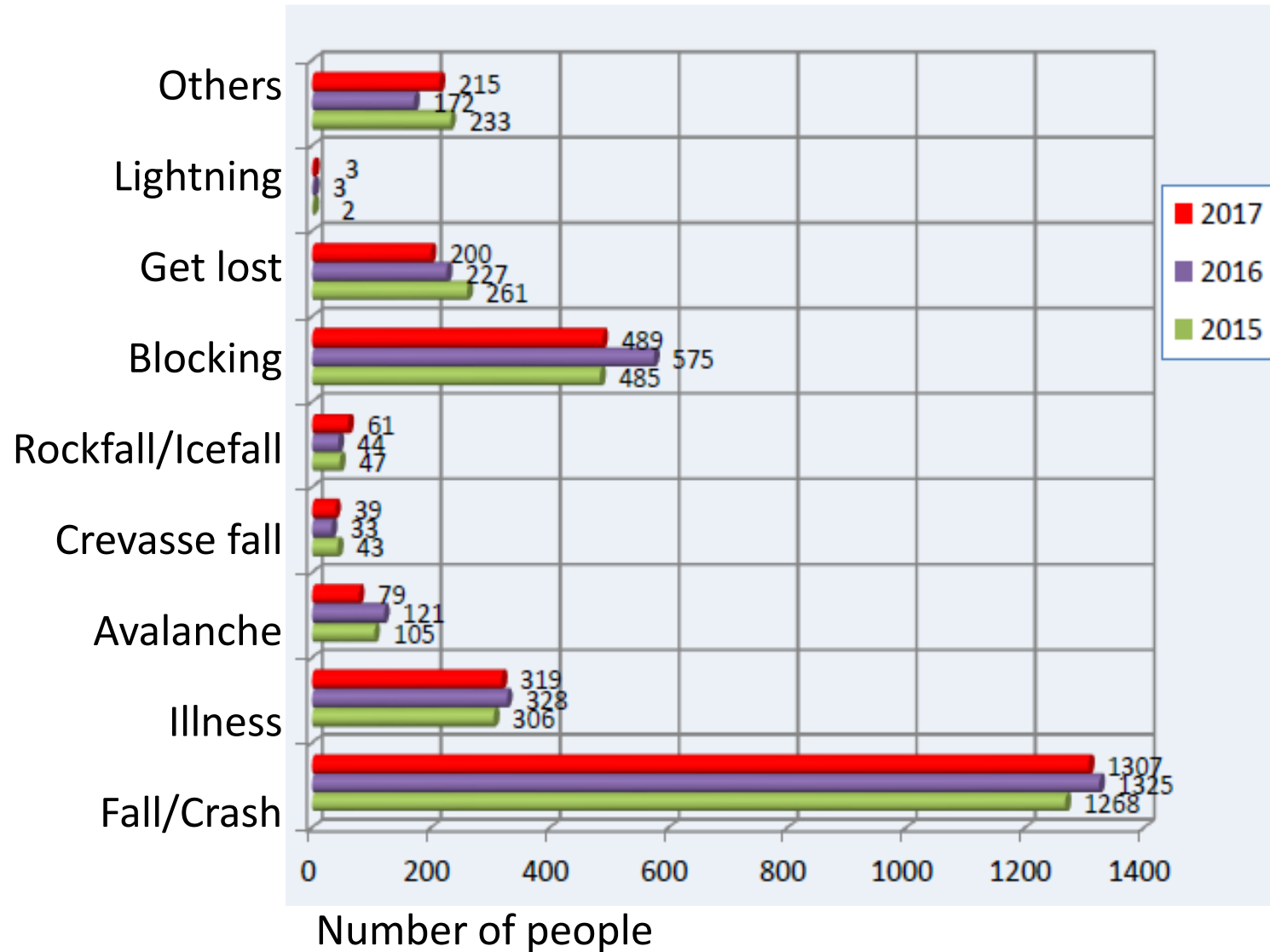


Inhalational Analgesia:

Penthrox[®] or Entonox[®]

