This version of the ARV manual contains authorised draft material (shaded in green) added subsequent to the manual release in January 2016.

Version posted: 29/07/2016
This document is intended as an operational reference manual and educational resource for ARV clinical staff.

It is to be read in conjunction with all Ambulance Victoria Clinical Practice Guidelines. The Clinical Practice Guidelines developed by ARV and AV for use in the field by MICA and Flight MICA paramedics are appropriate in general and base scope to the range of practice of medical Retrieval Physicians. These CPG’s are overseen by the Medical Advisory Committee and are the initial reference point for ARV clinical practice. All ARV practice occurs within the overarching policy framework of Ambulance Victoria.

The CPG’s are guidelines and do not strictly limit the scope of clinical practice of practitioners, who in certain circumstances may reasonably work beyond or outside of the guideline. ARV medical practitioners are additionally credentialed as advanced trainees and specialist qualified medical practitioners, and work within the scope of clinical practice normally afforded to such a practitioner and as modified within retrieval practice by these and other guidelines and policies including formal credentialing processes.

The application of this manual will be reviewed through the ARV and AV case review and audit system, and appropriate feedback will be available. In addition, all retrieval cases are actively reviewed by a qualified specialist medical practitioner peer.

This manual also contains reference material and clinical recommendations that are specific to the specialist retrieval medical practitioner environment, which do not constitute formal guidelines.

This document is managed within standard AV document tracking systems as a departmental manual. It is endorsed by the AV Medical Advisory Committee. In addition the document contains elements introduced for information or advice which have been added subsequent to the last approval cycle – such items are shaded pending formal review.
INTRODUCTION TO RETRIEVAL SYSTEMS .................................................................8

Retrieval Processes ........................................................................................................9
Clinical Principles in Retrieval and Prehospital Medicine ...............................................13
Controversies / Emerging Issues .....................................................................................17
Australian Retrieval Services ..........................................................................................18

ADULT RETRIEVAL VICTORIA – PROFILE AND ACTIVITY ..............................21
Establishment .....................................................................................................................21
Activity .............................................................................................................................23
REACH .............................................................................................................................26
ARVIS ...............................................................................................................................28
Trauma Victoria ..................................................................................................................30
ARV Website ....................................................................................................................32
ARV Activation Promotion Flyer ........................................................................................33

HR AND STAFF PROCESSES .......................................................................................34
Credentialing .....................................................................................................................34
Fatigue ..............................................................................................................................34
Leave .................................................................................................................................35
Orientation .........................................................................................................................35
Performance Management ...............................................................................................36
Personal Leave / Illness ......................................................................................................36
Roster Process ...................................................................................................................36
Uniform ...............................................................................................................................37
ARV Organisational Structure .........................................................................................38

CASE COORDINATION PRINCIPLES .......................................................................39
Coordination Systems ......................................................................................................39
Coordination Processes and Procedures ............................................................................39
Communication ................................................................................................................40
Setting Goals and Review Points ......................................................................................42
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation for Transfer</td>
<td>43</td>
</tr>
<tr>
<td>Technological Support</td>
<td>43</td>
</tr>
<tr>
<td>Triage</td>
<td>44</td>
</tr>
<tr>
<td>Destination Planning</td>
<td>45</td>
</tr>
<tr>
<td>Logistics</td>
<td>45</td>
</tr>
<tr>
<td>Crew Skillsets</td>
<td>46</td>
</tr>
<tr>
<td>Cognitive Overload</td>
<td>46</td>
</tr>
<tr>
<td>Crew Briefing and Debriefing</td>
<td>48</td>
</tr>
<tr>
<td>Coordination Training and Continuous Quality Improvement</td>
<td>48</td>
</tr>
<tr>
<td>Controversies and Future Directions</td>
<td>48</td>
</tr>
<tr>
<td>Coordination Do’s and Don’t’s</td>
<td>49</td>
</tr>
<tr>
<td>ARV COORDINATION &amp; RETRIEVAL GUIDELINES</td>
<td>50</td>
</tr>
<tr>
<td>Activation of Retrieval</td>
<td>50</td>
</tr>
<tr>
<td>Acute Coronary Syndromes</td>
<td>51</td>
</tr>
<tr>
<td>Aviation Resources</td>
<td>52</td>
</tr>
<tr>
<td>Body Fluid Exposure</td>
<td>53</td>
</tr>
<tr>
<td>Blood and Blood Products</td>
<td>53</td>
</tr>
<tr>
<td>Briefings (Operational Handover)</td>
<td>54</td>
</tr>
<tr>
<td>Call Processes</td>
<td>54</td>
</tr>
<tr>
<td>Case review &amp; Audit</td>
<td>55</td>
</tr>
<tr>
<td>Cardiac Pacing</td>
<td>55</td>
</tr>
<tr>
<td>Clinical Practice Guidelines</td>
<td>56</td>
</tr>
<tr>
<td>Command &amp; Control</td>
<td>56</td>
</tr>
<tr>
<td>Contact and Availability</td>
<td>56</td>
</tr>
<tr>
<td>Continuity and Handover</td>
<td>56</td>
</tr>
<tr>
<td>Coordinator Contact and Availability</td>
<td>57</td>
</tr>
<tr>
<td>Crew Briefing</td>
<td>59</td>
</tr>
<tr>
<td>Crew Mix</td>
<td>59</td>
</tr>
<tr>
<td>Death of Patient</td>
<td>60</td>
</tr>
<tr>
<td>Debriefing (operational)</td>
<td>61</td>
</tr>
</tbody>
</table>
Introduction to Retrieval Systems

The definition of retrieval varies by jurisdiction, however it includes the interhospital transfer of critical patients using specialised clinical staff, transport platforms and equipment. In most regions this definition extends to the prehospital environment when medical staff crewing is deployed and in this setting is termed primary retrieval. In various systems, staff may include medical, nursing, advanced life support (ALS) paramedic, or intensive care paramedic (or equivalents) in a range of combinations or crew-mix. Retrieval generally involves the transfer of patients with critical illness or life-threatening injury: situations where the patient requires the highest levels of clinical care and vigilance. Retrieved patients are often unstable, at the margin of physiological compensation, and in need of specialised investigation and intervention. They are often at that phase of an emergency presentation where diagnosis is incomplete, treatment is problem-focused and risk is high. This setting therefore requires special expertise, risk-averse processes, and fail-safe systems characterized by anticipation, redundancy, rapid response, and reliability. Retrieval is a coordinated process that provides specialised assessment and management, prior to and during transfer of critically ill patients from situations where resources or services are inadequate, to a destination where definitive care can be provided. It aims to deliver the same or higher level of clinical care than that available at the point of referral, thus ensuring that the patient is not exposed to any reduction in the quality of clinical care, despite the inherent risks of the transport environment.

The need for retrieval is related to the limitations of health facilities and the geography of populations. It is a reasonable premise that rural communities have a right to equitable and timely access to Critical Care Medicine however, it is recognised that there is often an urban/rural divide in regard to the accessibility of healthcare generally and to specialised critical care in particular. Key clinical ‘gap’ areas exist at both urban and rural and regional levels in regard to trauma, neurosurgery, cardiac, and neonatal and paediatric critical care. Advances in medicine & technology are inevitably (and at least initially) will usually be concentrated in major metropolitan centres, thus increasing the need for critical patient transport (e.g. coronary percutaneous procedures, interventional radiology such as angio-embolisation, major trauma centres, and paediatric tertiary and quaternary care hospitals. Given that such divides exist, and that critical care transfer is inevitable, retrieval medicine aims to ensure quality of care in transfer in distinction to the somewhat ad hoc approach to irregular critical care transfers that otherwise may be the case in less systematised approaches.

Retrieval Systems are often a product of their geography and some services have evolved due to their unique environment. Examples include Nordic systems and alpine systems that have emerged from the demands of challenging altitude and temperature extremes, urban trauma service (such as HEMS London), and systems driven by the tyranny of distance such as the Queensland retrieval system.

Retrieval systems vary by State and Internationally. There are no uniform system designs or standards, and consequently services vary in their use of transport platforms and crew types (nurse, paramedic, doctor). Staff may be employed by a health department, ambulance service, by contract with a private provider, or a retrieval service may utilise hospital personnel. A state service may incorporate several retrieval service providers with central coordination; alternately, systems exist with local governance and responsibility at a district or area level. Transport platforms are generally state owned and/or operated or are contracted; however non-government owned helicopters may be part of a state system (and have historically received both benevolent and state funding). In the past, such services were the mainstay of retrieval practice and were often initiated by passionate volunteers, being funded by community donations, corporate sponsorship and government grants. Governance systems for such services, and their coordination and performance responsibilities were typically variable. Consequently retrieval systems have evolved, leading to increased systematisation and corporate and clinical governance, aiming at reduction in variation, greater accountability, and increased reliability at the system level.

Most countries have progressively moved towards centralised state systems. These are characterised by central coordination centres that use nurses, paramedics and doctors who work together utilising their complementary skills and experience. Neonatal, paediatric, perinatal and adult retrieval services may be
integrated, collocated or separate, however the trend of recent years is to collocate these services with common governance, to allow synergies to be realised in regard to operational processes, infrastructure, management, education, research, response platforms and clinical staff.

Most retrieval services have developed similar systems for management of the generic operational processes of: patient referral, case coordination, response and logistics, clinical intervention, and destination determination. In addition these are usually supported by a formal array of governance elements:

**Clinical Governance:**
- Guidelines for Coordinators
- Guidelines for Retrieval Clinicians
- Support Staff Guidelines
- Equipment Management Systems
- Orientation and Training
- Professional development
- Clinical Documentation
- Case follow up and feedback
- Case Review and Audit
- Incident Management
- Indicator Measurement
- Credentialing
- Performance Management

**Operational Management:**
- Program Guidelines
- Quality Reporting
- Reporting to Medical Standards Committee
- Management Guidelines
- Data Management
- Organisational Structure
- Contracts and Memoranda of Understanding
- Budget and Financial System
- Annual and Strategic Planning
- Management and Data Reports

In addition States may legislate\(^1\) or learned and academic bodies may publish guidelines and standards to promote safe systems of patient transfer, particularly in the critical care sector\(^2\).

**Retrieval Processes**

**Retrieval Coordination**
Case coordination is at the heart of all retrieval systems. As a process it commences with the initiation of contact from a referral site. It is important for referrers to understand the indications for retrieval and

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to have clear guidelines (both system and local) to encourage early referral and good decision-making. Statewide trauma systems and neonatal paediatric care systems often have well established transfer criteria however processes for other clinical groups are often less developed and may be ad hoc. Mature retrieval systems act as a single point of entry for the referrer, preferably providing services by initiation of a single call to a system wide phone number. Coordination staff are appropriately qualified senior clinicians, with specialised training and knowledge. Case coordination fundamentally answers: what are the needs of the referrer and their patient? Are the needs for clinical advice, for organisation of transport and crew, or for assistance in obtaining an appropriate destination for a critical patient? The coordinator must determine quickly and efficiently the planning and intervention priorities for each case. These may be for immediate care or advice, immediate response, destination planning, or consideration of complex decisions involving logistics, crew or transport platforms. Coordinators need to display leadership whilst at all times taking a systems perspective and avoiding tunnel vision or task fixation. Coordination must be provided through high performance organisations, and typically utilizes sophisticated communication technologies such as multiparty conference calls, telehealth videoconferencing, case recording and comprehensive data management systems. Coordination of retrieval also implies an ongoing process of communication and feedback with the referrer of case progress, estimated response times, and knowledge of patient status changes. During the response and transfer phase the coordination centre maintains communication with response teams, providing logistic support and mission oversite.

**Transport platforms**

Retrieval services generally use road, rotary wing (helicopter), or fixed wing aircraft response and transport platforms. For international retrieval missions, commercial larger jet transport is used, and in uncommon settings, aquatic transport platforms may be used. In consideration of platform selection for a mission, clinical factors must be factored first; these will include need for pressurization, need for space for specialised crew or equipment, and patient size. Further to these factors, urgency (of response or return leg or both outbound and return components), distance to referral hospital, availability of helipads at referral and destination hospitals, and need to minimize the out of hospital time for the patient. Heightened risk for patients in transit is experienced during platform transfers (from bed to trolley to ambulance to aircraft stretcher and so on) and in general terms in the out-of-hospital setting. Minimization of number of patient transfers and the out-of-hospital time for the critical care retrieval patient are important principles.
Road transport platforms should be specifically designed and fitted out for retrieval purposes to minimize variation (improving crew performance and safety) and the risk of ad hoc unsecured equipment placement. Use of helicopters (with crews of appropriate skill mix) in retrieval response has been demonstrated to improve patient outcomes\(^3,4\), particularly patients with severe trauma and others with a need for time critical interventions. In general, helicopter transfer is considered for retrieval of patients approximately 75-175 km from base, with road response used for shorter transfers and fixed wing for longer. These broad recommendations will vary depending on road, geography and climatic conditions and on the performance characteristics and landing options for individual aircraft. Fixed wing transfers have the advantage of providing a (usually) pressurized aircraft, greater speed and comfort, more space, and a controlled temperature. Rotary wing aircraft have advantages of door-to-door transfer where helipads exist at referral and destination sites, the primary response capability, and the potential to avoid road transport legs and multiple patient transfers. Road transfer offers spatial flexibility, door-to-door transfer and cost efficiency.

