Why include supervision ratio recommendations in the AAAS?

Preface

Supervision ratios is a topic that is constantly discussed. There are many opinions regarding both their use and what the appropriate ratio may be. Supervision ratios are about providing guidance as to the number of dependent participants an activity leader can reasonably supervise during an activity. For example, 6 participants to 1 activity leader.

The Australian AAS Steering Committee reviewed the use of supervision ratios prior to inclusion in the Good Practice Guides (GPGs). Guidance was provided to the Technical Working Groups as to how to handle this issue, so that all activity GPGs addressed supervision ratios in a consistent manner.

This document outlines what the Australian AAS Steering Committee considered in concluding that supervision ratios should be provided in the Australian AAS (AAAS). This is a historical document. What follows was written in November 2015. Therefore, as you read this document know that AAAS now refers to AAAS and GPGs. Release of the document is to help the sector understand both strategic issues and considerations relating to supervision ratios at that time.

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1.0 Introduction

Many of the existing Adventure Activity Standards (AAS) in Australia provided guidance on the participant to leader ratio. The NSW AAS currently does not but is intending to move in that direction. The NZ legislated system that has only just been implemented does not provide ratios. However, during inspections and certification operators receive expert guidance on the subject particular to their context[1].

Should ratios be included in the Australian AAS (AAAS) is a question worthy of review and analysis.

This briefing provides some of the theoretical and philosophical reasoning for and against inclusion. In addition, it reviews information on the current incident data and examines if that provides guidance on whether inclusion is warranted. It should be noted that the current AAS provide ratios as a guide and only provide a maximum limit along with considerations for why that maximum might be reduced in certain circumstances. Operators are instructed to review their particular context and risks and adjust the ratio accordingly.

2.0 Theoretical and philosophical arguments for and against

For each argument provided there are also counter arguments or limitations within that argument that are identified. This is to attempt to provide an in depth analysis of the arguments rather than just stating the argument.

2.1 Reasons for not providing ratio's in the AAAS

Reasons supporting not having a participant to leader ratio include but not limited to:

2.1.1 Providing a ratio encourages inadequate risk review

A recommended or set ratio encourages 'cookie cutter' programs that do not think through all the risks before deciding on a particular ratio. Rather than reviewing the specific participant and other factors the default ratio is used and this is the ratio set within the AAAS.

However, this implicitly assumes that providers always travel the path of least resistance and do not think about the unique circumstances that are faced by default. It takes the view that providers cannot be trusted to check to ensure the number used is actually suitable for their own situation. This is more a safety culture issue rather than a ratio issue.

The AAAS discuss that while the ratio is provided other factors need to be considered to determine if it should be varied. If providers are unwilling to follow this recommendation with a provided ratio, then it is unlikely that the situation would change if they needed to derive their own ratio. They would select a ratio, possibly after a significant amount of effort to decide upon it and then stick with it because of the effort involved. This may thereby defeat the stated purpose of encouraging adequate risk review dependent on the changing circumstances. It is important that continual review of their ratios is conducted on an ongoing basis for circumstances and appropriateness. Providing or not providing the base ratio used is unlikely to change the likelihood of this continuous review of risk and an appropriate safety culture.

[1] Outdoors Safety Workshop presentation by Garth Gully. 31 Aug 2015. Melbourne

2.1.2 Different circumstances should use different ratios

Each provider should be thinking about and assessing their own program risk and deciding on an appropriate ratio based on that assessment. By offering a ratio this can signal to providers what they can get away with and therefore encourages them to use an inappropriate ratio despite a risk review indicating otherwise.

Again, this argument assumes that providers will either not carry out or ignore risk assessments indicating a specific ratio and just use the generic ratio. This is contrary to the AAAS which advises review of the ratios for individual circumstances. It places emphasis on the undemonstrated quality that by not providing a number this will somehow make providers do things that they would not otherwise do. If they fail to follow the AAAS guidance to continually review the ratios, then it is difficult to see how not providing a ratio will motivate them in developing their own (which is an additional step) and then continually review it.