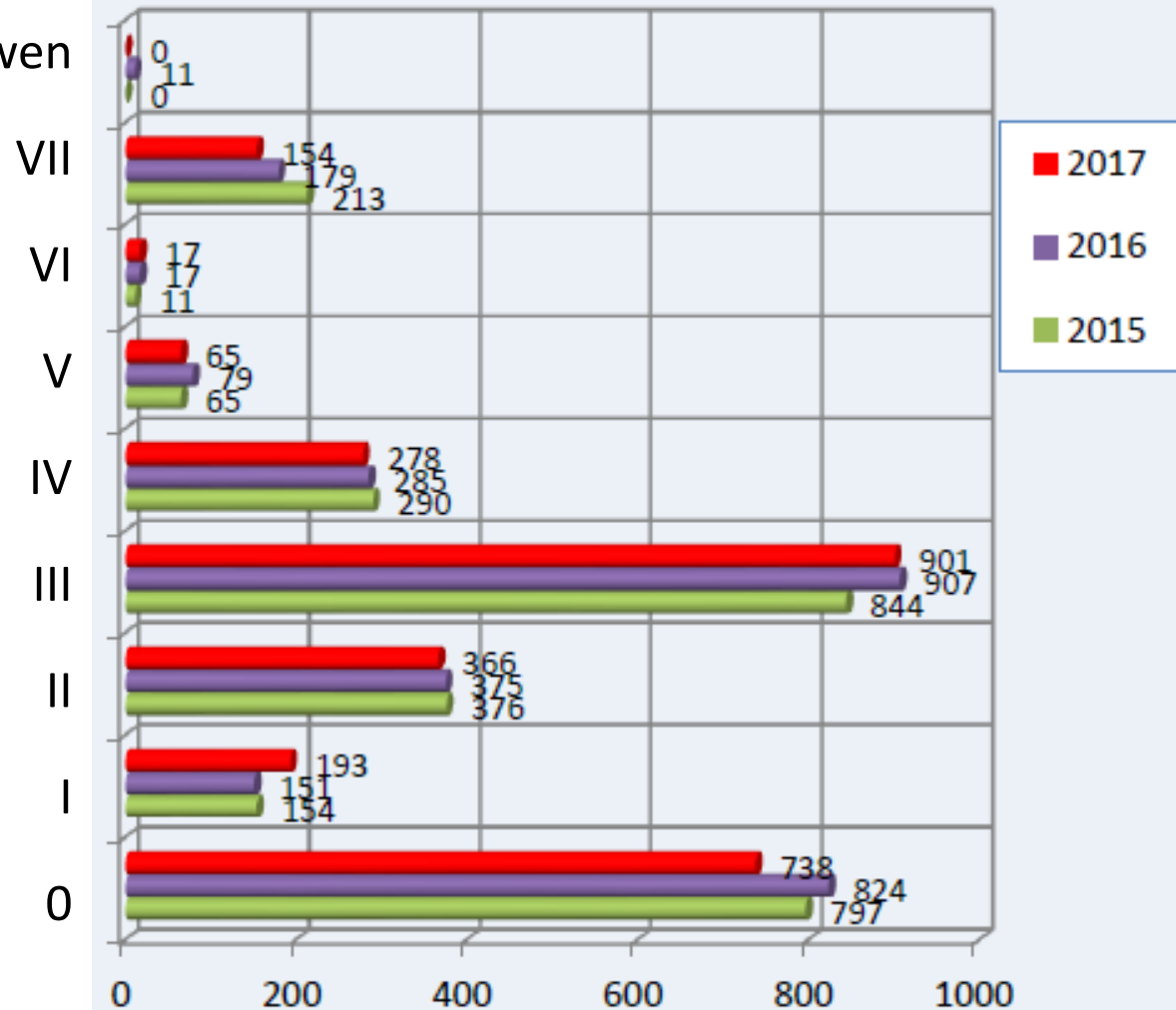
– which is better suited to mountain
rescue?