Figure 1 Retrieval transport platform allocation grid for fixed wing, helicopter and road transport based on distance vs transport urgency of either the response leg or the patient transfer leg of the retrieval mission.

**Crew**

Staff selected for roles in retrieval must meet required professional and personal standards. Critical care capability is essential, and medical staff specialist training in a critical care specialty is desirable. Similarly, nursing and paramedic staff must be trained to intensive care practitioner level. In addition all

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3 Brown, Joshua B. BA; Stassen, Nicole A. MD; Bankey, Paul E. MD, PhD; et al, Journal of Trauma-Injury Infection & Critical Care. 70(2):310-314, February 2011.
4 Brown, Joshua B. BA; Stassen, Nicole A. MD; Bankey, Paul E. MD, PhD; et al, Helicopters and the Civilian Trauma System: National Utilization Patterns Demonstrate Improved Outcomes After Traumatic Injury, Journal of Trauma-Injury Infection & Critical Care. 69(5):1030-1036, November 2010
staff must have specific training in management of the retrieval environment, clinical care in transport settings and personal and crew behaviours. The retrieval environment poses particular risk, and technical training regarding platforms, procedures, relevant legislation, communication methods, rescue and escape procedures, and equipment performance characteristics is needed. Training in clinical care during retrieval needs to ensure capability in management of the complete range of critical care, trauma and intensive care scenarios, and an ability to apply depth of clinical knowledge to the relatively compact window of patient care that the retrieval mission represents. Practitioners need to understand in a retrieval setting: that an intervention may be possible and ideal whilst also being inappropriate and inefficient or, that an intervention may be desirable but not be possible or practical. Compromise and pragmatism have a role in pre and interhospital transfer particularly where priority exists for reaching a definitive care destination. Training in personal and crew behaviours is necessary to optimize the cohesiveness and functionality of the retrieval team – formal exposure to crisis resource management tools is a standard component of aeromedical and road based retrieval education. In interaction with referring practitioners and primary responders, the retrieval team needs to exhibit empathy, listening skills and professional behaviours – avoiding arrogance, premature conclusions or judgmental behaviour. The training and knowledge base required is significant, therefore training processes must be formalized and must be supported by ongoing professional development and regular credentialing in addition to compliance with relevant regulations. Crew safety is paramount, so personal protective equipment and clothing which meets aviation and ambulance service standards is mandatory. Safety risk arises also in long and/or overnight missions, and crewing must be adequate to allow sharing of clinical vigilance duties and patient interventions at times of fatigue, and to allow for adequate breaks and rest. Retrieval services play a major role in disaster response and management and generally provide a significant component of the early response to such incidents. Retrieval services and in particular their coordination processes are also key to the distribution and reception phase of the disaster response – providing system overview of capability and capacity of health services to receive victims. Retrieval staff must therefore be trained to expert status in this discipline.

**Skillsets**

Retrieval medicine and primary response aeromedical settings provide the most challenging of all clinical environments, and therefore choice of staff skillsets and professional team makeup is fundamental to optimising clinical outcomes. The central tenets of this clinical environment are that a critical care retrieval team must consist of (at least) two professionals. They must be trained to critical care standard and work within their core scope of practice. The skill set they provide must meet the clinical needs of the patient. In most national and international jurisdictions blended medical practitioner and paramedic or nursing crews satisfy these tenets. Significant literature supports the role of medical practitioners in this environment due to the additional diagnostic capability, procedural range, extent of knowledge, and depth of clinical understanding they contribute. Such skills are complemented by the skillset of critical care trained nursing staff. Paramedic staff contributes substantial critical care capability (depending on individual jurisdictional training levels) together with expertise in the transport and prehospital scene environments. Crews comprised of paramedic or nursing practitioners must have specific training in management of the retrieval environment, clinical care in transport settings, and personal and crew behaviours.

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staff paired in various combinations and without a medical crewmember are appropriate for lower risk critical care transfers, or for non-critical-care retrieval. Skill set needs to match the requirements of the patient in the basic dimensions of clinical complexity and physiological stability; the more unstable and complex patient clearly requiring a higher skill mix in the retrieval team. In rare situations, and where life saving intervention may be possible, the transport of highly specialised clinical staff to the patient may be appropriate and should be considered, for example transporting a surgeon to perform an infield amputation on an entrapped patient.

Figure 2 Crew skill set matches the clinical requirements of the patient

Equipment
Within a retrieval service, equipment should be standardized as far as possible. Response kits and platform layouts will then be familiar to all practitioners at all times, including at night and during uncontrolled clinical emergencies. Equipment must meet the needs of the patient population or therapeutic interventions, and must consider the operating environment, mission duration, availability of electrical power in transport platforms, oxygen consumption, and standard oxygen supplies available in vehicles. Stretchers and equipment bridges must meet aviation engineering standards, as must all electrical equipment that may be used in aircraft.

On all missions, the retrieval practitioner must have access to the complete range of airway management equipment including a difficult airway kit, cardiac monitor defibrillator pacer, multiple infusion pumps appropriate for inotrope infusions, a transport ventilator capable of complex respiratory support, invasive pressure monitoring, temperature monitoring, capnography and oximetry. All equipment must be maintained to the highest level of biomedical support and be fitted with appropriate auditory and visual alert systems. A comprehensive range of drugs is necessary to cover the spectrum of clinical presentations and scenarios encountered in the retrieval setting. These should be maintained in sealed drug kits, with attention paid to expiry dates and to temperature control where relevant. The retrievalist will also require access to antivenoms, thrombolytics, blood and blood products and other specialised agents at times – systems must be in place to ensure timely access to uncommonly used pharmacologic agents.

Clinical Principles in Retrieval and Prehospital Medicine

Preparation for Transport
In many cases the referral of a patient for retrieval is an uncommon event that may occur at one site perhaps once or twice each month and which may involve individual staff members only once or twice per year. Therefore clear understanding and communication of the needs of the critical care patient for transfer must be in place. Common dilemmas are faced:

- Does patient require intubation for transfer?
- If so, should they be intubated now, later or wait for the retrieval team to arrive to intubate patient?
- What IV access does the patient require? CVC? Arterial line?
- Drug and Equipment Compatibility - What will the retrieval team expect? What will they want to take with them?
- What if the patient’s clinical status changes?

Airway management is perhaps the greatest risk in the critical care retrieval setting. The need for intubation for transfer should be discussed between the retrieval coordinator, referring staff and the retrieval team. In general terms the patient should be intubated if needed for respiratory failure, or if significantly aggressive, agitated or obtunded, or if their clinical condition makes it likely that they will deteriorate enroute e.g. large intracranial haemorrhage, complete cervical cord injury, or if they have threatened airway obstruction e.g. burns, epiglottitis which would present a high risk in-transit intubation.

The following general principles should be applied systematically in the preparation of patients for retrieval:
PREPARATION FOR RETRIEVAL

Careful Preparation for Retrieval Transport Improves Care & Reduces Risk

ENSURE PATIENT AIRWAY SAFETY
1. Assess airway stability for all patients
2. Secure endotracheal tube
3. Record size and lip length
4. Oro-gastric tube placed
5. CXR to confirm position of endotracheal tube

ENSURE OPTIMISED OXYGENATION
1. Observe respiratory rate and character
2. Measure SpO2 and ETCO2
3. Administer oxygen using the correct delivery device
4. Check ABG’s if indicated
5. Secure intercostal catheters if present

ENSURE IV ACCESS & MANAGEMENT
1. Insert two peripheral IV lines
2. Secure all lines – ensure injection ports are accessible
3. Prepare drug infusions in 50 ml syringes
   For advice on infusion concentrations call ARV
4. Record all IV fluids
5. Transduce all arterial and central lines

ENSURE COMPLETE PATIENT DOCUMENTATION
1. Complete ARV on-line or telephone referral
2. Provide copies of all patient charts
3. Investigation results – pathology & ECG
4. Imaging – films / scan / MRI
5. Please advise any ‘limitation of treatment’ orders

OTHER
1. Maintain body temperature
2. Consider indwelling catheter – maintain Fluid Balance Chart
3. Empty drainage bags prior to transport
4. Administer antiemetic and analgesia as required
5. Maintain spinal precautions if indicated

ALERT
It is important that you notify the ARV Coordinator of:
1. Significant deterioration in –
   - Conscious state
   - Respiratory status
   - Blood Pressure
   - Oxygenation
   - Heart Rate
2. Major clinical developments such as significantly abnormal diagnostic tests, new clinical signs etc
3. The need for major interventions prior to the retrieval team arriving (e.g. intubation, surgery etc)

1300 36 86 61 Statewide 24 hours
Monitoring

Monitoring equipment used in transport should be in accordance with recommended jurisdictional standards. Most patients require at least continuous ECG, pulse oximetry and blood pressure monitoring. In addition, capnography, invasive pressure monitoring, temperature, ventilation and other monitoring may be required. Equipment must be selected carefully, and where possible be integrated. Sophisticated light, transport-specific, multimodal monitoring units are now available which include the above components plus defibrillation and external pacing capability. Display screens must be visible in daylight and battery life must be appropriate for duration of transport. Equipment alarms must be clearly visible as auditory alarms are difficult or impossible to hear in moving vehicles, especially aircraft. A major component of any monitoring system is the observer, and in the retrieval setting, the need for vigilance is paramount; at all times at least one of the retrieval crew members must be absolutely focussed on the patient and monitors, continually scanning measured parameters and clinical status (including temperature, peripheral circulation, urine output, conscious state and respiratory oscillation).

Environmental Impacts

Transport environments are usually confined and limited in space, which may present hazards for all staff, the patient and equipment. Care, deliberate planned actions and vigilance are important as is the need to ensure all equipment is secured (and equipment that is needed is accessible). Planned exercise, movement, nourishment, breaks and fatigue avoidance must be considered, depending on the mission characteristics. Aircraft retrieval presents particular challenges. Altitude results in reduction in barometric pressure and associated reduction in partial pressure of oxygen and expansion of gas within enclosed spaces. Expansion of gas (such as in an undrained pneumothorax, or in a distended bowel) may result in pain or significant worsening of underlying pathology. In a normal person with sea level SpO2 of 98%, and without supplemental oxygen, SpO2 decreases to about 90% at 3000m altitude (10,000 ft.). Most passenger jet aircraft are routinely pressurised to around 8000 ft., however some aeromedical platforms may be able to be pressurised to sea level, whilst some (including most helicopters) cannot be pressurised at all. In patients with respiratory and cardiac disease impacts are felt at lower altitudes. During descent, trapped gas will occupy less space causing contraction of flexible tissues such as membranes and mucosal surfaces – this may cause pain for example when middle ear or sinus space pressures cannot be equalised with the rising external atmospheric pressure. Air transport of patients with decompression sickness requires particular planning and care, since the condition may be significantly worsened at altitude as gas solubility in blood decreases with altitude (due to reduced barometric pressure), and dissolved gas comes out of solution in the circulation, forming nitrogen bubbles with devastating consequences.

Other impacts of flight include those due to noise, vibration, humidity, gravity, acceleration and deceleration, third space effects (swelling), and fatigue.

Critical Incidents

It is likely that the most complex patients receiving the highest levels of support are also most likely to be exposed to in-transit critical incidents or equipment failure. A component of clinical practice in this setting is therefore the anticipation of such events, vigilance to detect them and rehearsed and standardised problem solving algorithms to rectify them. Examples include: ventilator failure, unexpected hypoxia, high airway pressures, cardiac arrest in flight, etc. Such approaches are routine in the aviation industry, from which retrieval and prehospital medicine draws much at a cultural level, and have been applied commonly in anaesthesia.


**Respiratory Support**

Provision of appropriate oxygen therapy via correct delivery systems will be required for most retrieval patients. Oxygen supplies vary on different patient transport platforms, and these must be checked prior to transport. Assisted ventilation is a frequent intervention in critical care retrieval and must be approached with discipline. A reliable and capable transport ventilator will provide suitable ventilation mode options including Intermittent Positive Pressure Ventilation (IPPV), Synchronised Intermittent Mandatory Ventilation (SIMV) and Pressure Support. Non Invasive Ventilation (NIV) methods are not commonly utilised in air transport, however may be valuable in road transfer, and in retrieval of patients in whom intubation and assisted ventilation may be undesirable or contraindicated, or in patients for whom short term assisted ventilation is indicated. Ventilators are almost universally power dependant so back up ventilation systems (manual self inflating bag/valve system) must be available at all times in the patient cabin to allow management of power, gas or mechanical failure.