2.1.3 Not including a ratio increases the review of risks

This assumes that because no guidance is provided on ratios it increases the likelihood of providers thinking about risk management and assessing the most suitable ratio for the situation. If they wish to know what other operators are doing, they will research this and try to understand the risks involved and why these operators are using a certain ratio. It encourages research, asking questions and reviewing their personal risks.

Most providers do not have significant resources to devote solely to developing risk management policy and procedures. There is a significant time and cost burden in having to do this work and it may not be sustainable or possible for most operators to do so. This also creates a significant amount of duplication. If every operator did a full investigation this would utilise significant resources to duplicate and determine ratios.

The end result is likely to be a common practice ratio, not a risk assessment based ratio. In addition, this would create a system where the highest common denominator would likely flourish. The temptation would be to select a ratio that provides the best cost benefit rather than the best safety benefit. Industry “standard” might slowly increase as research and discussions continually over time provide pressure to use a higher ratio (also see 2.2.5 procedural drift).

2.1.4 Numbers give a false sense of safety and predictability

Quantifying a ratio makes us feel better as we have a number to measure. It is easy to measure and tick the box leading to a false sense that we have done all there is to ensure safety.

Research shows that any incident has a range of causal factors and not one cause (see section 3.0 below). In many cases supervision is a factor leading to the incorrect assumption that if supervision is adequate this can negate the other causal factors. In an effort to improve supervision, focus is then placed on ratios but the other causal factors are not addressed. In essence a range of factors is condensed into one number when it should not be.

The unfortunate consequence of this reasoning taken to the extreme is that there should never be a select number as it gives false hope of safety. Even after a careful risk analysis it should not come up with a number for this particular instance least it causes complacency. It means we cannot decide on the size of the group or the ratio in any situation creating either paralysis or open slather. Avoiding providing a ratio is not the solution to overcoming complacency.

What is required is ongoing monitoring and building a safety culture that overcomes this false sense of security once a number is selected. The ratio is only a small part in the overall safety systems put into place. To argue that it should not be provided in the AAAS because it would encourage complacency, seems to put too much in store on ratios. It would reinforce the view that it is the most important safety element. So important that only a ratio specifically designed by the provider will be able to ensure the safe running of the activity, while potentially minimising the other broader safety systems. By default, it signals to providers that they need to spend a significant amount of time on deciding ratios when in fact there is a range of requirements that also need attention.

The lack of a ratio could in a perverse way increase the sense of safety once it was arrived at and in the process diverted significant attention and resources from other equally important aspects of safety.

2.1.5 There is no definitive evidence that ratios improve safety

Current evidence indicates that all incidents occur due to a multitude of factors (see section 3.0). There is no evidence that specifically indicates that having a specific ratio is safer.

The difficulty with this argument is that lack of evidence does not demonstrate that it is correct. The current situation is that most States using ratios and therefore the incident data is primarily based on ratios being in place. Therefore, we do not understand what removal of ratios will do within the system. By removing ratios we may inadvertently change the system to such an extent that we do begin to see the actual evidence that ratios where an important safety factor. The actual evidence that ratios are effective is possibly hidden. The best means to examine this is to compare evidence from Australia with other counties without a ratio (e.g. Canada, NZ).

The use of ratios has come out of the need to address concerns around what can many might label as "supervision" issues. The use of ratios does help limit the number of participants needing to be supervised. The fact that there is a lack of evidence that ratios affect safety might be an indicator that the existing ratios is actually working and are currently set at the right level.

2.1.6 Ratios lack logic across different types of hazards and risks

Currently when you compare ratios across different activities with different risks there appears to be no logic to explain them when compared. For example, in the Victoria AAS:

- White-water up to grade 3 kayaking/canoeing ratio 1:6
- Overnight bushwalking with minors ratio 1:6

It seems illogical that a dynamic, fast moving and inherently more hazardous environment like white-water has the same supervision ratio as a less dynamic and potentially less time critical decision making environment as bushwalking or camping in the bush.

However, this is not actually an argument not to have ratios. It is simply identifying an issue currently occurring with ratios across activities. This should be reviewed and addressed. If it is not possible to address, then this might then provide an argument towards not including them. Until that occurs it is premature to announce this is actually a reason for the abandonment of ratios.