Emergency causes



NACA Index

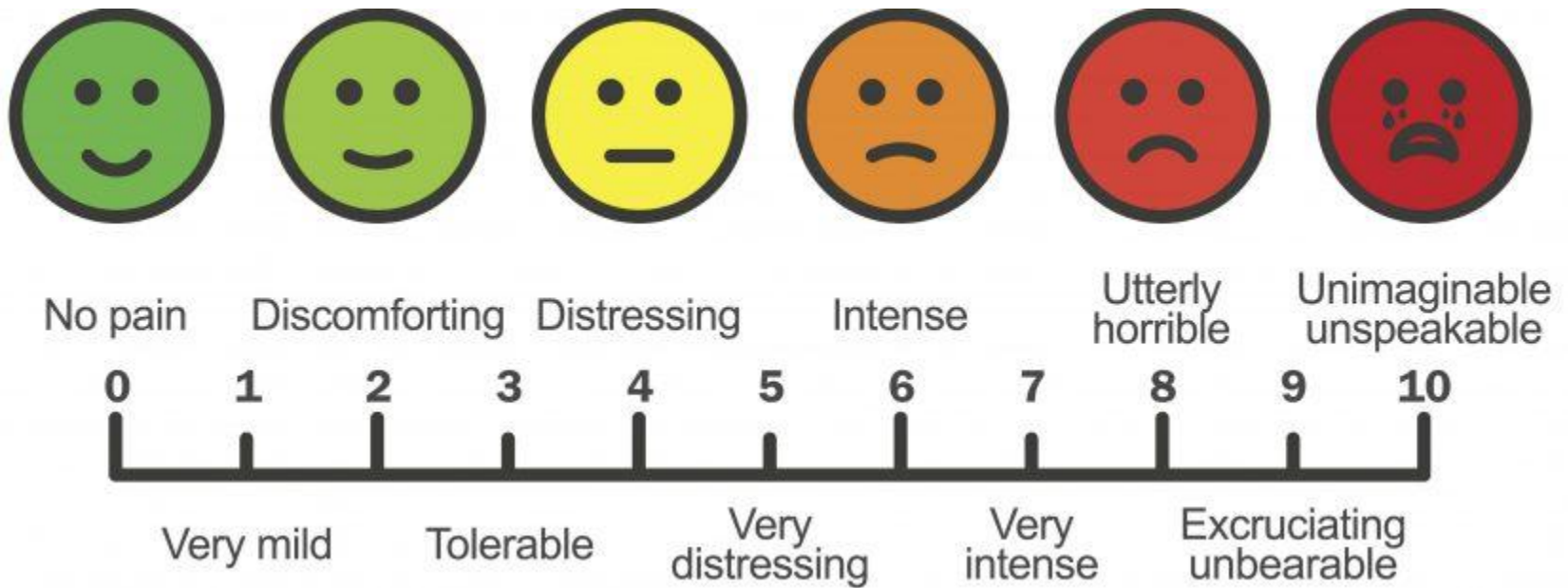
Unknown



Number of people





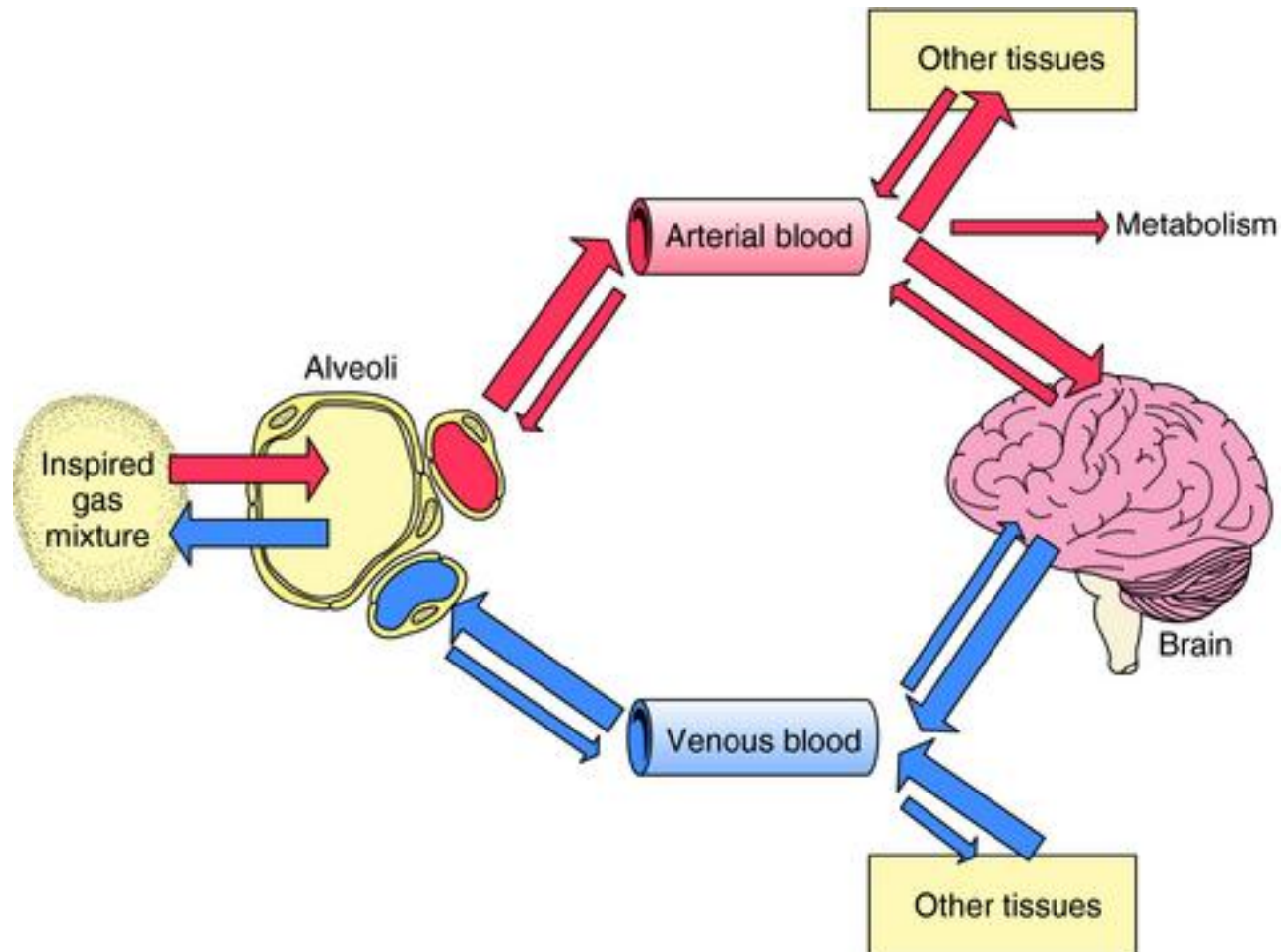


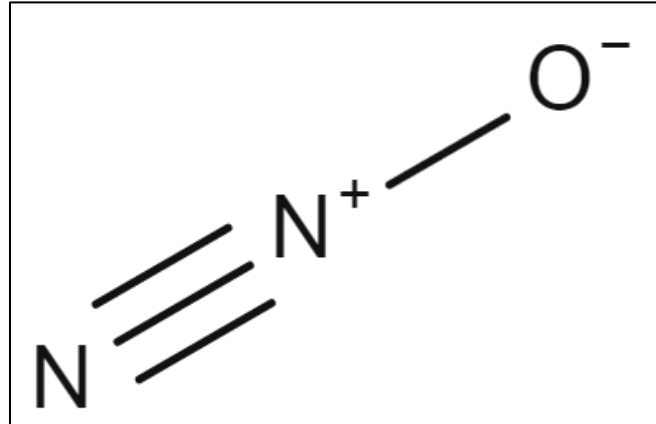




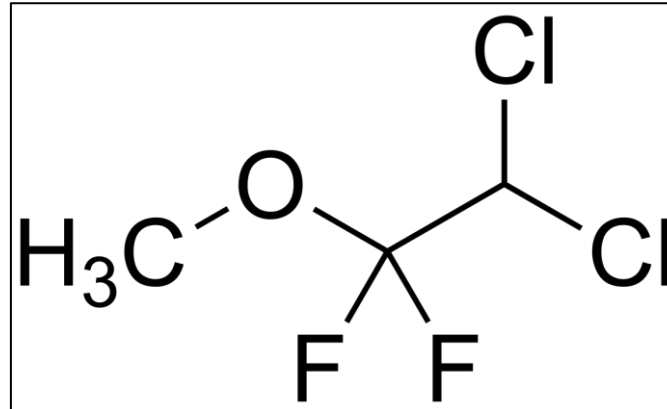
- Ketamin 1.0-3.0 mg/kgBW
- Midazolam 0.2-0.3 mg/kgBW
- Fentanyl 0.002 mg/kgBW
- Morphin 0.1-0.2 mg/kgBW

Pathway of an inhalational analgesic agent during absorption (red arrows) and emission from (blue arrows) the body .
The large arrows indicate the direction of net movement.





