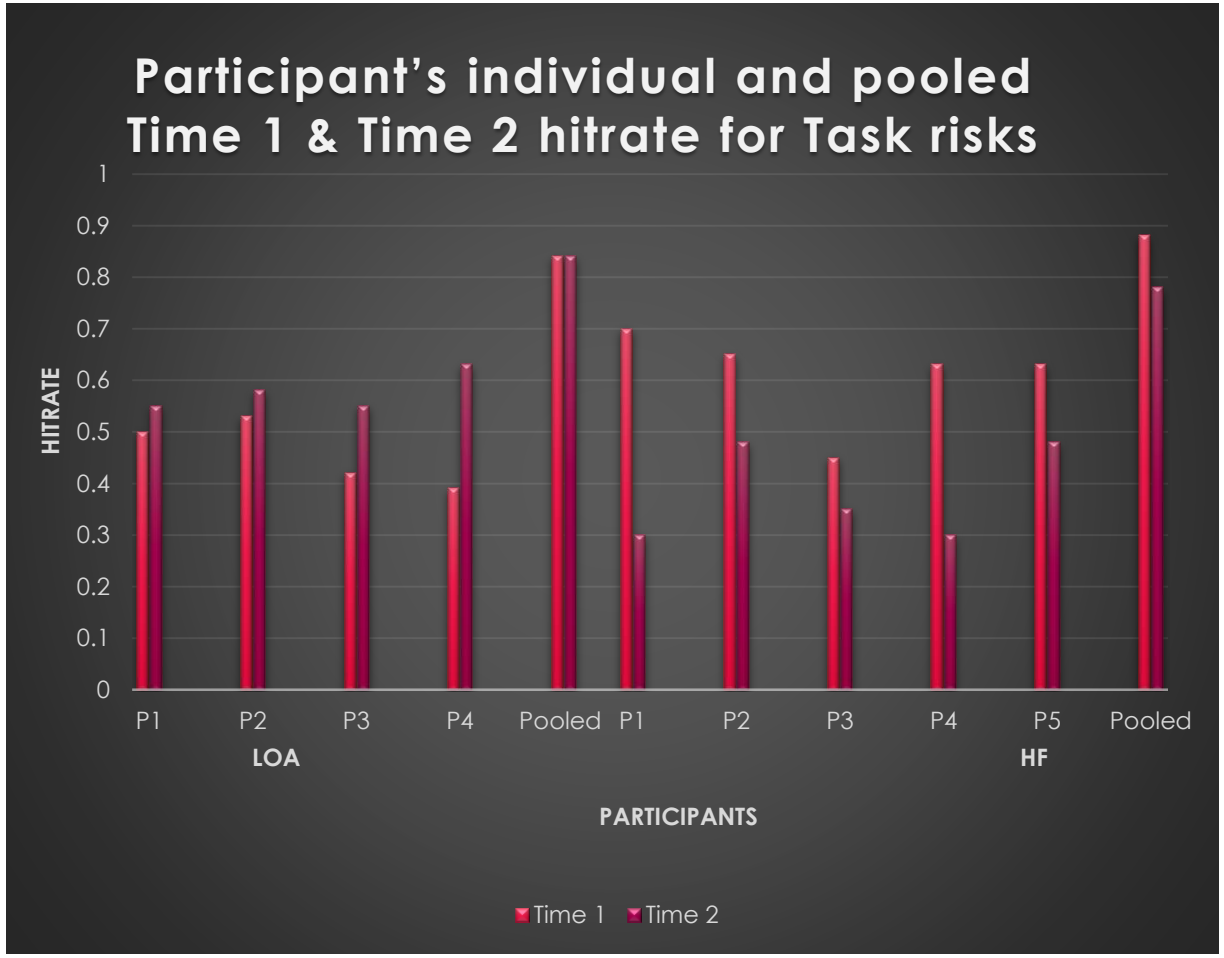
- **The largest number of emergent risks reside within the tasks not associated with delivery of the activity.**

