

Presentation to HEMS NZ 20 June 2022 :AvaLife

1) Tena koutou, tena koutou , tena koutou katoa

My name is Malin and today I will share about the NZ Government endorsed avalanche rescue algorithm, AvaLife.

These are the organisations I represent . I have no conflict of interest or commercial interest in any of this.

2) NZ SAR provides strategic governance to all SAR agencies in NZ: Civil Aviation Authority, Department of Conservation, Maritime NZ, Ministry of Transport, NZ Defence Force, Fire and Emergency NZ and NZ Police. NZ Police engage LandSAR as their volunteer agency. NZ SAR Avalanche readiness guidelines were first published 2014 and recently updated and published last month . I am very happy that we included AvaLife .

3) Mountain Safety . Info is the international knowledge base for best practices in mountain safety, developed by subject matter experts worldwide. Private individuals can access the content at no cost , but if organisations wish to use it for commercial training , there is a subscription charge. Manuel Genswein is the lead professional and he works with a large team. Manuel has kindly delivered two webinars recently to NZ LandSAR and Alpine Cliff Rescue, they are recorded and if anybody would like the links, I am allowed and very happy to provide those. Manuel has also offered to deliver a more in-depth training session to HEMS NZ if so desired.

This will only be a brief introduction of AvaLife in the 30 minutes I have. AvaLife is a holistic rule based decision tool. It is holistic in the way that it caters for all levels of responders, every link in the chain of rescue, from Basic Life Support (**BLS**) companion rescuer to **BLS+**, advanced first aid trained outdoor professionals like ski patrol, heliski guides and Alpine Cliff Rescue team members to **ALS** medical practitioners like yourselves.

The algorithm ensures the “**Greatest good to the greatest number** “.

It is also holistic because it includes every phase of the operation: **search, excavate, reverse remote (rescue) triage , resuscitation, transport priorities , intermittent CPR and hypothermia management.**

I should mention now that Swiss rescue helicopters are on scene at an avalanche on average within 8 minutes of being called. With the somewhat longer response times here in NZ, AvaLife can still be applied without any issues.

4) In New Zealand, avalanches with persons trapped are rare events in NZ. Exactly for this reason , it is essential to have a cognitive aid available, and even if regular training occurs, skills fade is a problem.

Avalanche rescue takes place in a dynamic environment where both direct and indirect threats exist and rescuers need to be aware of these and know how to mitigate them. The AvaSAR algorithm, included in the NZ SAR readiness guidelines, helps to determine the risks to rescuers.

Avalanches have a high potential to be mass casualty incidents , which means resources are highly likely to be overwhelmed, both on the hill and in the next link in the chain of rescue.

If companion rescuers are present on scene, they are highly likely to be very emotionally distressed , due to the fact that the buried victims are their friends, family or clients.

Reverse remote (rescue) triage is how to give the statistically best chance of survival for the victims. It is different from being able to see and examine patients, they are still buried under snow but there are clear indications of who is more or less likely to survive and we will cover that in more details further on.

Hypoxic cardiac arrest does not fit the High Performance CPR criteria which you are all used to delivering in primary cardiac arrest situations.

Also Hypothermic cardiac arrest (if non asphyxial) can have a very good neurologically intact outcome if all the right protocols are in place .

5) In the interest of time, I will not cover epidemiology of avalanches in NZ or physiology of avalanche burial, those are extensively discussed on my website and in the references on today's webpage.

What you do all need to know, is what the people on scene before you, what they know and why they have done what they have done.

When you arrive on scene, you will be expected to carry out reverse remote (rescue) triage so you need to have a clear understanding of that.

You will also be expected to make the decision around continuing or stopping resuscitation, and you need to know what AvaLife says about that, since it is different from St John CPG and also the ERC 2021 algorithm (more about that soon)

The transportation priorities are listed in the AvaLife for ALS, as an organisation you need to carefully scrutinise those and see if you agree with them and if not, they need to be amended.