- ENTONOX 50:50 mixture nitrous oxide / oxygen.
- Contraindication: Condition where gas is entrapped within a body and where its expansion might be dangerous.
- For immediate use, ENTONOX cylinders should be maintained above 10°C (50°F) for at least 24 hours before use.
- Cylinder 700 l, approx. 4 kg; 350 l, approx. 2.4 kg



- 1960 Methoxyflurane introduced => inhalation anaesthetic for human.
- Doese-related renal tubular damage were reported.
- The US-FDA withdrawn Methoxyflurane in 2005.
- Australia/New Zealand => Methoxyflurane has never been withdrawn.





1968



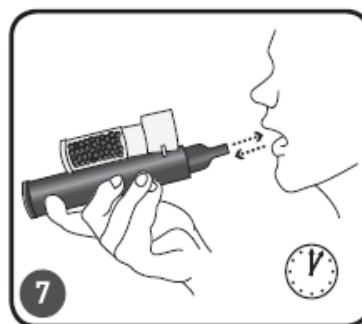
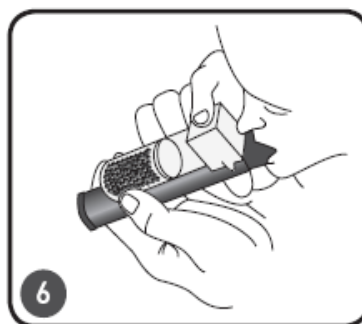
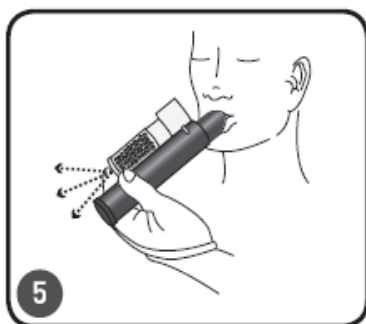
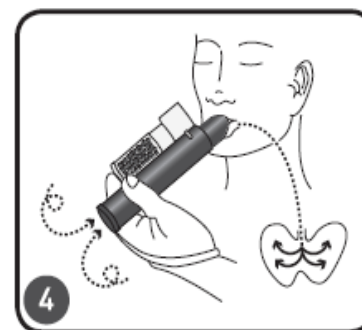
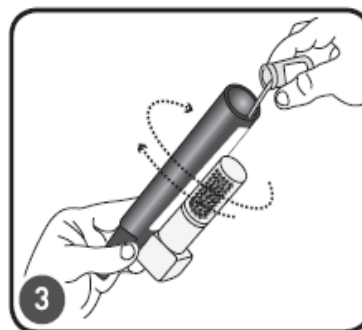
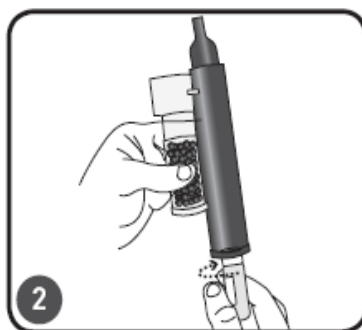
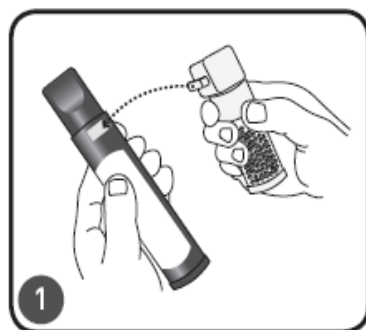
2015

- Analgesic doses => blood concentration 0.6-2.6 mg/100 ml methoxyflurane
- Anaesthetic doses => blood concentration 6-13 mg/100ml methoxyflurane

Anaesthetic	MAC-hours	Serum fluoride level ($\mu\text{mol/L}$)	Blood methoxyflurane level (mg/mL)
Calculated average	1.0	20	10–13
Safe upper limit	2.0	40	20–26
Subclinical toxicity	2.5–3.0	>50	25–33
Clinical toxicity	>5.0	>90	>45
Analgesic	0.3	< 10	0.6-2.6







- Methoxyflurane is contraindicated in renal impairment, and children under 18 years.
- It should not be used in patients with liver damage secondary to anesthesia, hyposensitivity to fluorinated, malignant hyperthermia, diabetes, crush injury, ventilatory depression, reduced awareness, hypovolemic shock.