Investigation of the incident data would help identify any particular ratio issues for specific activities. This could help determine the logic and appropriateness of particular ratios for particular activities.

2.2 Reasons for stating a ratio in the AAAS

Reasons supporting inclusion of a participant to leader ratio include but not limited to:

2.2.1 Provides expert guidance

The technical working groups have the experience, knowledge and expertise to provide advice to operators on the considerations for ratios and what they see as the maximum number of participants to leader ratio. There are very limited external organisations that can provide that type of assistance to providers currently. By including a maximum ratio this provides the best available advice to everyone.

Because of the nature of the activities there is a broad range of contexts by which the Standards need to cover. Therefore the standards can only provide general recommendations and the argument begins to fall down. This reduces the actual level of expert guidance that can be given. It is easy to provide specific advice regarding things like equipment specifications but when it comes to human and environmental elements it becomes impossible due the variability of the factors involved.

2.2.2 Limits the level of risk irrespective of individual appetite

Adventure activities depend on the social licence of the community to operate. The community provide this licence because they view the risks as being well managed and the industry has a good safety record. By using ratios it provides a limit or level playing field for all providers. It acts like a speed limit and ensures those with less risk appetite are not disadvantaged in comparison to those will a lot of risk appetite. This is needed for the overall good of the industry. Those willing to sustain a larger risk would not only be impacting their own operation in the event of an incident, but could damage the whole industries reputation including instigating the withdrawal of its social licence to operate.

This rests on the premise that incidents can only happen to those who take larger risks. This is not only a fallacy but also unhelpful as it undermines the message of what is an effective safety culture. It encourages operators to simply follow the rules and this will automatically lead to safe outcomes. Adventure activities are complex systems that are always changing and a safety limit is not the only requirement to maintain safety.

2.2.3 Limits span of control when things go wrong

Providing a ratio helps ensure a limit to the span of control for leaders if things do go wrong i.e. when an incident occurs it ensures sufficient staffing to deal with incident and to cover ongoing group management. It ensures staffing is calculated on the minimum leadership needs in a possible worst case scenario, rather than the leadership needs in a best case scenario of no incident.

Spans of control issues is well understood in other contexts such as emergency services. The Australasian Inter-Service Incident Management System (AIIMS) utilises the principle that the span of control used reflects "the scale or complexity of the incident." AIIMS suggests "up to five reporting groups or individuals is considered desirable, as this maintains a supervisor's ability to effectively task, monitor and evaluate performance" although …"ratios ranging from 1:3 to 1:7 may be adopted" depending on "the scale or complexity" [2]. (Note: This is not provided to advocate as the ratio required. It is only an example from a different context where they are responding to dangerous situations on a day to day basis. From experience emergency managers know that when the span of control is too large this can lead to further complications or incidents.)

The reason for this type of ratio this is that it becomes difficult to lead, manage and track increasing numbers of people in fast changing environments. The lesson from this is when an incident does occur, the leader(s) need to be able to not only respond to the incident but also adequately supervise and manage the safety of those not directly affected. This might be achieved by using ratios to limit the overall span of control through a maximum number of participants to leaders.

This also create an artificial trade-off between safety and income & staffing costs (see 2.2.4 below) irrespective of the context which may vary.

2.2.4 Limits the impact of competing objectives

Ratios help overcome/limit dilemmas faced by providers through competing objectives within the system. For example the ratio will affect both income possible via the number of participants it can take and the costs involved via the number of staff needed to run the activity. This creates competing objectives of safely staffing program, keeping staff costs down and maximising income.

By providing the industry with a recommended ratio it helps resolve these interrelated dilemmas by guiding providers as to what is industry standard. This avoids the potential to place the financial objective before the safety objective and also reduce procedural drift (see 2.2.5 below).

This assumes that providers will in most cases resolve competing objectives in favour of objectives other than safety. In other words they are either unable or unwilling to balance objectives successfully which may or may

[2] AIIMs 4th Edition 2013: Australasian Inter-service Incident Management System. Australasian Fire and Emergency Services Authorities Council. Page 14

not be true. A further issue with this argument is it also cannot account for all variations and objectives in the particular context it is used in.