If we have time at the end of the presentation , we can discuss destination policies around non-asphyxial hypothermic cardiac arrest and ECLS / ECMO in New Zealand.

6) This is the ICAR avalanche victim resuscitation checklist. The original 2013 version had core temperature before ECG rhythm, that was amended in the 2015 version, where ECG rhythm came before core temperature. It is very difficult to obtain an accurate core body temperature in the field. The ICAR checklist only refers to one patient and it also assumes sufficient resources. I taught this to outdoor professional from 2015 to 2019, and then we transferred to AvaLife.

7) The St John CPG illustrates the saying” Don't let perfect stand in the way of good” It was almost, but not quite compatible with ICAR. A CPG needs to be straight forward and easy to implement and I was fairly pleased with the final version.

8) This is the 2021 European resuscitation Council guidelines. The black arrow points out where the St John CPG differs. St John do not discriminate between duration of burial ie below or above 60 minutes as to whether resuscitation occurs if there is snow in the airway, potentially under resuscitating some patients

AvaLife differs from the ERC with regard to universal ALS. If there are number of victim outnumbering rescuers, then a normo thermic cardiac arrest patient may only get 6 minutes of CPR and if ROSC is not obtained, the rescuers will move on to the next buried victim. More about that later.

9) There is AvaLife for BLS rescuers, however, companion rescuers if recreationalists and not professional outdoor guides are unlikely to be aware of AvaLife or ICAR or hypoxic first aid CPR since that is not normally taught in any first aid courses for the public. As mentioned before, they are also likely to be very upset. (Photo credit Ryan Long, NZ Avalanche Dispatches ,June 2022)

10) AvaLife for BLS+ and ALS rescuers contain an element for Search. The reverse remote triage identifies the victims with the statistically highest chance of survival.

Terrain which is more likely to cause traumatic injuries, ie rocks and bluffs and also trees (even though here in NZ most ski terrain does not have trees) also causes trauma when the person is carried down slope by the debris and impacts.

Depth- the shallower the better and deeper than 1.5 metres burial is statistically worse for survival. This is not to do with duration of burial, ie time it takes to excavate ,but the fact that the more snow depth reduces the chances of there being an air pocket, the snow compressed any air pockets.

The search efforts need to be balanced with the excavation resources available , statistically achieving “the greatest good for the greatest number”. If there are more resources that victims, then this does not need to be a consideration.

The accepted terminology is “victim” when the person is fully buried and once the face or rest of the body is accessed , the terminology is “patient” .

It is not possible to talk about avalanche rescue and not include avalanche search dogs. However, AvaLife does not stress this point , because often the logistics are such that the dogs do not arrive in the first , most time critical search period. NZ SAR Avalanche readiness guidelines do mention dogs , but again the timeliness of arrival needs to be kept in mind. (Photocredit :Porters ski field, NZ Avalanche dispatches June 2022, dog:unknown, not NZ)

11) Both the BLS+ and the ALS versions of AvaLife have excavation modules which are the same. If resources are limited, the statistically more likely to survey victim is excavated first, but once the immediate first aid has been rendered, they may be left incompletely excavated, in order to save precious minutes to then excavate the next victim, to give the next victim the best chance of survival. Also , if a patient is left partially excavated, they will be insulated and stay warm better than if they are excavated and then not insulated on the surface on the snow, by use a “microclimate” eg bothy bivvy

12) AvaLife algorithm comes in two parts for BLS+ and ALS.
The BLS+ search and excavate has a red and yellow checkered border, you will see the ALS version has a green and yellow checkered border.
You can see it also has the Hypothermia staging and intermittent CPR details.

13) This is the first part of the ALS algorithm. Just like the eBLS it has search and excavate, hypothermia staging and intermittent CPR.
There are special rules about the duration of continuous (not compression only , but contentious with initial rescue breaths and ventilations) necessary ,depending on the duration of burial, make sure you pay attention to that when you look at these algorithms after this presentations.