Mark Zagorski

Director at Mount Beauty and Falls Creek Medical Centres

Albury, Australia | Medical Practice

Current Mount Beauty and Falls Creek Medical Centres

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FALLS CREEK SKI PATROL PENTHRANE ADMINISTRATION REPORT

INTRODUCTION

The data in this report relates to Penthrane administration by the Falls Creek Ski Patrol from 2006 to 2010 and 2013 to 2017, the data from 2011 and 2012 has been omitted due to some invalid data.

Over the ten seasons covered by the data the Ski Patrol attended 12799 call outs transporting 6337 patients to the Falls Creek Medical Centre and administering Penthrane on 1006 occasions. The patrol on average transport 50% of their total call outs to the Medical centre. Penthrane was administered to 16% of patients transported to the Falls Creek Medical Centre.

Year	2006	2007	2008	2009	2010	2013	2014	2015	2016	2017	Total
Total Call Outs	1053	1260	1135	1320	1385	1081	1345	1353	1290	1577	12799
Transport to Medical Centre	612	690	599	616	711	462	630	649	632	736	6337
Transport to Medical Centre %	58%	55%	53%	47%	51%	43%	47%	48%	49%	47%	50%
Penthrane Used	78	104	97	101	97	83	87	96	124	139	1006
Penthrane / Medical Centre%	13%	15%	16%	16%	14%	18%	14%	15%	20%	19%	16%
Penthrane / Total Call Out %	7%	8%	9%	8%	7%	8%	6%	7%	10%	9%	8%



Mark Zagorski

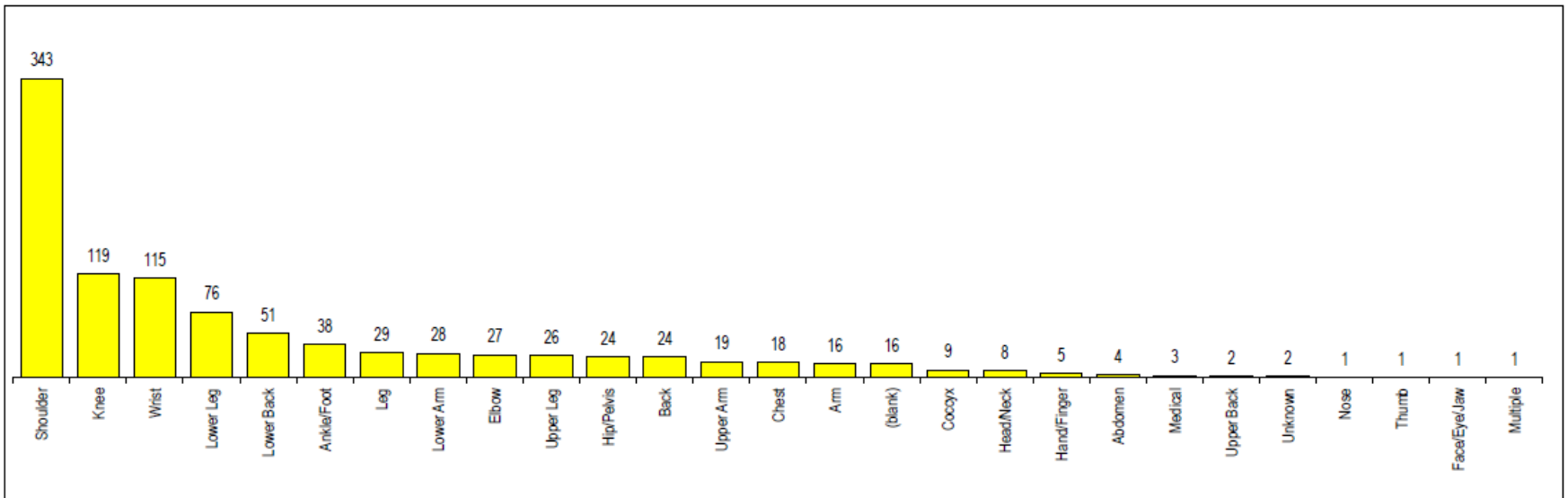
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INJURY TYPE