2.2.5 Limits the amount of procedural drift

Recommend ratios places a ceiling on possible procedural drift. Procedural drift is where small changes are made over time with the end result meaning the procedure moves significantly from what was intended at the outset.

For example, all went well with taking 12 participants, so another participant is added to meet some other objective like increased income. All continues to go well and so a similar decision is repeated at a later stage to then make it 14 participants. Based on the previous positive outcomes the ratio begins to drift significantly. However, the positive outcomes may have only occurred through good luck, rather than good risk management.

This argument assumes pressure and conflict between safety and other objectives will in most cases end in moving away from safety in favour of other objectives. They are either unable or unwilling to balance objectives successfully. This is a significant and broad assumption which may or may not be true.

2.2.6 Perception in a court situation

The use of supervision ratios is a well-established risk management practice (e.g. currently in existing AAS). In the event of a court or coroner's case, it is likely that independent experts will be called to discuss the level and competence of the leadership and supervision. It may place the Standards usefulness as the industries guide to safety into doubt, if there were no ratios when other industry experts provide evidence that may indicate that there should have been ratios. The avoidance of the inclusion of a well-established practice may then be seen as 'negligent' on the part of the creators of the standard and damaging the reputation of the usefulness of the Standards.

This presents a theoretical argument as to what may occur. Legal advice and review of past court or coroner's cases has not been undertaken to establish if this would be the case. While a possibility, this is at the present time unsubstantiated.

2.2.7 Ratios set to meet administrative objectives rather than safety objectives

The AAAS are developed by industry and activity experts. A key function of the ratios is for safety. If ratios are to be set, the developers of standards are the people best placed to determine those ratios. In the event that ratios are not included, this may mean other interested parties such as land managers may need to address this void for administrative reasons.

This may see administrative ratios being set which bear no relation to an appropriate safety ratio e.g. income maximisation or environmental sustainability is the basis of the ratio. In addition, the administrator setting the ratio may not have the required expertise, experience and judgement to set a relevant safety ratio even if it attempts to do so. Irrespective of the framing of an administrative ratio, it is likely to then become the default ratio for the activity. This creates a situation where an administrative ratio then sets a de facto safety ratio, where the reverse should occur.

By inclusion of ratios in the AAAS this can be set by activity experts and the focus can be on safety. Other interested parties can then modify this for administrative or other purposes where necessary - but having a definite benchmark available for safety.

This argument assumes that administrators do not have access to the relevant expertise which may not be the case. In addition, the assumption is the possibility that administrative ratios are likely to be worse for safety when this may also not be the case. In some cases, the administrative ratio may even provide better safety than the AAAS ratio e.g. reduced participant numbers in difficult terrain in South West Tasmania improves safety as small groups can move quicker.

3.0 Current incident data

The following discussion refers to risk management levels based on Rasmussen's risk management framework. Refer appendix 1 for details.

3.1 NZ data

The review of NZ accident data over 5 years (2007-2011) identified a theme around *high participant to staff ratio* at the technical and operational level[3] (also see appendix 1). This found that a high ratio was a causal factor in 2.56% of all incidents which represented 26 incidents.[4] This was the second highest causal factor behind *poor planning of activity* 58 incidents (5.72%) and level with *poor planning for participant abilities special needs* 26 incidents (2.56%). The review did not indicate if this was a factor in any of the 6 fatalities within the data.

The NZ data therefore indicates that ratios are a contributing factor to incidents.

The NZ report does not provide details of the regulatory framework in place at the time and if there were ratio guidance being provided (e.g. via a standard) for the activities within the data set. While the resultant *high participant to staff ratio* factor occurs at the lower end of the framework, this could actually be a symptom or result of the lack of ratio guidance at the regulatory level.

3.2 Australian Data – UPLOADS project

The UPLOADS project is the only available database that is currently able to be consulted regarding recent outdoor incidents. The project is able to provide a special report on group size and ratio's, both on an overall and activity level basis. This would be possible in their next round of reporting which is scheduled for completion in Feb 2016.