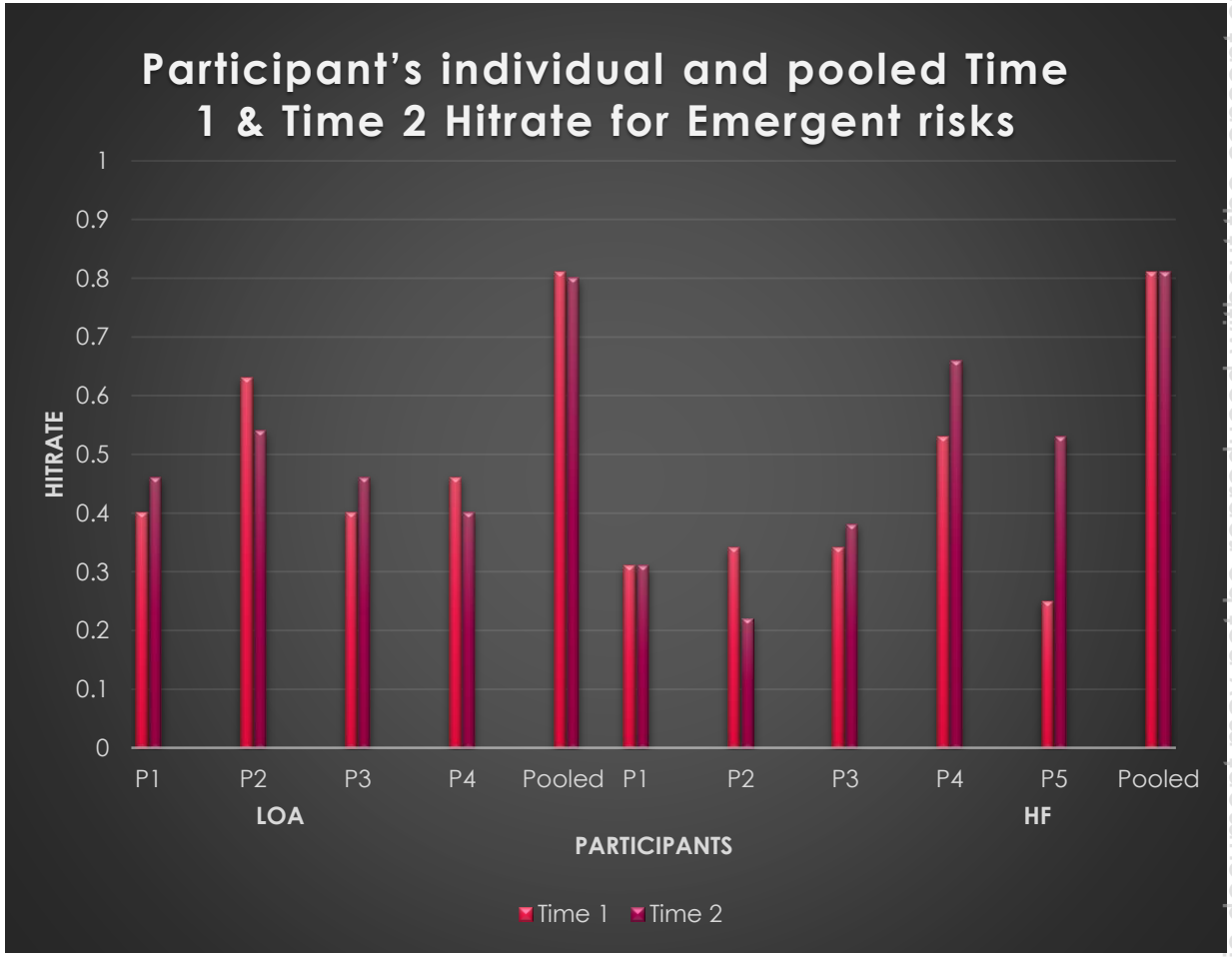
- Overall, the study demonstrated the existence of 5.8 times more emergent risks in the system than task risks.

TRANSLATION INTO PRACTICE



VALIDATING NET-HARMS





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

UPLOADS features in Australian Research Council's new 'Making a

Upcoming Events

No upcoming events

ACKNOWLEDGEMENTS/FURTHER INFORMATION

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QUESTIONS/ COMMENTS/ MUSINGS