**Circulatory Support & Infusions**

Intravenous infusions are best delivered using simple and compact syringe drivers. These are available in various sizes and configurations, including banks of multiple syringes. Each retrieval service and preferably the jurisdiction in which it operates should maintain standard infusion protocols for preparation, labelling and administration of therapeutic agents and in particular inotropes. Use of syringe systems that have error reducing software and programs integrated in them reduces risk of adverse events and patient harm. The retrieval environment is dynamic, and attention must be paid to maintenance of infusion rates during transfer and power interruption. Critical patients are often highly dependent on inotropic support and brief periods of interruption of infusions may be associated with catastrophic circulatory collapse. Adequate fluid volumes and spare syringes which are pre-prepared for longer transfers must be planned for, as must the availability of blood and blood products which may need significant coordination.

**Infectious Risk**

The proximity of the retrieval environment means that patients with infectious diseases may present hazards to medical crew, flight crew including pilots and other patients or passengers. Clearly the application of universal precautions against infectious diseases is applicable as in all clinical settings however other measures may be important such as use of ventilator expiratory filters, avoidance of use of nebulisers which may for instance aerosolise influenza, use of prophylactic medications such as rifampicin after prolonged exposure to meningococcal disease, barrier precautions in patients with vancomycin resistant enterococci (VRE) and so on.

**Highly Specialised Retrieval**

Neonatal, obstetric and paediatric specialised retrieval systems have been a part of many health systems for decades. Whilst the clinical demands of these systems require particular sets of knowledge, the retrieval frameworks required are complementary and intersect with the larger and higher volume world of adult retrieval and prehospital care. Consequently blending, collocating or integrating retrieval services is seen as a sustainable model and has become more common. Technical advances in critical care such as increased use of extracorporeal membrane oxygenation (ECMO) support in severe respiratory failure for example influenza have promoted the development of specialised retrieval systems to manage these highly fragile patients. Interestingly, in response to these needs, technology has evolved rapidly to offer lighter, smaller, less invasive and simpler ECMO systems.

**Controversies / Emerging Issues**

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Increased centralisation is a consistent feature in Australian retrieval (and internationally). Where states and regions previously may have had multiple systems for retrieval, it is more common now to see single coordinated systems with improved governance. In addition, there is a nationally progressing movement for co-location of adult and paediatric services, integration of these services, and for the increased formalisation of the role of retrieval and prehospital medical services in disaster medicine. Building economy and efficiency from such commonality in systems is a driver for these developments, however such benefits and advantages often require cultural and system readjustment and therefore may remain unrealised whilst change is managed. Building on relevant interfaces which are a strong part of retrieval work is a common theme so that movement of retrieval services into management of critical and acute care bed flow and access management, outreach and support, telehealth and education is being seen. Retrieval and prehospital medicine in Australia is moving progressively to specialist status within academic colleges and has fully reached this point in some countries. Formal training systems and qualifications are evolving in both the tertiary education sector and in specialist medical college settings.

**Further Reading**
Cases in Pre-Hospital and Retrieval Medicine, Textbook, Ellis D and Hooper M, Elsevier Pub, 2010, Sydney.

**Australian Retrieval Services**

**Victoria: (ARV)**
Adult Retrieval Victoria (ARV) is a business unit within Ambulance Victoria. It is responsible for the coordination of adult emergency retrieval services within Victoria. It also and provides clinical advice relating to the management of time critical patients requiring retrieval, and facilitates access to intensive care and coronary care beds across Victoria. It is the access point for transfer of all major trauma patients between hospitals, and provides a telehealth critical care support service to much of the state. ARV transfers critically ill adults throughout Victoria, Tasmania and southern NSW. It handles 4500 critical care cases per annum, coordinating about 2500 retrievals, and providing broader clinical support to Ambulance Victoria including communications, authorization of aspects of paramedic practice, and advice to clinicians. ARV has a very limited role at present in primary response, multi-victim incidents and disaster response. The Paediatric Infant Perinatal Emergency Retrieval Service (PIPER) is located at the RCH as of 2011 and have an evolving common governance system. They share initial call taking systems however functionally remain distinct and have no coordination overlap with AV. PIPER transfers critically ill children from hospitals throughout Victoria, Tasmania, and southern New South Wales to the Royal Children’s Hospital and Monash Medical Centre in Melbourne. PIPER also provides telephone advice to doctors, nurses, and ambulance staff on the resuscitation of critically ill children. They manage approximately 900 cases per annum of which about 50% are acutely retrieved. PIPER provides transportation of sick newborn infants, continuing education in perinatal care and clinical advice regarding care of sick newborn infants. They manage approximately 1000 emergency cases per annum.

The service also provide maternity care providers in Victoria with a coordinated, timely and safe approach to facilitating perinatal emergency transfers to appropriate facilities when required, providing

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12 Intercollegiate Board for Training in Pre-hospital Emergency Medicine, Sub specialty training in prehospital and retrieval medicine - A guide for trainees, trainers, local education providers, employers and deaneries, College of Emergency Medicine, London, UK, 2012.
access to obstetric and neonatal resource information and providing access to optimal expert clinical advice about perinatal emergencies.

**Tasmania - TMRS**
The Aero-medical and Medical Retrieval Division (AMMRD) of Ambulance Tasmania (AT) provides interfacility transport and mobile critical care for patients requiring movement within and outside Tasmania. AT utilises a range of transport options for Aero-medical and Medical Retrieval activity which includes road ambulances, the fixed wing air ambulance, special operations vehicles and occasionally the Tasmania Police rescue helicopter. Adult and paediatric retrievals are performed by the AMMRD with a team based in Launceston, while neonatal and limited paediatric retrievals are performed by the Neonatal Emergency Transport Service (NETS) based in Hobart.

**South Australia – MedSTAR**
Medstar Emergency Medical Retrieval Service came into existence in 2009 following the amalgamation of several individual hospital based retrieval services and it subsequently became part of SA Ambulance Service (SAAS). MedSTAR coordinates all adult, paediatric and neonatal retrievals as well as primary medical responses. Call taking and clinical coordination is collocated within the SAAS call centre in Adelaide and the operational base is located at Adelaide airport. Neonatal and Paediatric coordination/advice is located at specialist hospital sites, however all operational teams, including paediatric and neonatal response crews are located at the MedSTAR base. Pre-Hospital and Retrieval teams are comprised of medical plus nursing or paramedic crew members. Medstar also plays an integral role in the State medical disaster response at both coordination, field response and Ausmat levels.

Total caseload is approximately 3750 per annum of which 2500 are retrieval. About 70% of cases are adult retrieval, 12.5% paediatric, and 17.5% neonatal. Response platforms are road 40%, RW 25%, and FW 35%. MedSTAR has recently taken over the clinical coordination of all aeromedical aviation movements from the RFDS in SA and as such will be responsible for approximately 5000 more cases per annum.

MedSTAR currently has limited involvement in critical care bed management usually helping resource limited country facilities to find beds. Other referrers (eg ICU to ICU) are required to obtain a destination for IHT patients themselves.

**Queensland**
Retrieval Services Queensland: paediatric, neonatal & adult retrieval coordination services were combined under a new retrieval system in 2009. All calls for any of the specialties and the early notification of trauma are directed to a single statewide number. Initial call taking is managed by critical care nurses who are supported by a collocated medical coordinator. Specialised cases (NETS, PETS, Obstetric then access individual medical coordinators at rostered sites). The service also coordinates all aeromedical responses (primary and interhospital transfer). It utilizes highly systematized telehealth technology across the entire state to assist in patient assessment and clinician support. The service handles approximately 20,000 calls per annum, resulting in about 6000 high acuity transfers of which 4000 are medical crewed. QAS has limited intensive care paramedic capability, and therefore relies heavily on medical staff crewing.

The RCQ directs callers to their area of required specialty and liaises with Queensland Ambulance Service (QAS), Royal Flying Doctor Service, Community Helicopter Providers and contracted services. All Retrieval Medical staff and some coordination staff are contracted from Careflight.

The Queensland service is closely integrated with the State disaster response system and played a significant role in recent natural disasters, bridging knowledge and communication gaps between existing critical care systems and the extraordinary civil and health responses required during these events, and providing FEMO and medical coordination roles.

**NSW - AMRU**
The Aeromedical and Medical Retrieval Services Division (of Ambulance) comprises the Aeromedical Operations Centre (AOC), the Aeromedical Retrieval Unit (AMRU), fixed wing services and rotary wing services. It is staffed by Ambulance uniformed personnel and critical care clinicians and provides clinical care and statewide air transport of patients from pre-hospital locations and IHT. Most patients that are transported by fixed wing aircraft are cared for by flight nurses.
Urgent responses to major accidents and emergencies are usually provided by helicopters staffed with a paramedic/doctor crew mix. IHT’s of critically ill patients are done using either a doctor/paramedic or doctor/nurse crew.

In the greater Sydney area, the service performs approximately 2800 medical retrievals of which 75% are IHT and 25% are primary response. Cases are distributed across rotary, fixed wing and road platforms in the ratios of 45%, 10% and 45% respectively.

The unit also provides the infrastructure and systems for the state-wide medical disaster response, coordinating medical and ambulance response to disasters.

**Western Australia**

RFDS based system (RFDS governance), utilising mixed RFDS, Careflight aircraft, and Paramedic Primary response.

The West Australian retrieval system is currently under review, with significant changes foreshadowed

**Northern Territory**

Centralised clinical coordination is in place, with strong links to RFDS

Medical Staff from Alice Springs and Darwin principally, and are part State and part Careflight resources.

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Section reproduced and adapted with permission from A/Prof M. Kennedy & Oxford Handbook of Retrieval Medicine, 2015.
Establishment

In April 1993, the Office of the Coordinator of Emergency and Critical Care Services commenced operation of the Medical Emergency Adult Retrieval Service (MEARS). In 1999, the Department of Human Services released the Review of Trauma and Emergency Services – Victoria 1999 (RoTES) report. RoTES was the final report of the Ministerial Taskforce on Trauma and Emergency Services and the Department Working Party on Emergency and Trauma Services and provided a framework for the management of trauma known as the Victorian State Trauma System. RoTES made recommendations relating to adult retrieval and transfer and proposed a retrieval service model be developed by a consultancy for further consideration. KPMG Consulting were engaged to review adult emergency retrieval and delivered the Service specifications for medical retrieval services in Victoria final report in March 2001.

The KPMG report led to the establishment of the Victorian Adult Emergency Retrieval and Coordination Service (VAERCS) which subsumed the responsibilities of the Office of the Coordinator of Emergency and Critical Care Services and Medical Emergency Adult Retrieval Service. VAERCS commenced operations in 2002 under the auspice of St Vincent’s Health. A further Department of Health review in 2006, led to the transition of VAERCS to Adult Retrieval Victoria (ARV) as a business unit within the Ambulance Service in November 2007, with the service becoming active from January 2008. Subsequently, medical retrieval and coordinated critical care interhospital transfer has increased in volume significantly, building on the logistics and communication infrastructure of ambulance. The role of retrieval in major trauma transfers has increased dramatically, and has been associated with continuing improvement in clinical care and transfer times for patients not transported to an MTS directly from the scene.

The DHS working party involved in the transition of VAERCS to Metropolitan Ambulance Service (MAS) identified ten principles of an effective and efficient retrieval service to be incorporated in the new ARV service model:

- Standard operating procedures to include single activation process, standardised equipment and protocols, occupational health and safety standards, staff competencies, appropriate patient escorts, risk management strategies that include hospital and retrieval service feedback across the continuum of patient care.
- One-stop shop with a single telephone number to access retrieval service for medical advice, critical care bed, and retrieval activation.
- Central governance structure accountable for retrieval service conduct and outcomes.
- Operational integration including coordination with ambulance, health and interstate service providers.
- Clinical Governance processes for retrieval benchmarks, data collection, analyses and comprehensive reporting.
- Centralised service with dedicated 24/7 medical teams coordinated by a physician, and including regional and metropolitan retrievalists.
- Comprehensive system to include delineated hospitals that are resourced appropriately, suitable transport platforms, equipment and patient escorts in a timely and risk affirmative environment.
- Accessible statewide retrieval service and awareness, including access to critical care beds.
- Promote health service participation within the retrieval system.
- Early warning and activation.

Subsequently, business transition occurred from St Vincent’s Hospital to the Metropolitan Ambulance Service (later merged with the Rural Ambulance Service to become Ambulance Victoria). Staff were recruited including a new Director, medical and administrative staff, and the service commenced working from Brady Street Ambulance Base (South Melbourne). Basic governance and clinical systems were established, and extensive communication and consultation initiated through 2008.