The current available incident data was examined for causal factors that might be affected by group size. There was one specific factor of group size. One other factor was identified as possibly being affected by changing the group size and this was *activity leader: supervision & leadership of activity*. The larger the group, the more challenging the supervision & leadership requirements.

1st June – 30th Nov 2014 data[5] indicated of 219 injury causing incidents:

- 3 (1.4%) had an activity group size: group size factor involved
- 16 (3.1%) had a activity leader: supervision & leadership of activity factor involved
- Totalling 19 (5.9%) factors of a total of 322 factors

For the same period of 60 near miss incidents:

- 1 (1.6%) had an activity group size: group size factor involved
- 8 (13.1%) had a activity leader: supervision & leadership of activity factor involved
- Totalling 9 (8.8%) factors of a total of 102 factors

The injury causing accident data factors map (ACCIMAP) is provided in appendix 2.

[3] Injury causation in the great outdoors: A systems analysis of led outdoor activity injury incidents. Paul M. Salmon, Natassia Goode, Michael G. Lenné, Caroline F. Finch, Erin Cassell. Accident Analysis and Prevention 63 (2014) 111– 120

[4] table 8 page 117

[5] Report national-incident-dataset-report-30th-november-2014-final downloaded from http://uploadsproject.org/findings-from-the-national-incident-dataset/

It should be recognised that the above data is only preliminary and not necessarily fully representative of the impact on group size and ratios. However, they do provide an indication that around 1.5% of incidents have a causal factor related to ratios and this may be larger if other factors are proven to also be related.

As noted in 2.1.5 above, although there is no evidence that ratios improve safety, this might be because the existing ratios at the regulatory level is impacting on incidents to such an extent they rarely show up.

4.0 Summary

4.1 Arguments summary

The following table summarises the arguments for and against.

	Arguments against ratios	**Issues with argument**
1	Encourages inadequate risk review	Assumes inadequate ongoing reviews is function of using a ratio when more driven by the safety culture
2	Ratios need to alter depending on context	This is already addressed in instructions for use of ratios
3	Increases review of risks	Matter of safety culture, creates duplication of effort within industry and possible use of highest common denominator rather than best safety ratio
4	Numbers provide false sense of safety & predictability	This is an issue of safety culture not use of numbers. Could counterintuitively increase the sense of importance placed on the ratio to the detriment of other causal factors
5	No evidence ratios improve safety	NZ data indicates ratio is a factor. Aust. data is influenced by existing ratios so unknown what would occur if removed. Lack of Aust. data may indicate ratios do work
6	Lack logic when compared across hazards & risks	Argument indicates ratios across activities need review, not that we need to remove ratios

	Arguments for ratios	**Issues with argument**
7	Provides expert guidance	Impossible to provide in an AAAS due to varying contexts
8	Places limit on level of risk irrespective on individual willingness for additional risk	Encourages idea that incidents only happen in larger groups
9	Limits span of control issues when things go wrong	Decides on safety vs income & staff costs trade-off irrespective of context
10	Limits impact of competing objectives	Assumes operators cannot adequately balance risk vs other objectives. Cannot adequately account for varying contexts
11	Limits possible procedural drift	Assumes operators cannot adequately balance risk vs other objectives
12	Perception of court or coroner	Requires more research to substantiate
13	Avoids administrative objective replacing safety objective	Assumes administrators do not consider safety as an objective and/or have expertise to make decision on safety issues

4.2 Discussion

There is incident data from NZ and Australia to suspect that participant to leader ratios is a causal factor in incidents. The fact that Australia has used ratios for a number of years might have reduce the frequency of this being a factor and hide the actual impact this has had. Part of the reason behind thinking the data is affected, is that the AAS is high up in Rasmussen's taxonomy (see appendix 1) in the regulatory level. This has flow on affects to the lower items e.g. level of supervision, level of instruction & ability for one to one communication.

It will be interesting to get deeper understanding of the issue when the UPLOADS team examine the Australia data set in more detail.