Injury Type	Shoulder	Knee	Wrist	Lower Leg	Lower Back	Ankle/Foot	Leg	Lower Arm	Elbow	Upper Leg	Hip/Pelvis	Back	Upper Arm	Chest	Arm	(blank)	Coccyx	Head/Neck	Hand/Finger	Abdomen	Medical	Upper Back	Unknown	Nose	Thumb	Face/Eye/Jaw	Multiple	Total
Penthrane Administration	343	119	115	76	51	38	29	28	27	26	24	24	19	18	16	16	9	8	5	4	3	2	2	1	1	1	1	1006



Mark Zagorski

Director at Mount Beauty and Falls Creek Medical Centres

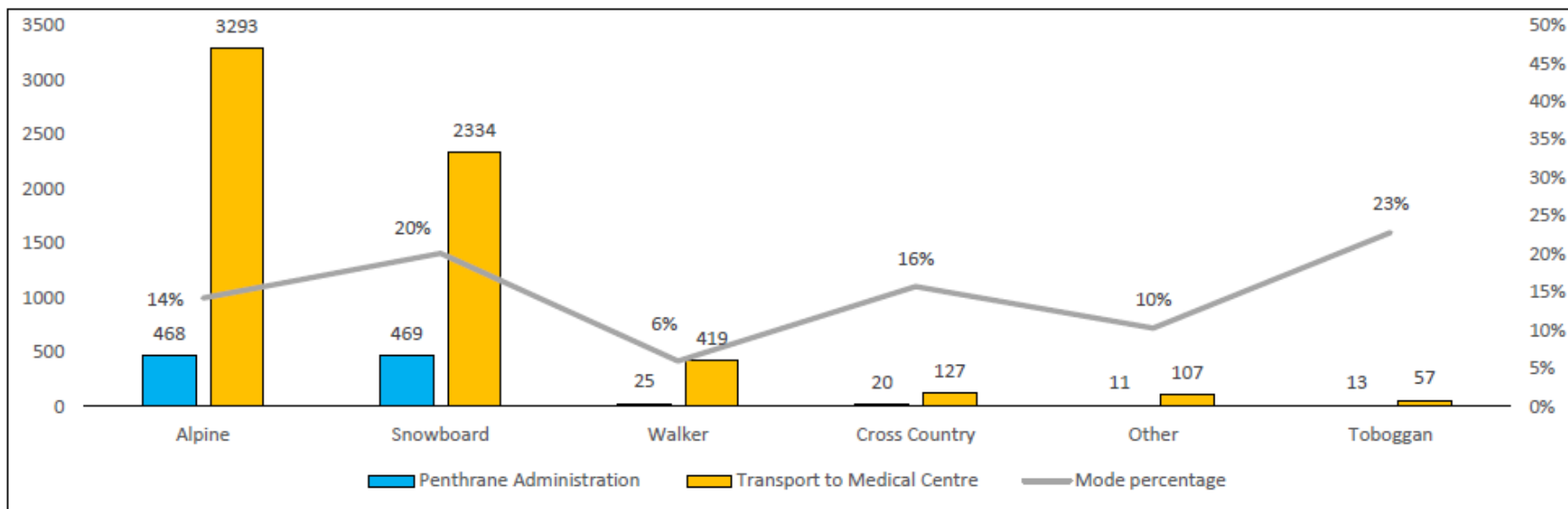
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MODE TYPE



Mode	Alpine	Snowboard	Walker	Cross Country	Other	Toboggan
Penthrane Administration	468	469	25	20	11	13
Transport to Medical Centre	3293	2334	419	127	107	57
Mode percentage	14%	20%	6%	16%	10%	23%



mt baw
baw
Winner: Business of the Year



Australian Ski Patrol Models of Casualty Care, Medication Administration and our Medical Milieu.