Through extensive internal and external consultation, the ARV SIP was developed in 2008 and released in January 2009. This document represented the development of a 3-5 year future strategy for the
service. It outlined the proposed future direction and future service model of adult retrieval services and critical care bed management and access arrangements across the state of Victoria for the next three years and beyond. It also identified service costs and funding requirements to effectively manage an expanded service. The principle outcomes of the SIP included:

- A more integrated, comprehensive efficient and effective adult retrieval service operating across all of Victoria
- A responsive and flexible workforce to meet a growing service demand
- A retrieval system designed to have a strong patient focus, and to utilise state-wide resources to support patient outcomes
- Improved response times through at-base staffing, increased rotary platform availability and encouragement of early activation
- Extended availability (7 day coverage) of medical regional retrieval capability in existing locations, and an expansion of medical capability across the state (not restricted to 3 of 5 DHS regions)
- The opportunity to share resources and capability within an entire neighbourhood and thereby attract and retain more staff and increase retrieval roster coverage
- A more integrated and seamless approach bringing together staffing and logistical resources in a fully integrated way
- Extension of the Service to cover high risk metropolitan retrieval activity to ensure the right level and quality of service and to reduce the risk of scarce hospital resources being removed from the overall health system
- Improved platform arrangements (e.g. increased helicopter availability and opportunity for specialist and/or dedicated road vehicles to support metropolitan retrieval and short haul regional retrievals)
- Medical retrieval and critical care co-ordination skills being used to support other service delivery activities within Ambulance Victoria
- A more productive, efficient, higher quality and cost-effective service
- A knowledge based agency, active in retrieval research, becoming a national leader in retrieval services
Activity

Case and Retrieval Activity

Case Rate by Region and Date

<table>
<thead>
<tr>
<th>Region</th>
<th>Total</th>
<th>Region</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro</td>
<td>967</td>
<td>Metro</td>
<td>21.13%</td>
</tr>
<tr>
<td>Gippsland</td>
<td>890</td>
<td>Gippsland</td>
<td>19.45%</td>
</tr>
<tr>
<td>Loddon Mallee</td>
<td>708</td>
<td>Loddon Mallee</td>
<td>15.47%</td>
</tr>
<tr>
<td>Hume</td>
<td>662</td>
<td>Hume</td>
<td>14.46%</td>
</tr>
<tr>
<td>Barwon South West</td>
<td>548</td>
<td>Barwon South West</td>
<td>11.97%</td>
</tr>
<tr>
<td>Grampians</td>
<td>450</td>
<td>Grampians</td>
<td>9.83%</td>
</tr>
<tr>
<td>Undefined (eg prehosp consult)</td>
<td>262</td>
<td>Undefined (eg prehosp consult)</td>
<td>5.75%</td>
</tr>
<tr>
<td>New South Wales</td>
<td>79</td>
<td>New South Wales</td>
<td>1.73%</td>
</tr>
<tr>
<td>Australian Capital</td>
<td>3</td>
<td>Australian Capital</td>
<td>0.07%</td>
</tr>
<tr>
<td>Territory</td>
<td>3</td>
<td>Territory</td>
<td>0.07%</td>
</tr>
<tr>
<td>Tasmania</td>
<td>3</td>
<td>Tasmania</td>
<td>0.07%</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>2</td>
<td>Northern Territory</td>
<td>0.04%</td>
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<tr>
<td>South Australia</td>
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<td>South Australia</td>
<td>0.02%</td>
</tr>
<tr>
<td>Queensland</td>
<td>1</td>
<td>Queensland</td>
<td>0.02%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>4577</td>
<td>Grand Total</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

A “case” is any occasion of service provided for a patient by ARV. It may involve critical care or other advice, retrieval, or facilitation of access to a critical care bed.

ARV cases originate from all parts of the State of Victoria, with small numbers from interstate (particularly southern NSW).

Case rates have increased by 11.3% from 2014-15. The geographical distribution of case origins remains similar to previous years, with the exception of the number of Metro referrals which has increased by 21%. Ongoing support to AV staff, clinicians and AAV (including authorisation of transfusion and early / prehospital notification of cases) has continued to increase through 2014-15. Case rates in winter months are somewhat higher than summer months.
Activity Rates by Time of Day and Day of Week

Distribution of calls through the day shows relatively uniform spread of cases through day and evening hours – possibly reflecting earlier activation of retrieval.

The pattern of calls (by time and day) has not altered in the current year. ARV continues to advocate for early referral of cases likely to need transfer. ARV performs 6-7 retrievals per day which are evenly spread throughout the week. Distribution of retrievals through the day shows relatively even spread from 1000-2200 hrs, with lower rates overnight.

ARV receives approximately 12-13 cases per day which are evenly spread throughout the week. Case rates at peak periods during winter months can reach 20-25 critical care cases within 24 hours and at times 10-15 concurrent cases. This case volume creates significant pressure on current single Call taker/Coordinator capacity and requires flex of additional administrative and support staff into these roles.
ARV receives approximately 11-12 cases per day which are evenly spread throughout the week. Case rates at peak periods during winter months can reach 20-25 critical care cases within 24 hours, which exceeds current single RASO/Coordinator capacity. This requires flex of additional admin and support staff into these roles.

![Problem Type Chart]

- Cardiac
- Trauma
- Neurological_Neurological
- Respiratory
- Gastrointestinal
- Sepsis
- Toxicological
- Vascular (not neuro)
- Renal
- Other
- Oncology
- Endocrine
- Immune_Allergy
- Haematological
- Obstetric/Gynaecological
- ENT
- Genitourinary
- Metabolic
- Dermatology
- Psychosocial
- Musculoskeletal
REACH

The Retrieval and Critical Health (REACH) Information System is a real time, web based bed occupancy reporting tool used by Adult Retrieval Victoria (ARV), health services and the Department of Health (DH). It provides a statewide and hospital level view of critical care, mental health and incident specific bed capacity, based on regular hospital data input. REACH has been developed by ARV in conjunction with the Department of Health, to provide an interactive and more responsive monitoring and reporting tool for health services across Victoria. ARV is responsible for its management.

REACH is comprised of four main areas:
- Critical Care (ICU/HDU and CCU)
- Mental Health (Adult, Aged and Child & Youth)
- Incidents (HICT: Health Incident Consequence Tool)
- Directory of Services (records hospital profile, capability and communication data)

Access to this website is IP restricted, so access via a non-approved IP will require a username and password in order to view or edit the system. Each dashboard within REACH calculates and displays the current occupancy levels for a given bed type based on data that has been entered into the system. Occupancy levels can be set to trigger alerts via either email, SMS or both when specific thresholds are reached. This can alert specific users within the system when occupancy levels are reaching capacity.

Critical Care Dashboards

The Critical Care component consists of a dashboard for ICU and HDU beds, and a separate dashboard for CCU beds. Both dashboards classify hospitals as Tertiary, Metro Sub-Tertiary, Regional Sub-Tertiary and Private hospitals.

The following data elements are collected: the number of empty beds which are staffed, the number of beds containing a patient, the number of patients awaiting admission to the unit and the number of patients assessed as clinically ready to be discharged from the unit for each of the critical care bed types. Hospitals are required to update this information four times a day and where two consecutive update periods are missed, alerts are automatically sent to the Principal Hospital Contact to notify them of the breach. This system produces a near-to-real-time picture of state-wide critical care capacity and flow.

Mental Health Dashboard

The Mental Health dashboards within REACH support access to acute mental health inpatient beds. There are three separate mental health dashboards showing acute mental health inpatient bed status by age demographic and by health service/hospital: Adult, Aged, Child & Youth

There is also an overview dashboard which enables the user to view all bed types in the one location. The following data elements are collected: the number of empty acute inpatient beds which are staffed, the number of known patients awaiting admission to an acute inpatient bed already in the ED, the
number of known patients awaiting admission to an acute inpatient bed via community based teams and the total number of staffed acute inpatient beds in the unit.

**Incident Dashboard**

The Hospital Incident Consequence Tool (HICT) is visible at all times, however will only display an incident specific dashboard if there is a live incident. There are two sections within an incident dashboard. The Patient Data dashboard provides information specific to patient presentations and admissions. The Surge Bed Capacity dashboard provides information specific to bed availability within the various departments. Incidents are initiated by the Department of Health. Each incident setup is customised to select which involved hospitals submit data along with the specific data elements required to be collected given the nature of the incident.

**Hospitals Dashboard & Directory of Services**

The Hospitals Dashboard provides users with easy access to basic hospital information such as contact numbers, the hospital address, DH region, trauma classification and which Mental Health service they belong to (where applicable). Hospitals have the ability to indicate which bed types, clinical services, point of care testing, blood products and laboratory and diagnostic services are available at their hospital campus. When selecting a laboratory or diagnostic service, hospitals have the ability to indicate what hours this service is available.

Hospital alerts can be used by hospitals to advise other users of the system of any outages which may affect daily operation. An alert end date can also be entered so the alert will automatically clear once the end date is reached. This data provides a clear service profile of the capacity of each hospital.
ARVIS

Case Management System

The Adult Retrieval Victoria Information System (ARVIS) is a real time case management system designed to capture Adult Retrieval Victoria (ARV) cases. ARVIS is linked to the REACH (Retrieval and Critical Health) website and introduces some decision support for ARV staff. The system has been designed to accommodate various case types. Each form contains a slightly different data set and/or mandatory fields which are customised per case type to ensure appropriate data is captured given the nature of the referral. An ARV call taker creates a case by capturing basic details about the referrer and the patient. Cases may also be initiated by on-line e-referral. As the case is created it appears on the open cases dashboard and is then handed over to the ARV Medical Coordinator who then works through the form and captures all the clinical information in regards to the patient and the patient transfer.

Clinical Dashboard

The case dashboard provides the working desktop for the system. It brings together patient demographic information, case logistic information, communication technologies, risk mitigation software and decision support tools. These are combined to deliver an intuitive interface where highest risk cases are displayed with alerts to the user and where process steps and events are supported by time or outcome based visual indicators in the user interface. As a case progresses and data is collected, there are various sections which provide rule based decision support. Rules and decision support prompts vary according to the case type or form selected at the time of the referral. In a standard ARV case, a brief hospital profile containing information about the capabilities and geographic location of the referring site is displayed in the form based on the information which has been populated in REACH. This provides the Coordinator with health service context regarding the patients’ location as well as geographical and logistic data, important in planning a retrieval mission.

Decision Support

Guideline documents are linked to presenting problem types and other triggers, and display in the case form and on the dashboard as an interactive link. The Coordinator may refer to these guidelines or forward them directly from the application to the referring clinician by email. Clinical observations are captured and are displayed sequentially as a case progresses. These are linked to alerts which flag on the case dashboard. When providing clinical advice to a referrer, the system provides standardised drug formulary and infusion preparation information which can be forwarded to the referrer for reference and education.
Decision support tools have also been introduced in the formulation and planning section to assist the Coordinator in regard to the assignment of appropriate ratings for case complexity and stability of the patient. This ensures that decisions regarding skillset of crew and suitability of transport platform are optimised.

There is a separate mission logistics component to the form which allows the Coordinator to capture the actual crew and platform used and where the preferred and actual crew or platform are different, requires capture of the reason for variance. This section also allows capture of basic mission times such as the dispatch time and ETA’s for both the referring and the destination sites. As these fields are populated, they display on the dashboard for easy reference.

Each case has an associated notes section to allow capture of progress notes and details of ongoing case discussion and advice.

ARVIS also provides the ability to attach clinical documentation received such as images, ECGs or the retrieval physician’s documentation. This ensures all patient information remains linked to the electronic case record.

Email functionality enables a case summary to be emailed to the accepting physician or emailed/printed for the retrieval team prior to the transfer. This provides the destination with a patient summary and clinical details prior to the patient’s arrival and provides the retrieval team with comprehensive, legible handover information.

In addition to real-time case management, ARVIS has a strong governance focus, capturing medical retrieval patient follow up and peer audits of all retrieval cases (which includes an audit of the case coordination and the clinical management of the patient throughout the retrieval process). Based on the findings of the audit process, cases may be automatically sent for a formal case or incident review or cases can be manually requested to undergo a review. The system provides a structured format and process for case audit and incident review.

Handover is well supported and documented within ARVIS, and is automated and recorded in each case.

REACH / ARVIS received a State merit award for innovation at the Australian Information Industry Association (AIIA) 2014 awards - AIIA is the Australian peak industry body and advocacy group for the ICT industry.

The ARVIS manual is available at:
**Trauma Victoria**

The State Trauma System is committed to provide educational resource to clinicians. The Trauma Victoria project delivers a Department of Health funded, trauma-focused sustainable statewide educational system directed toward clinical staff (doctors, nurses, allied health, paramedics) across the State. ARV will provide management of this service within its scope of activity as a statewide provider of coordinated, systematized clinical advice, retrieval and information management (via the Retrieval and Critical Health Information System (REACH)).