A number of the reasons against inclusion (# 1, 3 & 4) can be grouped according to the main issue with these arguments. This being it is more about the safety culture of the AAAS user rather than what is in the actual AAAS. Reason # 2 is currently addressed in existing AAS via directions to amend the ratio depending on the context and places this responsibility on AAAS users as it should do. Current evidence (section 3.0) seems to contradict reason #5, while reason #6 demonstrates a potential issue with ratios but not that they are inherently wrong.

There appears to be no strong reason to support not including ratios.

With the reasons for including ratios, reasons #7, #12 & #13 complement each other. They all demonstrate reasonable arguments for inclusion of ratios within the context of the broader communities' expectations and the legal and administrative systems i.e. the higher level systems in Rasmussen's framework. Reasons # 8, 9, 10 & 11 all focus on limiting the potential for incidents to occur and if they do occur limiting the consequences. They use an argument for setting a boundary to help provide guidance and a level playing field within the industry. The kindest view would be it ensures those that have lessor skills, knowledge or experience do not take on too much risk. The darker view is that it might ensure more unscrupulous operators – who place financial considerations above any competing safety objectives - do not damage the social licence currently enjoyed by the industry.

The reasons for including a ratio therefore appear far more convincing.

Having 'no' participant to leader ratios provided – even if a process for deriving suitable ratios were supplied – does not have sufficiently convincing arguments to support it.

In complex systems there is never going to be one factor that will make the final difference between an incident occurring or it being averted. Therefore, ratios need to be seen in that context and used as one tool among many tools to assist in the safe delivery of adventure activities. They should not be seen as the most important but there is the potential for ratios to have flow on affects throughout the system.

4.3 The type of ratio options

The above material indicates that there is two possible options with relation to the type of ratio to include in the AAS:

1. 'Hard' ratios use of fixed ratios and no deviation from the standard provided for
2. 'Soft' ratios which are recommended ratios that should be amended based on consideration of the individual circumstances, context and a risk assessment

The current AAAS utilise the 'soft' ratio option. The move to a hard ratio would therefore be a significant shift in approach.

Reasons used for having 'no' ratio (reasons #1, #2, #3 & #4) would also provide the main arguments for preferring a 'soft' ratio rather than a 'hard' ratio. In essence using a 'hard' ratio is likely to remove any critical inquiry regarding the particular context and risks involved. It could lead to inappropriate restriction on activities and/or insufficient leadership being available, by forcing a ratio to be used when other factors mitigate the need or indicate a lower ratio is needed for that particular context.

5.0 Conclusion

5.1 Inclusion of participant to leader ratio's in AAAS

Inclusion of participant to leader ratios in the AAAS is warranted given that:

- the participant to leader ratio is a factor in incident causation based on the NZ data
- the increased number of participants to leaders increases the complexity of the system and therefore has safety implications
- the logic for limiting the span of control (i.e. number of people to manage) that leaders will have if an incident does occur, is a sound risk management practice
- currently there is limited ability to provide independent and tailored advice to providers on a suitable ratio for their individual circumstances and contexts
- there exists a need to provide some guidance to some sectors of the community and industry
- it helps resolve difficult trade-off decisions (e.g. cost of staff vs appropriate staffing levels) for providers in borderline situations
- ratios maybe applied externally either by administrators and/or following court/coroner proceedings
- ratios are a well-established risk management practice already in use in AAS and other safety critical areas
- the need to protect the industries social licence to operate requires all operators to have adequate safety guidance in relation to ratios
- most reasons for not including a ratio speak to safety culture issues rather than the inclusion of a ratio per se.

5.2 The type of participant to leader ratio to use

The use of a 'soft' participant to leader ratio provides the best balance and outcome given that:

- it does not close down the critical inquiry needed to think about the risks for the particular context it is being used in
- it avoids the unintended consequences of using a 'hard' ratio
- it avoids the unintended consequences of using 'no' ratio
- it encourages use of a process to decide on a ratio while still providing guidance.

5.3 Review of existing AAS participant to leader ratios

The review and further development of AAAS should examine and take into account the ratios across the varying activities to ensure that ratios are substantiated "logically" and are based on the best available data.