You will also see the transport priorities for different categories of patients, it will be worth the organisation looking closely at these.
Some of these priorities assume that ECLS capability is available .- In my considered opinion, more work needs to be done round this for New Zealand. **Nonasphyxial** hypothermic cardiac arrest is rare in avalanche situations, but in land based nonasphyxial hypothermic cardiac arrest (at least one a month country wide, see my coronial data analysis) this capability is definitely needed.

14) Resuscitation

- Initial rescue breaths
- CPR with ventilation (not high performance CPR since asphyxia)
- Injuries incompatible with life is established after CPR is initiated (New criteria)
- Normo thermic / Hypothermic / Trauma (orange, blue, black blocks on the algorithm)
- **Greatest good for greatest number**
- seamless interoperability with advanced life support (ALS) qualified medical personnel arriving on site.
- As every minute counts, withholding first aid, partial excavation
- advice to limit CPR duration for normothermic patients to 6 min in case of multiple burials and shortage of resources,

Note:many patients buried prone & head down . CPR is not going to be effective in prone position on uneven avalanche debris, attempt to quickly pull patient out and perform CPR with either a firm backing like a Corpuls or LUCAS backboard or a “snow platform” trodden firm and even by rescuers.

15) This slide is quite crude and should not be re-shared. It is just attempting to show that moderate terrain results in burial and asphyxia is biggest risk
5 initial rescue breaths, like drowning, ERC 2021

The likelihood of a BLS-trained companion or organised rescuer being able to reverse the effect of an increasingly asphyxiating patient who is not in cardiac arrest is **high**

Most buried subjects are excavated in **less than 60 min** (overseas) and are therefore very high probability **normo thermic** avalanche patients.

Where there is a shortage of resources, limit CPR duration to 6 min to provide the “Greatest good for the greatest number” with the limited number of available rescuers.

16) Again, this slide should not be re-shared. It is a crude attempt at showing that in extreme terrain, ie climbers and mountaineers, may get knocked off the cliff by an avalanche, falling some distance but may not necessarily be buried by snow, but may sustain severe poly trauma.

- lower extremities might still need to be fully freed before being able to determine **extent of mechanical impact** of being transported downslope in the debris flow.
- the life of very severely injured patients is most often unsalvageable, even after short burial durations and in shallow burial depth (like mountaineers)
- Traumatic cardiac arrest is the by far most unlikely cause to be survivable in a mountain environment (0.8–1.2% for non-mountain related accidents) [9], and treatment options for BLS-trained rescuers are very limited.
- “injuries incompatible with life” as follows: **Obvious evidence of severe mechanical impact/high fall/severe collision with trees or rocks or a head/truncal body position incompatible with life** (ICAR definition often not reached ie decapitation, transection thorax, frozen chest)

17,18,19,20

These four slides are in order:

BLS+ normothermic, ALS normothermic (note the orange box)

BLS hypothermic, Also hypothermic (note the pale blue box)

It is the duration of burial (over 60 minutes) that determines that the patient may be hypothermic. There is no need to use a thermometer but if you do, the gold standard is oesophageal probe. Infrared tympanic does not work in cardiac arrest and is not accurate in cold patients that have a pulse either .

Please not the use of the **HOPE score** for prognostication. A dichotomous triage using potassium levels in no longer adequate or acceptable.

21 and 22 are the complete BLS+ and ALS algorithms. For PDF versions please see the NZ SAR Avalanche readiness guidelines document. The ALS one is a long format, not A4, there will soon be a new format which prints out better ,Manuel tells me. I'll let Tatsu know when it is available .

By this stage of my presentation I had already yarned on for 45 minutes instead of my allotted 30- so I only briefly mentioned slide 23) the ERC accidental hypothermia guidelines and the **ASAIO journal article which is the “Edmonds cookbook of ECMO” (link in references)**

If anyone has any questions, comments or would like me to produce a table top or scenario exercise please don't hesitate to get in touch.

If you read this far- thank you very much indeed for your interest and perseverance!
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