The audience for this educational system will not be restricted however is intended to be clinical staff who provide early care for major trauma patients outside of a major trauma service. Other health system staff will also have access to this material. It is intended that the system provides these personnel with access to:

**Guidelines**

New guideline style documents have been delivered to support awareness of key aspects of the trauma system and early trauma care and include:

- The Victorian Trauma System – structure, function and access (including the Major Trauma Triage Guidelines)
- Initial (primary) hospital assessment of the major/multi trauma patient (including thoracic and abdominal injury)
- Preparation for retrieval and transfer
- Management of the deteriorating patient
- Teamwork, handover and communication – human factors in early trauma care
- Interhospital Major Trauma Transfer Guideline
- Prehospital triage Guideline

Clinical Guidelines have also been updated

- Traumatic Brain Injury
- Spinal Trauma
- Paediatric Trauma
- Obstetric Trauma
- Burns

The revised guidelines have been presented in four formats:

- Posted as retrievable documents on the DH website
- Linked web pages accessed via the Retrieval and Critical Health Information System (REACH)
- Poster formats (integrated) for simple reference in ED resuscitation rooms
- Integrated into future systematized and sustained trauma educational content (below)

**Learning Modules**

A statewide web-based learning management system has been implemented on a Moodle platform. This is accessible free of charge to health service staff. The system will:

- Provide modules to support each of the principal guideline areas referred to above and additional modules addressing key trauma procedural interventions (skills tutorials) such as vascular access, intercostal catheter insertion, etc
- Provide individuals with access to professional online multimedia material
- Monitor use and document user access for CPD purposes
- Be CME accredited by appropriate professional colleges or groups
- Enable wide audience accessibility
- Be delivered at two levels: standard and advanced, to reflect the varying needs and experience of users
- Undergo pilot testing prior to any release
- Be modified over time in response to user feedback
**Moderated Remote Tutorials**

Utilizing the content of the learning modules, plus themed, case-based material, remote multidisciplinary groups come together for local tutorials and discussion. These tutorials may also be accessed by individuals. They have a common template or delivery style, and are scheduled fortnightly. The content of the modules is based on sample cases however will specifically link to each of the 12 core guideline components above and to specific procedural or interventional guides.

**Facilitated MTS Visits**

These will be brief (1-2 day) visits by regional and rural staff to a major trauma service to observe systems and clinical care. Commencing 2016

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The Trauma Victoria Website – Designed and produced by ARV
**ARV Website**

(Due for upgrade mid 2016)

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**Adult Retrieval Victoria (ARV)**

Adult Retrieval Victoria is a single contact point for Major Trauma and Critical Care Advice, Critical Care Bed Access, and Retrieval of Critical Care Adult Patients Statewide.

This statewide service is available 24 hours, 365 days a year.

ARV is part of Ambulance Victoria.

**Ambulance Victoria Contacts for patient transfers:**

- Immediate emergency ambulance response - 000
- ARV interhospital retrieval of critical care patients - 1300 36 86 61
- PIPER - 1300 137 650
- Non emergency interhospital transfer - 1300 36 63 13
ARV Activation Promotion Flyer

Adult critical care advice and bed access
Retrieval of critical adult patients
Victorian adult major trauma advice and referral

MAJOR TRAUMA ACTIVATION
For patients meeting major trauma criteria initiate early consultation with ARV.

Vitals Signs

<table>
<thead>
<tr>
<th>Age</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>&lt;60 or &gt;120</td>
</tr>
<tr>
<td>RR</td>
<td>&lt;10 or &gt;30</td>
</tr>
<tr>
<td>BP syst</td>
<td>&lt;90</td>
</tr>
<tr>
<td>SpO2</td>
<td>&lt;90%</td>
</tr>
<tr>
<td>GCS</td>
<td>&lt;13</td>
</tr>
</tbody>
</table>

Specific injuries
- Penetrating injuries (excluding isolated / superficial limb injuries)
- Major blunt injuries or fractures
- Limb threatening Injuries
- Spinal Injury
- Burns > 20% or Inhalation / electrical injuries
- Traumatic Brain Injuries
- Obstetric Trauma

EARLY RETRIEVAL ACTIVATION
For all critical care transfers consider early activation.

Why?
- Early retrieval activation ensures access to critical care advice and more effective retrieval response
- Early activation and timely critical care transfer improves clinical outcomes

Who?
- Patients likely to need transfer for critical care
- Referral may precede availability of test results or investigations. For example:
  - Major Trauma
  - Intubated patients (requiring respiratory support)
  - Circulatory failure
  - Severe sepsis
  - Complex multi-system disorders with clinical instability
  - Specialised critical care need

How?
- PHONE – for immediate advice or referral escalate local response team or system immediately and call 1300 36 86 61
- INTERNET – streamline your referral and reduce your initial call time by utilizing the ARV e-Referral form available via REACH – https://reach.vic.gov.au

1300 36 86 61 Statewide 24 hours

Adult Retrieval Victoria
HR and Staff Processes

Credentialing

Credentialing is an ongoing annual process that is required by regulation and good governance policy and principles, and ensures the retrieval service offered by ARV is provided by a suitably qualified and competent workforce. As a requirement for appointment as a medical practitioner at ARV, evidence of competence and ability to fulfil the tasks and responsibilities of safe retrieval medicine is required. This system aims to create a positive environment for medical practitioners, with a clear recognition of the resources required to support high-quality services with appropriate and effective clinical governance.

Annual credentialing is undertaken throughout a six-month cycle as a “course” in the ARV web-based learning management system.

Fatigue

- ARV aims to minimise and manage the risk of medical staff fatigue in accordance with duty of care obligations for crew and patients.
- The Civil Aviation Safety Authority (CASA) has prescriptive requirements for fatigue minimisation for licensed aircrew engaged in emergency medical operations.
- These instructions have influenced the construction of this guideline.
- ARV will ensure that:
  - A safety culture is established and maintained within the organisation
  - All medical staff are educated in the identification and symptoms of fatigue
  - Adequate rest and sleeping facilities are provided when necessary
  - The principles of this guideline are understood by operational and management staff.
ARV Medical staff will ensure that:

1. The fatigue management guideline and system are understood and upheld
2. Fatigue reduction methods are employed whenever it is practical to do so during duty periods (see below.)
3. Any infringement or safety issue that impacts on the fatigue management guideline is reported to management as soon as possible.

Duty Periods
A duty period commences when the member performs any duty associated with the activation of a medical task. This applies to on base and on call staff.

A duty period shall not exceed 12 hours except as provided for below:
A duty period already commenced may be extended when medically essential to recover the patient to appropriate medical facilities and the medical staff consider themselves physically and mentally fit to do so. Where possible and appropriate, arrangements can be made to replace fatigued staff for the final leg of the mission (e.g. airport to hospital.)
A duty period which contains a clear rest period of 4 consecutive hours or more at suitable resting accommodation may be extended by up to 2 hours (from 12 to 14 hours.) This extension may be applied once only during a duty period.
A duty period which contains a clear rest period with sleeping accommodation can be extended by up to 4 hours (from 12 to 16 hours.) This extension may be applied once only during a duty period.
The ARV Coordinator must give approval to extend duty periods after consideration of the medical aspects of the case and consultation with the retrieval team.

Time Free of Duty
When a duty period exceeds 12 hours, time free of duty shall be a minimum of 10 hours.
Staff should be aware of this when performing rostered on-call shifts vis a vis their other clinical duties

On Call Periods
Prior to undertaking rostered on call shifts with ARV, medical staff should have appropriate rest. The nature of this rest / preparation is influenced by the type and nature of work previously performed, and the length of prior shift. Staff are required to apply a sensible ‘safe hours’ approach, as would be their responsibility in normal medical workplace rostering.

Safety and Extended Duty Periods
Extended duty for Medical staff may be limited by aviation safety requirements of the aircrew.
Medical staff must be mindful of fatigue implications for the pilots.
Extended pilot hours have implications for subsequent rostering.
Complex mission planning involving fatigue concerns should be escalated to ARV admin on call.
Sleeping areas are provided or alternative transport arrangements (other than driving home in private car) can be made for Medical staff to return home after working extended duty periods >12 hours.

Leave
Applications for leave should be submitted in advance to the Admin Officer ARV. Please note that ARV will aim to accommodate all leave requests in line with other (external) employment arrangements that RP’s may have, however this is not able to be guaranteed, and there may be times when restrictions are placed on the availability of leave, particularly during induction periods for new staff in February and August.
Leave requests need to be submitted in writing at least 4 weeks prior for approval. The earlier the request, the more likely it can be granted.

Orientation
A comprehensive orientation process reviews all operational and structural elements of a retrieval service:
- Base orientation and map
- Staff introductions
- Guidelines (Medical Reference Manual)
- Process flow chart for coordination
- Documentation (coordinator record)
- Coordinator reference pack
- Outline of case review systems
Orientation and induction of new staff also involves developing explicit understandings of daily “routine” activities. This ensures smooth running of a service, and reliable performance of important checking and preparation routines.

**Performance Management**

Retrieval physicians will participate in yearly performance reviews which will be performed in accordance with AV policy, and which are modified to ensure relevance and appropriateness to medical staff.

The performance management system also defines the general scope of practice of the retrieval physician.

Retrieval physicians will be expected to maintain a general level of health and physical fitness appropriate for the physical requirements of their work and the retrieval environment.

**Personal Leave / Illness**

Personal Leave policy and procedure is determined by AV policy POL/PAC/014.

Notification of Personal Leave is required at the earliest opportunity and in hours is required via the ARV office (99459961). After hours notification is required via the ARV operational desk (1300368661) and also by sending a confirmatory email to arvadmin@ambulance.vic.gov.au.

Documentation or certification supporting personal leave must be submitted as required. Under the revised Personal Leave Policy employees may continue to utilise 3 days accrued leave each year without providing any verification, and may continue to provide either a Statutory Declaration or a Medical Certificate for any additional absences of less than 5 days duration.

However, in circumstances where an employee is absent from the workplace for 5 consecutive days or more, or more than 5 working days in one calendar month, they will be required to provide a Medical Certificate from a registered Medical Practitioner.

**Roster Process**

The roster is constructed in four-week blocks.

In the last week of each roster cycle, you will receive (on the Monday) a request to submit roster preferences for the roster block beginning in 5 weeks.

Staff will be requested to:

- submit preferences within the next 5 days (by 5pm Friday)
- submit alternates where at all possible (in case your preferred shifts are not available)
- nominate shifts according to your contract
- include nominated weekend shifts (roughly one weekend shift per cycle for most staff)
NB this is required even if you work semi-fixed days, so we can account for special requests, weekend commitments and leave. Staff are required to submit roster requests as per the base roster conditions agree in the Schedule on their contract.

On the Thursday of that week you will receive an e-mail reminder that roster preferences are due the following day.

On the following Monday, the roster will be constructed from the requests made, using a best fit approach and considering long standing agreements. If we have been unable to accommodate your request we will contact you to arrange alternates where possible. If you have not submitted roster preferences for the roster period being constructed, we will allocate shifts according to your previous preferences and in line with your contract. NB Locum shift requests will normally be filled after permanent staff requests are dealt with.

On Tuesday of that week, the draft roster for the next cycle will be circulated with gaps highlighted. Shifts you have been allocated on this roster are considered fixed unless you swap into an empty shift or arrange a swap with another person.

The ARV Admin Officer is required to be notified of any roster changes.

**Uniform**

**Wearing the uniform**

AV operational uniform is only to be worn by operational staff when:

- rostered to work,
- attending an AV authorised function (for example; funerals, medals presentation),
- engaged in official AV business or
- in other circumstances with the approval of the operational staff member’s line manager.

AV Operational staff will only wear uniform items supplied to them by AV. Employees are not permitted to make changes or variations to their issued AV uniform, unless; this is required for sizing or fitting requirements.

When wearing uniform, AV operational staff will ensure they maintain clean and polished footwear, ironed shirts and clean trousers or overalls; additionally, operational staff are required to wear epaulettes and badges appropriate to the position and/or qualification on all required uniform item when wearing uniform, including wearing name tags, located to the right side.

AV operational uniform is not to be worn at any time other than is approved in this work instruction.

All staff will continue to ensure the security of uniform items that they have been supplied and the disposal of retired or damaged uniform items.

**Traveling to and from work**

While travelling to and from work, AV staff travelling in non-AV vehicles should not be readily identifiable by an AV uniform.

While AV uniform is not to be worn outside of work hours, it is acceptable while travelling to and from work to do the following to achieve this:

- change into an undershirt/non-AV shirt
- wear a non-uniform jumper or jacket to cover up

It is not necessary at the beginning and end of every shift to completely change into and out of their uniform.