Additional research should be conducted into the impact of ratios to inform the ongoing development of the AAAS by:

- requesting the Uploads project team to produce a special report on participant to leader ratios
- checking with the authors of the NZ report to attempt to clarify the regulatory environment i.e. was there recommended ratios in place during the period the incidents occurred

Appendix 1 – Rasmussen's framework

"Rasmussen's framework … system levels are described:

- a Government level at which laws and regulations are developed;
- a Regulatory level at which industry standards are developed based on laws and regulations;
- a Company level where company policies and procedures based on industry standards govern work processes;
- a Management level where company policies and procedures are implemented;
- a Staff level representing the activities and characteristics of workers performing the processes; and

- a Work level representing the equipment and environment within the work context."[6]

The technical and operational levels in the list includes the management, staff and work levels.

The regulatory level also includes risk management activities completed by regulatory bodies, associations, schools[7] which in this instance would also include standards.

Appendix 2 Australian uploads project report factors diagram

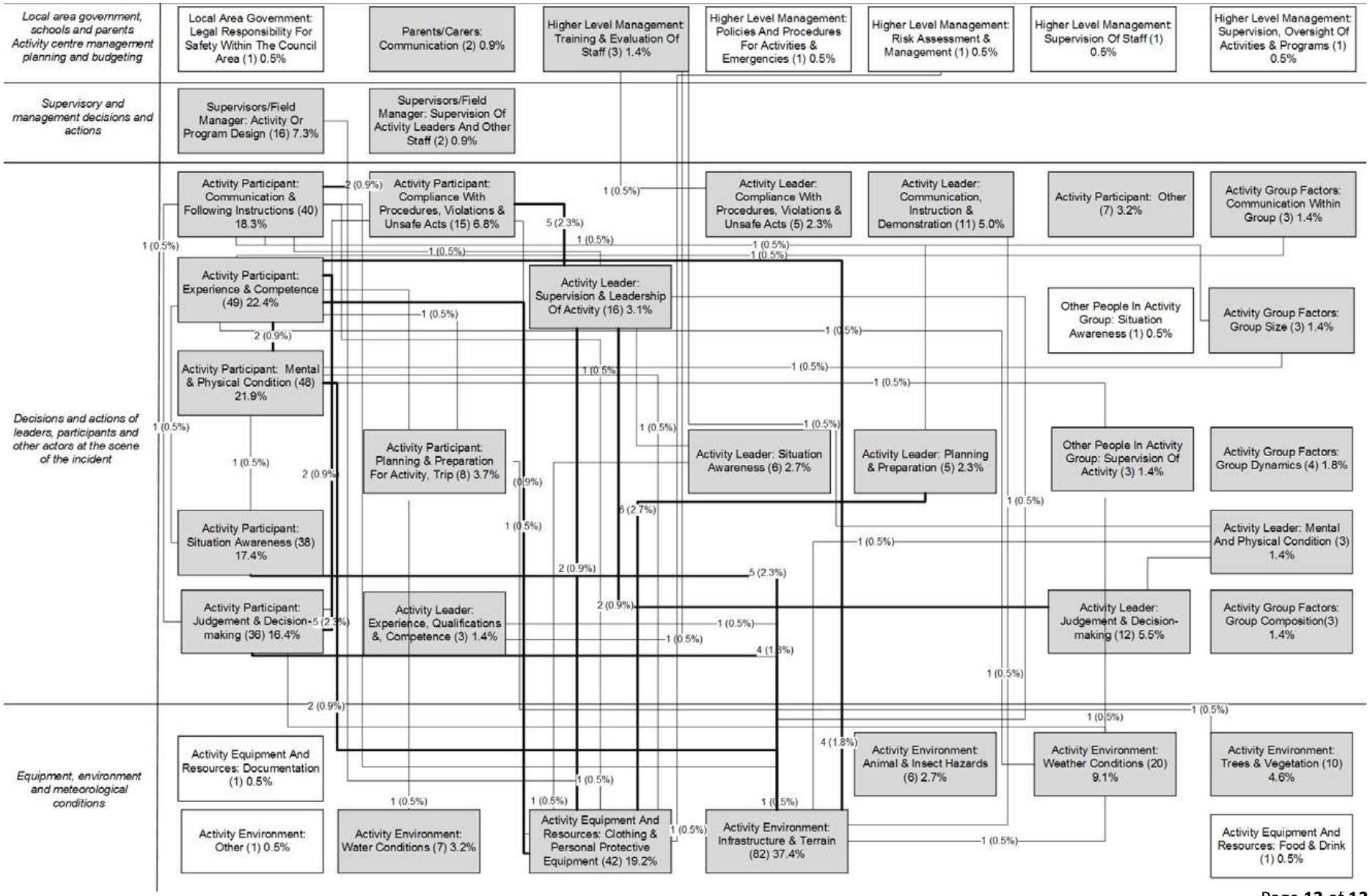
The following page shows Figure 10[8] from the June to November 2014 Uploads Project report showing "Factors and relationships identified which contributed to injury-causing incidents (n=219). Factors identified in more than one report are shaded in grey, and relationships identified in more than one report are bolded"