Presenter: Dr Rowena Christiansen

Special interests in Pre-Hospital and Wilderness Emergency Medicine

Chair, Australian Ski Patrol Association Medical Advisory Committee

Hon. Medical Officer, Educator/Assessor and Volunteer Ski Patroller, Mt Baw Baw Alpine Resort

Member, Australian Resuscitation Council Victorian Branch and Basic and Advanced Life Support Instructor

Board Member, World Association for Disaster and Emergency Medicine

Medical Educator, University of Melbourne and Ormond College



Medications Scope of Practice

- Ski patrollers may provide to a casualty:
 - *Oxygen*;
 - *Methoxyflurane* (Penthrane/Penthrox); and
 - *Entonox* (50% nitrous oxide/50% oxygen).
- Patrollers must recertify their competency to use these substances on an annual basis.



Ski Patrol Medications

- *Methoxyflurane:*
 - ASPA-qualified ski patrollers normally carry and administer Methoxyflurane on scene to casualties, who are then stabilised and transported to either the medical centre, first aid room or a location where handover to ambulance personnel is possible.



Ski Patrol Medications

Methoxyflurane (Penthrane)

Presentation	<ul style="list-style-type: none"> 3 ml glass bottle with plastic seal
Indications for use	<ul style="list-style-type: none"> Pre-hospital pain relief
Contraindications	<ul style="list-style-type: none"> Pre-existing kidney disease Exceeding total dose of 6 ml in any 24 hour period Lowered level of consciousness (or if the casualty is unable to understand the instructions)
Precautions	<ul style="list-style-type: none"> Pregnancy Penthrox inhaler must be held by patient so that if unconsciousness occurs it will fall from patient's face Patient must be supervised at all times during Methoxyflurane administration
Dose/route	<ul style="list-style-type: none"> 3 ml via Penthrox Inhaler. This will provide approximately 25 minutes of pain relief and may be followed by one further dose once the original dose has expired, if required.
Side effects	<ul style="list-style-type: none"> Drowsiness Exceeding maximum total dose of 6 ml in 24 hour period may lead to kidney damage
Special notes	<ul style="list-style-type: none"> Analgesia commences after 8 - 10 breaths and lasts for approximately 3 - 5 minutes once discontinued Concurrent administration of Oxygen 3 - 8 lpm through the inhaler during use is recommended where appropriate





Ski Patrol Medications

- *Entonox:*
 - Due to issues around storage and transportation, in general, Entonox is used as a ‘second-line’ agent in the first aid room or other location (according to local protocols) to manage only those casualties that require further pain relief beyond the limits of other drug and supportive methods, and where a delay is expected before ambulance handover can be effected.



Ski Patrol Medications

Entonox (Nitrous oxide and oxygen)

Presentation	<ul style="list-style-type: none"> High pressure blue cylinder with white and blue quadrant shoulder (contains 50% nitrous oxide and 50% oxygen) C cylinder - 440 litres
Indications for use	<ul style="list-style-type: none"> Ongoing pain management
Contraindications	<ul style="list-style-type: none"> Chest injuries (tension pneumothorax) Lowered level of consciousness (or if the casualty is unable to understand the instructions)
Precautions	<ul style="list-style-type: none"> Check cylinder before use: no damage, correct colour, intact heat tab Beware of fire or explosive hazards, oils and grease
Dose/route	<ul style="list-style-type: none"> Via demand valve mask
Side effects	<ul style="list-style-type: none"> Nausea Drowsiness
Special notes	<ul style="list-style-type: none"> At temperatures below -7°C the gases in the cylinder may separate. Therefore, the cylinder must be stored in a warm place. When used in the snow, the cylinder must be laid on its side and well insulated. The separation of components can be prevented from occurring by shaking the cylinder before use.



Conclusion

The inhalative administration of analgetics shows clear advantages over intravenous analgesia with regard to invasiveness and practicability in particular for paramedics.

Logistical considerations (such as size, weight of the application systems) must be taken into special consideration in mountain rescue.

Country-specific legal features must also be taken into account during the analgesic application