**Personal presentation**

Due to AV’s high public profile, operational staffs’ professional standing and Occupational Health and Safety (OH&S) risks, the following requirements apply to all operational staff on shift or when otherwise representing AV:

- Personal presentation must be of a suitable professional nature at all times.
- Jewellery is restricted to ring(s) without protruding stones and one appropriate earring per ear, other jewellery items must not be visible.
Case Coordination Principles

Coordination lies at the heart of retrieval systems. It commences with initiation of contact from a referral facility, accident scene or ambulance dispatch centre. The ideal system has a single entry point from a single call to access a senior clinician with specialized training and knowledge. The coordinator determines the needs of the referrer and patient. These may include:
- Clinical advice
- Organisation of transport and crew
- Assistance in obtaining an appropriate destination facility
- Planning and intervention priorities for each case must be determined quickly and efficiently including:
  - Immediate care or advice
  - Immediate dispatch of retrieval team
  - Destination planning
  - Consideration of complex decisions involving logistics, crew and transport platforms.

The Coordinator must display leadership and consider the patient, referrer and system perspective. An ongoing process of communication and feedback with the referrer should be established to advise of case progress, estimated response times, and to determine any change in patient condition.

During the response and transfer phase the coordinator maintains communication with response teams, providing logistical support and mission oversight. The retrieval coordinator is a central point for the interaction of people from all over the health care system all of whom will bring different skills, assumptions, priorities and pressures and who must be made to work together for the sake of the patient. The skills required include use of specific critical care, aeromedical and health care system knowledge, time management, triage and delegation skills and interpersonal communication and negotiation skills. A good retrieval mission commences with good coordination and this cannot be overemphasized. Retrieval resources are valuable and expensive and must be tasked wisely, safely and effectively. Little has been written to date relating to retrieval coordination and hence the new coordinator often relies on extrapolation from knowledge and skills learnt elsewhere.

Coordination Systems

Retrieval systems vary in who performs the Coordination role, what training they receive and their physical location. Personnel may have medical, paramedical or nursing backgrounds. Clinical coordination and coordination of logistics may be performed by a single operator or by different personnel. Staff involved in coordination may be co-located and employed by a single organization (e.g. ambulance service) or off-site and based at a health facility.

Coordination Processes and Procedures
- Referrer call logged. Patient and referrer details recorded
- Clinical Coordinator records and analyses clinical information and referral location details
- Weight and size of patient must be recorded for all patients
- Guidance provided to referrer, relating to immediate clinical care, transport or accessing specialist advice and/or intervention.
- Needs analysis of case for transport on grounds of urgency, stability and complexity.
- Triage of case and review of existing caseload.
- Assignment of priority (urgency) crew (stability and complexity) and discussion of logistics with platform providers.
• Destination planning and discussion with receiving clinicians
• Crew briefing
• Update referrer with transport plans and estimated time of arrival.
• Maintain role as central point of contact for referrer, retrieval team and receiving clinician.
• Above process will be modified depending on case: pre-hospital multi-trauma cases require urgent early dispatch on minimum information with pre-identified destination whereas interfacility transfer of hospital inpatients may be less urgent but more complex requiring careful coordination and planning.

5 Phases of Coordination

1. Open case
Collect clinical details and patient location. Determine what resources are available to manage patient at current location.

2. Decision making.
Determine management that is required. Diagnosis, clinical complexity and urgency (to get retrieval crew to patient or to get patient to definitive care) will determine platform, crewmix and destination

3. Communication
Brief crew on mission and communicate clinical management and transport plan to referrer and to receiving hospital team

4. Case Tracking
Continue to receive clinical updates from referrer and retrieval crew. Provide referrer and receiving facility with logistical updates such as expected time of arrival. Ensure you are aware of and communicate any changes to the patients condition to all parties.

5. Case closure
Receive feedback about the case from the referrer and responding crew. Reflect on any learning points for future case management. Obtain feedback from the receiving facility on the retrieval and provide a clinical update to the referrer, therin completing the quality improvement loop.

Communication
Good communication is vital to the coordination role. The coordinator must excel in the following:
• Listening skills
• Critical analysis of information
• Clear transmission of information to relevant stakeholders
• Multitasking: The ability to (re)prioritise tasks on limited & evolving information
• Risk assessment & management
• Creativity and “thinking outside of the square”
• Empathy without attachment
• Emotional Intelligence and control of self
• Aligning the respective needs of the referrer, patient, transport provider and receiving facility
• Conflict resolution, arbitration & diplomacy
• Advocacy and escalation where appropriate
• Reflection

Coordination is facilitated by the use of sophisticated communication technologies e.g multiparty conference calls, videoconferencing, case recording and data management systems. Verbal communication should be supported by other modes of information transfer e.g email, fax, SMS to transmit referral forms, images, ECGs, radiology.
Barriers To Good Coordination

- Referrer stress and reluctance to engage
- Referrer “demands”
- Referrer perspective limited to the ‘here & now’ – unaware of other patients, system demands and priorities
- Finite transport resources
- Retrieval is resource hungry
- Critical care bed access/availability: “Call back this afternoon”
- Difficulty in contacting hospital personnel
- Variability in processes to access hospital services

Turning barriers into enablers

- Referrer understanding of process and indications for retrieval
- Common understanding of patient condition and needs (shared mental model)
- Understanding of patient environment and referrer constraints
- Anticipate logistical difficulties and delays
- Understand local culture

Advice

Provision of clinical advice is a crucial step in the coordination process. A system that provides access to a senior critical care clinician:

- Supports junior or isolated practitioners in managing the critically ill
- Allows escalation of treatment prior to arrival of retrieval team
- May avoid or defer some transfers where patient can be safely managed at referral site
- Enhances relationships with referrers and promotes early referral
- Allows more efficient use of resources
- Advice regarding patient packaging and preparation for transfer decreases the retrieval team scene time and facilitates smooth handover of care.

Coordinators must be familiar with referrer challenges and resource limitations in order to provide useful advice.

Coordinators may access clinical service networks or other local arrangements to facilitate advice on certain conditions e.g. cardiac care, acute stroke care, obstetric and neonatal services.

Statewide trauma systems often have well established transfer criteria with clear accessible guidelines promoting early referral and good decision-making.

Setting Goals and Review Points

The coordinator, in collaboration with the referrer should set resuscitation goals or targets.

- Escalate within the organization as a starting point: Necessary key interventions should be defined with time frames and responsibilities. This may require the referrer to call in senior staff within their organisation to achieve these goals. Examples include central line placement and commencement of inotropes, intubation and ventilation, fluid resuscitation and close monitoring of urine output.
- Provide advice & Set Targets for treatment e.g. Patients with moderate or severe brain injuries require measures to prevent secondary brain injury, such as avoidance of hypotension and hypoxia, maintaining a low-normal PaCO2 and maintenance of normovolaemia and normoglycaemia.
- Target parameters should be clearly stated e.g. mean arterial pressure (MAP) of 65mmHg and an action plan made for failure to achieve these targets.
- Communicate explicitly & with emotional intelligence: communication should be explicit and the coordinator must ensure that the plan is understood and can be implemented. This avoids the situation where resuscitation and interventions are inappropriately deferred until arrival of the retrieval team. It also gives the referrer (who may be a very junior doctor or nurse) permission to escalate within their own organization to call in senior staff.
- Teleconference in particular those referrers with high acuity unstable patients or those who are practicing at the limits of the capabilities. If there is no videoconferencing facility consider use of FaceTime with patient and referrer consent.
• Consider external support: In small facilities in remote locations the response may include local emergency services such as ambulance paramedics who can back up hospital staff.

• Provide ongoing support: The coordinator should check back at agreed times to monitor progress and the patient’s response to interventions.

• Ensure you have sighted key investigations e.g. ECGs, CT Reports and the copies are attached to ARVIS

• Identify Risks early: The coordinator should identify what the “red flags” or key risks are with each particular case and the referrer should also be told when to call the coordinator immediately. In such instances the urgency of response, crew-mix or destination may need to be altered.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Red Flags</th>
<th>Intervention Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEMI post thrombolysis</td>
<td>Ongoing or new chest pain</td>
<td>Urgent transfer for percutaneous coronary intervention (PCI)</td>
</tr>
<tr>
<td>Head injury</td>
<td>Decreasing conscious state</td>
<td>Urgent transfer for CT scan and/or neurosurgery</td>
</tr>
<tr>
<td>Asthma</td>
<td>Increasing shortness of breath and hypoxia despite continuous nebulized salbutamol</td>
<td>Respiratory arrest may be imminent</td>
</tr>
<tr>
<td>Multitrauma patient</td>
<td>Refractory hypotension</td>
<td>May require surgical intervention at referral hospital</td>
</tr>
<tr>
<td>Cardiac arrest and death</td>
<td></td>
<td>Cancel retrieval</td>
</tr>
</tbody>
</table>

Where cases continue across changes of shift (either the referrer or the coordinator or both) it is particularly important to review the status of the patient regularly.

**Preparation for Transfer**
Placement of lines, catheters or tubes may be required. All should be well secured but accessible. Explicitly ask about:

• Monitoring (HR, BP, SPO2, ETCO2, RR, Temp)

• Central line access

• Arterial line and site

• Endotracheal/tracheostomy tube and confirmation of placement

• Nasogastric tube

• Urinary catheter

• Number, size and site of IV cannulae

• Surgical drains

• Intercostal catheters

• Cervical collar

• Limb splints

• Infusions should be documented and spares drawn up.

• Spare muscle relaxants for intubated sedated patients.

• Blood products should travel with the patient in an appropriate container

• Copies of notes, observation and drug charts

• Copies of ECGs and imaging studies

• Check that the patient and relatives are aware of the transport plan

• Have a plan for patient belongings.

**Technological Support**

**Videoconferencing**
Use of videoconferencing (otherwise known as telemedicine or telehealth) can greatly enhance coordinator decision making and provision of advice. It allows transmission of real time clinical
information e.g. patient vital signs, skin colour, level of distress and frees up the referrer to continue caring for the patient. It enhances relationships by allowing the referral, coordination and retrieval teams to meet and collectively plan for the needs for the patient. In remote locations it allows direct communication with the patient allowing the coordinator to obtain further history and obtain consent for procedures such as thrombolysis for acute ST elevation myocardial infarction (STEMI).

**IT decision support and reference material**

Retrieval services may provide the following:
- Decision support tools to aid triage and dispatch decisions based on physiological, historical and geographical information
- Databases with information related to services available in various facilities (e.g., blood bank, operating theatre capability.)
- Evidence-based clinical guidelines to aid provision of advice to referrers
- System capacity indicators: to reflect real-time availability of critical care beds in the region

**Triage**

**Time Criticality**
- Condition which presents immediate threat to life, limb, cognition or future quality of life, and delay in definitive treatment will significantly increase risk, and definitive management likely to be achieved by urgent transfer, or management is beyond resource or clinical skill capacity of provider
- Factors impacting on Task Time Criticality
  - Patient stability
  - Physiology
  - Working diagnosis
  - Natural history of condition (may be known or unknown, predictable or unpredictable)
  - Capability of referral site
  - Benefit from retrieval team vs definitive care at receiving site
  - Time to respond to intervene (outbound leg)
  - Time to destination (return leg)
  - Total out-of-hospital time

**Tools For Determining Clinical Stability**

Patient physiology, as evidenced by current vital signs as well as taking note of trends over the previous four hours, are a good rapid assessment of clinical stability. The Rapid Emergency Medicine Score (REMS) score, which uses GCS, heart rate, MAP, respiratory rate, oxygen saturation and age and has been found to correlate with clinical deterioration and mortality. Many other scoring systems exist, some incorporating biochemical measures such as the Sequential Organ Failure Assessment score (SOFA) or APACHE. While these are useful for hospital inpatients, much of the information required may not be available to the retrieval coordinator.

**Entry Into The System**

Paramedic or medical staff may monitor ambulance systems for potentially time-critical cases in the pre-hospital arena to facilitate rapid dispatch of retrieval teams (e.g., moderate to severe head injury). Cases which would benefit from bypass of smaller facilities may also be identified in this way e.g., STEMI, acutely ischaemic limb, acute stroke, aortic dissection or aneurysm. In some jurisdictions, systems exist for early activation of retrieval services for inter-hospital transfer of patients with certain time-critical or time-sensitive conditions. This aims to decrease time to definitive care for the patient. Trauma systems should incorporate this approach. With multiple entry points into the system, changes to patient conditions with time and dynamic logistical constraints, the coordinator must continually reassess and reorder case priorities to do the most for many within a complex system.
**Destination Planning**
Specific destination may be chosen because
- Proximity/Geographical zoning
- Need for specific procedure or service (only provided at certain centres)
- Patient has chronic illness (continuity of care)
- Regional/Historical Network/Links
- Access (airport/helipad)
- Current Hospital or Emergency Department has capacity (system should attempt to balance demand and capacity across sites)
- Patient insurance status

Early activation (prior to destination planning) should occur if patient requires early transfer due to condition or isolated location.
Aim to get right patient to right destination while avoiding overburdening large or overcrowded centres where possible.
General principle (all other things being equal) is to move patients with less complex issues not requiring tertiary care to non-tertiary units.