Diagram on next page.

[6] http://uploadsproject.org/rasmussens-1997-risk-management-framework/ accessed 21/09/15

[7] Injury causation in the great outdoors: A systems analysis of led outdoor activity injury incidents. Paul M. Salmon, Natassia Goode, Michael G. Lenné, Caroline F. Finch, Erin Cassell. Accident Analysis and Prevention 63 (2014) p.113

[8] See note 10 - page 36


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
Local Area Government: Legal Responsibility For Safety Within The Council Area (1) 0.5%
Parents/Carers: Communication (2) 0.9%
Higher Level Management: Training & Evaluation Of Staff (3) 1.4%
Higher Level Management: Policies And Procedures For Activities & Emergencies (1) 0.5%
Higher Level Management: Risk Assessment & Management (1) 0.5%
Higher Level Management: Supervision Of Staff (1) 0.5%
Higher Level Management: Supervision, Oversight Of Activities & Programs (1) 0.5%
Supervisors/Field Manager: Activity Or Program Design (16) 7.3%
Supervisors/Field Manager: Supervision Of Activity Leaders And Other Staff (2) 0.9%
Activity Participant: Communication & Following Instructions (40) 18.3%
Activity Participant: Compliance With Procedures, Violations & Unsafe Acts (15) 6.8%
Activity Leader: Compliance With Procedures, Violations & Unsafe Acts (5) 2.3%
Activity Leader: Communication, Instruction & Demonstration (11) 5.0%
Activity Participant: Other (7) 3.2%
Activity Group Factors: Communication Within Group (3) 1.4%
Activity Participant: Experience & Competence (49) 22.4%
Activity Leader: Supervision & Leadership Of Activity (16) 3.1%
Other People In Activity Group: Situation Awareness (1) 0.5%
Activity Group Factors: Group Size (3) 1.4%
Activity Participant: Mental & Physical Condition (48) 21.9%
Activity Participant: Planning & Preparation For Activity, Trip (8) 3.7%
Activity Leader: Situation Awareness (6) 2.7%
Activity Leader: Planning & Preparation (5) 2.3%
Other People In Activity Group: Supervision Of Activity (3) 1.4%
Activity Group Factors: Group Dynamics (4) 1.8%
Activity Participant: Situation Awareness (38) 17.4%
Activity Leader: Mental And Physical Condition (3) 1.4%
Activity Participant: Judgement & Decision-making (36) 16.4%
Activity Leader: Experience, Qualifications &, Competence (3) 1.4%
Activity Leader: Judgement & Decision-making (12) 5.5%
Activity Group Factors: Group Composition(3) 1.4%
Activity Equipment And Resources: Documentation (1) 0.5%
Activity Environment: Animal & Insect Hazards (6) 2.7%
Activity Environment: Weather Conditions (20) 9.1%
Activity Environment: Trees & Vegetation (10) 4.6%
Activity Environment: Other (1) 0.5%
Activity Environment: Water Conditions (7) 3.2%
Activity Equipment And Resources: Clothing & Personal Protective Equipment (42) 19.2%
Activity Environment: Infrastructure & Terrain (82) 37.4%
Activity Equipment And Resources: Food & Drink (1) 0.5%