**Logistics**

**Platform Decisions**
Interdependence of crew & platform
Crew may be:
- Platform specific
- Retrieval service specific but across all platforms
- From referring facility
- From receiving facility

**Platform Selection**
- Crewing decision may dictate platform or vice versa
- Availability
- Task time criticality (urgency of response leg, return leg or both)
- Distance
- Terrain, weather, time of day/night
- Patient stability and complexity or likely need for certain interventions enroute (patient access)
- Impact on competing tasks (or potential impact if sole ambulance leaves station for protracted time.)
- Alternatives
- Aircraft landing sites: proximity to patient location
- Helipads at referring and destination hospital
- Patient condition dictates altitude restriction/pressurized cabin e.g diving incident, intra-ocular foreign body
- Total out of hospital time
- Crew and pilot duty hours and fatigue policy
- Cost

Many transfers require more than one platform which must be well coordinated to avoid delays. This can be aided by good communication and GPS tracking of aircraft and land vehicles.
The coordinator must constantly update platform providers with adjusted times. IT systems which can be readily accessed and update in real time facilitate this in some services.
Heightened risk for patients in transit is experienced during platform transfers (from bed to trolley to ambulance to aircraft stretcher and so on) and in general terms in the out-of-hospital setting.
Minimization of number of patient transfers and the out-of-hospital time for the critical care retrieval patient are important principles.
Crew Skillsets
Retrieval medicine and primary response aeromedical settings provide the most challenging of all clinical environments. Choice of staff skillsets and professional team makeup is fundamental to optimising clinical outcomes. Skill set needs to match the requirements of the patient. In the basic dimensions of clinical complexity and physiological stability; the more unstable and complex patient clearly requiring a higher skill mix in the retrieval team.
Examples that require the highest possible skillset include:
- Sepsis
- Multisystem disease
- Pregnancy
- Morbid Obesity
- Complex toxicology
- Current or prior severe abnormalities in vital signs
- High levels of support (inotropes, vasopressors, oxygen requirement)

Objective scoring systems may be used to quantify patient complexity and acuity based on physiological parameters.
One example is the Rapid Emergency Medicine Score (REMS) score which uses GCS, heart rate, MAP, respiratory rate, oxygen saturation and age and has been found to correlate with clinical deterioration and mortality.

Based on objective scoring and coordinator judgement an example of crew-mix tasking would be:
- Highly Unstable and Complex e.g severe multiorgan failure with abnormal vital signs: Consultant Retrieval Physician + highly skilled assistant (senior critical care trained paramedic/nurse)
- Very Unstable and less complex e.g hypotensive multitrauma patient or Very Complex and less unstable e.g respiratory failure requiring mechanical ventilation: Consultant Retrieval Physician or senior registrar + highly skilled assistant (senior critical care trained paramedic/nurse)
- Moderately unstable and complex e.g STEMI post thrombolysis with normal vital signs: senior registrar or critical care trained paramedic/registrar + highly skilled assistant

In rare situations, and where life saving intervention may be possible, the transport of highly specialised clinical staff to the patient may be appropriate and should be considered, for example transporting a surgeon to perform a craniectomy or infield amputation on an entrapped patient.

Cognitive Overload
The coordination job can be extremely demanding and it is easy to become overwhelmed and lose perspective. It is necessary to identify strategies to implement when this occurs. First identify what is contributing to the cognitive overload.
- Volume of tasks or cases
- Task acuity
- Clinical complexity
- Logistical complexity
- Emotional stress due to conflict with
  - Referrer
  - Receiving hospital staff
  - Transport platform providers
  - Other
- Hungry, dehydrated, feeling unwell, not had a break all day
- Personal issues unrelated to work

Strategies to consider include:
- Allocating tasks to other staff members e.g retrieval clinicians, administrative staff. Clinical staff can help obtain clinical details, particularly if it relates to a case they are likely to be tasked to. Administrative staff can relay information, such as expected arrival times, or collect demographic information from referrers
- Use of cognitive aids, such as checklists
- Making a list of outstanding tasks and prioritizing them.
- Deferring non urgent work to be reviewed at a later allocated time
- Taking a 15 minute break
- Using a Checklist to review outstanding cases can help the coordinator be more objective when prioritizing tasks and ensure that nothing is missed.

**6 Step Clinical Coordination Checklist**

- **WHY:** Why must patient move? (Clinical or others reason e.g no beds no staff) (Do they need a HDU/CCU/ICU bed, do they need a clinical intervention, do they need a clinical investigation or are they restricted by bed access or staffing levels)
- **Advice:** have you provided appropriate advice regarding immediate & further management. Can they provide this and do they understand what you have said?
- **Complete Complexity/Urgency & stability in ARVIS.** This will then assist you in determining your Crew skillset e.g. Dr, FP or Dr MICA. It will also determine your platform.
- **Destination:** Have you confirmed an available bed with the critical care clinician/bed manager/EDAO +/- parent unit for ICU referrals?
- **Does this patient require direct transfer to cath lab or theatre on arrival at destination?**
- **Crew briefing:** To all clinicians. Including likely complications, additional kit, logistical complexities
- **PLAN:** Review transfer plan and communicate to all parties.
- **ETA provided to referring centre**
- **ETA provided to receiving centre**

**3 Common Coordination Problems**

**Problem 1**
Air platform unavailable due to
Weather conditions
Currently on a mission
Tasked to do something else

**Solutions**
Consider halfway meet with road vehicles for time critical conditions (may need escort from hospital or local paramedics)
Can other task be done another way or deferred?
Staged road retrieval (transfer to larger centre then later transfer to definitive care)

**Problem 2**
Conflict with referrer because:
Feels that retrieval should occur sooner than has been arranged
Referrer refuses to perform intervention advised by coordinator
Referrer refuses to give information to coordinator

**Solutions**
Explain reasoning behind decisions
Involve third party e.g receiving hospital clinician
Use videoconferencing to enhance communication

**Problem 3**
Conflict with receiving hospital staff
Unable to confirm they can accept case due to key personnel being uncontactable
Receiving facility state they are full so can’t take patient
Conflict over management: receiving hospital staff feel patient should be treated at referral site (e.g urgent debridement of necrotising fasciitis) or that patient should stay and be palliated

**Solution**
Retrieval services should advocate for and be aware of policies that make certain hospitals responsible for patients in their area or who have certain conditions e.g severe trauma, acute STEMI, acute stroke. Policies should be in place when hospitals are at capacity. E.g. defined transfer
Retrieval service arrangements with local respected specialist advisors e.g. receiving intensivist are invaluable to give independent advice when conflict regarding management and disposition occurs.
Multiparty teleconference or videoconferencing can assist in problem solving. Escalation of problem within retrieval organization and hospital executive if all else fails.

**Problem 4**
Unstable surgical patient at referral centre requesting transfer out prior to surgical intervention

**Solution**
Communicate directly with surgical consultant at referral hospital. Explanation of risk of surgical intervention versus 4-6 hour out of hospital transfer time in a patient who is likely to deteriorate with no prospect of surgical intervention en route.
Consider as rare option transfer of surgical team to unstable patient to provide intervention

**Crew Briefing and Debriefing**
The coordinator should brief the retrieval team regarding the task. If rapid dispatch is required this can be done via radio or telephone while the crew are en-route. Details may be transmitted using electronic devices. If circumstances allow the retrieval team may be added to a teleconference with the referring clinician.
On completion of the task the team should provide feedback on the case to the coordinator. This allows reflection and learning.
Any issues, incidents or adverse events can be discussed at this time and appropriate action taken.
Debriefing following a serious incident in transit is essential and can be provided by the coordinator initially. Admin on call or senior management following the incident at a mutually convenient time using the AV MANERS Model.

**Coordination Training and Continuous Quality Improvement**
Coordination training should:
- Be service specific
- Incorporate the application of critical care, aeromedical, ground transport and health care system knowledge
- Include time management, triage, interpersonal communication and negotiation skills.
- A period of “buddy shifts” with an experienced coordinator should be undertaken
- Regular case review should occur using call recordings and written (electronic or paper) documentation
- Incident review should use a “whole of service approach.”
- Services which record clinical and logistical data can use this to target specific areas for improvement and optimize resource use.
- Patient outcome data and follow up assists coordinator learning and promotes a valuable feedback loop between referral, retrieval and receiving site clinicians.

**Controversies and Future Directions**
- Some patients may be deemed unsuitable for transfer due to medical futility, and/or inappropriate use of resources.
- Where all parties do not agree this can create conflict.
- Uncertainty relating to likely patient outcome is compounded by issues relating to remote assessment and demands made by refERRers and patient families.
- End of life discussions are best done by on site clinicians who have built rapport with patients and families however the coordinator may be called upon to support or guide referring clinicians towards these decisions.
- Transport of patients likely to progress to brain death may be transported in order to facilitate organ donation. This must be closely coordinated with the organ and tissue donation team and receiving site.
Coordination Do’s and Don’t’s

Do:

- Remain cool and objective no matter what
- Be polite, friendly and helpful
- Be precise and clear in communication with all staff especially when giving direct instruction
- Surround yourself with technological and cognitive aids
- Acquire local knowledge
- Get referrers to send ECGs and CT images
- Use videoconferencing to look at the patient, meet the staff and observe the environment. A picture equals a thousand words
- Remember that most referrers are highly stressed and outside their comfort zone.
- Remember that most receiving hospitals do not appreciate what it is like to work in a small hospital with few resources.
- Build a bridge.
- Be the patient advocate
- Eat, drink and take a break when you can
- Make detailed legible case notes
- Give advice on management and preparation for transfer
- Get regular clinical updates on the patient
- Inform referrer and receiving hospital of estimated time of arrival
- Be creative. Coordination can be fun.
- Remember to breathe

Do Not:

- Attempt to do other things during your shift, e.g child care, writing papers, cooking dinner
- Take it personally
- Attempt to please everyone
- Transfer patients overnight unless dictated by clinical condition or referrer resource limitations
- Assume you have been heard and understood – check through communication feedback styles
- Assume anything else
- Delay in initiating transport plans awaiting destination confirmation
- Be surprised if you can’t get a surgeon to speak to you in a timely fashion
- Fail to escalate if the patient is being exposed to unnecessary risk
- Expect weather to be on your side
- Be rude to anyone. Even if you feel they deserve it.
- Underestimate the impact of ‘throw away lines’ or quips : negative statements however ‘innocent’ come from negative thoughts and eventually become a feature of local culture
- Handover difficult cases at critical decision points.
- Forget that retrieval coordination is one of the trickiest jobs on the planet.

Section reproduced and adapted with permission from Dr. A. Creaton & Oxford Handbook of Retrieval Medicine, 2015.
ARV Coordination & Retrieval Guidelines

Activation of Retrieval

Scope of Cases
Referral to ARV triggers generation of a case, and assessment of need as a discussion between a referrer and the ARV specialist clinical coordinator. Receiving hospitals may be included in early case discussion also. Cases appropriate for ARV referral include:

- Interhospital critical care transfers (patients requiring admission to a critical care unit – ICU, HDU, CCU)
- Interhospital transfer of patients meeting the major trauma transfer triage criteria
- Requests for critical care advice and AV authorisation of certain clinical practices
- Any request for critical care bed availability information
- Interhospital transfer of patients in whom significant delay will contribute rapidly to deterioration and probable need for critical care
- Field response or deployment in multivictim or other incidents as required by Ambulance Victoria

ARV’s goal is to service both regional and metropolitan retrieval demand. Resource is deployed based on a triage risk assessment. Risk assessment would consider several factors, including: patient complexity, patient stability, impact of staff depletion on the referring hospital / broader health system, availability of ARV or AV staff, availability and seniority of referral hospital staff to perform the transfer, time-criticality of the patient, and availability of retrieval transport platforms.

Where cases are outside the scope of ARV practice, the ARV coordinator will obtain sufficient information to provide appropriate advice to the referrer. Such advice may be clinical or administrative. At times where cases of lower acuity (non-critical-care) are referred for assistance in bed finding or ‘system navigation’, or ‘problem solving’, the ARV coordinator will (in a professional manner) provide advice on options for local problem solving such as escalation to senior staff or site executives. At all times, the ARV coordinator will be cognisant of the limitations in resource available at many referral sites, and remain patient-focused in decision making.

Referral Hospital Assessment and Care
It is expected that prior to consultation with ARV, reasonable efforts will be made by referral sites to accommodate critical care patients within a campus of the health service to which they belong.

In all cases where a hospital has an accredited emergency department, initial assessment and care, and the appropriateness of transfer will be assessed by the referring hospital at a consultant level. Where a referral site has an ICU, it is required that patients are assessed by senior ICU staff who will be expected to consider all options for non-transfer, and who will be expected to provide local active case management, regardless of whether a patient is admitted, in the referral emergency department or in the referral ICU. ARV coordinators will request such involvement in cases where it may not have been sought for example by a referring emergency department.

Process
- Cases will be referred to ARV in the usual way via the State-wide retrieval phone number: 1300 368661 or via e-referral at https://reach.vic.gov.au
- Initial information is collected by a retrieval administrative support officer who will then connect a referring hospital to the ARV critical care coordinator.
- The referrer and coordinator will then discuss the clinical care, transport requirements and destination for the patient.
- The ARV coordinator will then facilitate destination, retrieval platform and crew for the case, and advise the referring hospital of expected timing.
- Referral hospital staff may be required to provide a direct clinical handover to receiving hospital staff depending on case complexity and as advised by the ARV coordinator.

Hours of Operation:
08:00-24:00 – Standard process, for all referral hospitals, for cases as described above (including Metropolitan and Tertiary referral hospitals)
00:00-08:00 - **Overnight retrieval** represents increased clinical and logistic risk, however will be considered for:

- Patients referred to receive time critical interventions or investigation (including any patient that meet major trauma transfer criteria), or
- Patients referred from sites which do not have the ability to provide suitable interim critical care services (includes all health services without on-site critical care unit support), or
- Situations where a hospital has significant staff limitations or critical caseload such that use of in-house staff to perform an interhospital transfer would represent a major local clinical or systems risk exposure.

**Balancing state-wide retrieval demand and prioritisation:**

ARV’s primary focus is rural and regional retrieval (given there are a range of alternative service delivery options in metropolitan Melbourne that are usually not available in regional and rural Victoria). Metropolitan retrieval activity is a secondary focus for ARV, but will be accommodated wherever possible, and ARV will not ‘reserve’ resource for anticipated cases, unless such cases have been formally referred and assessment commenced.

**Acute Coronary Syndromes**

Patients with uncomplicated angina or non STEMI are usually managed outside of the retrieval system i.e. hospitals in general have established systems for routine management and transfer (where required) of these patients. At times these systems may fail or there may be complicating factors in a case that require ARV involvement. In such circumstances the ARV coordinator will make appropriate efforts to ensure the best outcome for the patient (whilst being mindful of more critical patient demand and broader system needs).

There are several common scenarios which lead to referral of cardiac patients for retrieval:

1. **PCI group**: STEMI and unable to thrombolise, STEMI with failed thrombolysis, STEMI thrombolysed and requires early/urgent PCI. For most patients outside the metropolitan setting, thrombolysis is the choice of intervention for STEMI, however there are times when this is not possible or not effective in which case transfer for urgent PCI is appropriate.
2. **Cardiogenic Shock group**: Patients require maximum available skill set and urgent response. Anticipate intubation, ventilation and high levels of inotrope support. Consider mechanical supports (IABP, ECMO). NB ACS patients with ‘left ventricular failure’ regularly progress in the transport setting to hypotension and respiratory failure i.e. cardiogenic shock.
3. **Post arrest group**: as above; consider neuroprotective hypothermia
4. **Complex support group**: see guidelines for IABP and ECMO

Acute Coronary Syndromes (ACS) encompasses a spectrum of unstable coronary artery disease from unstable angina to transmural myocardial infarction. International guidelines confirm that patients with an acute coronary syndrome should be managed within a specialist cardiology service. In the presence of ECG changes or elevated troponin, all patients should receive Aspirin 300mg and Clopidogrel 300mg. In addition, Metoprolol (50 – 100mg orally) should be administered in the absence of the contraindications of: HR <65, systolic BP < 105 mmHg or signs of cardiac failure.

The immediate management of these patients is determined by the presence or absence of ST segment elevation; defined by the presence of ≥ 1mm ST elevation in 2 or more adjacent limb leads or ≥ 2mm ST elevation in 2 contiguous precordial leads or new onset bundle branch block.

Patients with ST elevation who can receive percutaneous coronary intervention within 2 hours of symptom onset should be transferred emergently to enable this to occur. This time needs to include transport times, and in hospital times at both source and destination times. These patients may benefit from the use of Tirofiban or other glycoprotein IIB/IIA inhibitors. This should be discussed with the receiving cardiology unit. All other patients with ACS should receive a dose of low molecular weight heparin.

The more likely scenario for non-metropolitan patients is that PCI within 2 hours is impractical. For patients who present within 12 hours of symptom onset usual treatment is thrombolysis. There are many contraindications including recent haemorrhage, trauma or surgery, coma, ischaemic stroke within three months, aortic dissection, bleeding diatheses, known structural cerebrovascular lesions including
neoplasms, and any prior intracerebral haemorrhage. Up to 50% of patients will be ineligible because of either timing (40%) or contraindications (10%). Patients who are ineligible for thrombolysis should be considered for emergency PCI, and transferred urgently to a suitable centre. Patients with ST elevation who fail to reperfuse following thrombolysis, should be considered for urgent rescue percutaneous coronary intervention, particularly those that present within six hours of symptom onset. Failure of reperfusion can be defined as <50% fall in ST elevation or ongoing chest pain. In patients with STEMI which responds to thrombolysis, early transfer to a PCI centre is also indicated in order to proceed with an early intervention or to ensure therapeutic options (PCI) are available should ischaemia progress despite initial response to lytics. PCI is available in the centres listed in the table below. Where bed availability is problematic, ‘cardiac defined transfer’ may be appropriate (see guideline). Crewing for these transfers should be Dr/paramedic in the case of those high risk post STEMI with:

- Ongoing chest pain
- Arrhythmias
- ECG changes that fail to resolve despite thrombolysis and comprehensive medical therapy

**Staged transfers**
Where a small rural facility is unable to thrombolysse a STEMI patient, consideration should be given to a staged retrieval to a regional centre or larger hospital for immediate care prior to subsequent retrieval or transfer to a PCI centre. Similarly, a STEMI patient may be thrombolysed at a small rural health facility, then transferred to a regional centre for interim care and observation whilst transfer/retrieval to a PCI centre is arranged. This is of particular relevance where the initial Urgent Care Centre or Primary Care facility has very limited clinical resource or where retrieval or transfer is delayed due to weather or platform availability. (For example a patient in Cobram with STEMI and who has been thrombolysed may be best ‘staged’ to Shepparton if there is a delay in platform availability, or limited availability of medical resource at Cobram.)

The following hospitals provide access to urgent PCI (July 2016). Services are 24x7 unless noted.

<table>
<thead>
<tr>
<th>Public:</th>
<th>Private:</th>
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<tr>
<td>Alfred</td>
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<td>Geelong</td>
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<tr>
<td>Ballarat (Mon 08:00 – Sat 08:00)</td>
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<tr>
<td>Bendigo (Mon 08:00 – Thurs 08:00 from 1/8/16)</td>
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**Aviation Resources**
The allocation of aviation resources is not primarily the responsibility of the ARV Coordinator, but rests mainly with AAV. Input and preference based on clinical need and urgency should be provided to the flight coordinator at the time of tasking. For example: “Preferred logistics for this case, based on clinical drivers are Rotary wing platform with doctor and flight MICA crew, for time-critical departure within 30 minutes” or “Preferred logistics for this case, based on clinical drivers are Fixed wing platform with registrar and flight paramedic crew, for departure within 60 minutes”, etc. It should be recognized that AAV may have multiple competing requirements, including primary response.
Aviation resources may not be available due to: weather conditions, pilot duty restrictions, aircraft maintenance or performance issues, or other tasking.

AAV, regional AV and the coordinator need to be involved in discussion related to the transfer of patients where the use of air resources is of marginal benefit or not available in a timely manner. Where aviation platforms are not available, the ARV coordinator must facilitate alternate retrieval arrangements for the patient in consultation with the AV Clinician and Duty Manager. This may include consideration of road platforms (such as HATS, CPAV, Emerg car – local or metro), and various options of retrieval team depending on availability and required skill mix. Failure to resolve response decisions satisfactorily requires escalation of the issue to ARV admin-on-call, AAV manager, AV DM, regional duty manager or others as appropriate.

For fixed wing transfers, a patient weight limit of 160kg exists for routine transfers however patients up to 220kg can be accommodated through stretcher configuration alterations.

For rotary transfers, patient weight limits are generally those of the stretcher (approximately 160-200kg) however the practical limitations of size and manual handling are usually reached by patients at much lower weights than this.

Any patient >120kg must specifically be discussed with the flight coordinator to determine appropriateness for RW transfer, and to consider OHS risk management.

At times when AAV is unable to fly due to weather or platform issues, the use of AAV crew in critical care transfers should be considered, particularly for movement of patients in regional settings to metro. Availability of staff in such circumstances is determined through escalation of discussion to the ARV admin on call or AAV duty manager.

**Body Fluid Exposure**

Wash the affected surface well with soap and water or if in field with Gel hand sanitising liquid

If eye or mucus surfaces contamination, rinse well with water or normal saline.

Notify the ARV Coordinator who will notify the AV Duty Manager (DM) as soon as possible. The DM will contact the AV Duty Medical Officer (1800 240 395) who will contact the ARV practitioner and recommend further investigation or treatment as required.


**Blood and Blood Products**

For Paramedic Blood Authorisation: See “paramedic consultation”

In a case of severe haemorrhagic hypovolaemia in an interhospital retrieval case, RCC and blood products are normally sourced via local (referral site or regional) blood banks. In uncommon circumstances it may be necessary for ARV to source and transport these agents to the patient or use them during transfer.

In such circumstances, urgent supplies of blood and blood products may be sourced from the Royal Melbourne Hospital Blood Bank (Contact: 03 93427275 or 7276). Contact is with the RMH Blood Bank Scientist on duty. The ARV coordinator will provide case details of: name, gender, age, diagnosis, planned destination.

Agents are to be used in compliance with the Critical Bleeding Massive Transfusion guideline published by the National Blood Authority, Australia. (See Retrieval Medicine Guidelines or http://www.nba.gov.au/guidelines/module1/index.html)

The standard ARV Transfusion Pack (ARVTP) is requested. It contains: 4 units of RCC, 300-600ml of plasma and one pool (4 units) of platelets (1:1:1). These are packed in a standard temperature managed container and individual units have temperature monitoring devices attached.

Laboratory preparation time for the pack is up to 20 minutes after system activation, and the coordinator/RASO will arrange collection of the pack from the RMH Emergency Department Shift Coordinator at the ED control desk. Transport is to be arranged via AV response vehicle, Police or other appropriate urgent transport method.

Included with the pack is standard documentation that must be completed by the ARV retrieval physician for each item administered. The ARV PCR must also contain a record of the serial numbers
of any units administered. A copy of both documents will be e-mailed to RMH at the completion of the case (send to Michael.Haeusler@mh.org.au).

Any blood products not used must be returned to base with the retrieval physician and then transferred to RMH Blood Bank in the transport container, via taxi asap. The RASO will advise RMH blood bank of the ETA.

In rare and very urgent / time-critical circumstances, use of PRBC stored at AAV may be negotiated with the flight coordinator or AAV manager.

**Warfarin Reversal Pack (WRP):**

In the presence of clinically significant haemorrhage with warfarin induced coagulopathy, prothrombinex is indicated. Current Australian consensus guidelines ("An update of consensus guidelines for warfarin reversal" MJA 198 (4) 4 March 2013) recommend:

- For life threatening haemorrhage, 50IU/Kg prothrombinex (up to a maximum of 4000IU dispensed in the WRP), 5-10mg vitamin K iv and 150-300ml of plasma (typically Intracranial haemorrhage).
- For clinically significant haemorrhage, 35-50IU/Kg prothrombinex, 5-10mg vitamin K iv

Prothrombinex will be provided by the RMH transfusion laboratory and is sourced by applying the same process required for release of the ARV transfusion pack. ARV will source iv vitamin K 10mg for patients locally as required. Administration of FFP from local blood bank stores may also be indicated.

The additional benefit afforded by the plasma may not be highly significant (and often omitted in warfarin reversal for less critical indications).

Unused Prothrombinex must be returned to the RMH transfusion laboratory where it will have its expiry date amended and returned to inventory. All batch numbers must be recorded on the documentation (VaCIS or equivalent) and faxed to the transfusion laboratory as for RCC transfusion.

**Briefings (Operational Handover)**

The coordinator will convene an all staff briefing at 0800 & 1600 each day. This is to include all staff on shift including administrative staff. The purpose is to share knowledge of significant issues that may affect operations, or which may require attention or resource. The following content is to be covered succinctly and by exception, recorded on the appropriate form and tracked by the ARV admin officer:

- FCC input
  - Weather alerts
  - Air platform alerts
  - Air Crew availability or limitations
  - AAV scheduled work
- Live cases
- Recent workload summary
- Fatigue issues
- ARV crew and staff status
- Kit checks complete
- Drug checks complete
- Vehicle checks complete
- Admin issues
- Training daily schedule
- Policy and procedure alerts
- Upcoming roster issues and alerts
- Incidents and case reviews
- IT, telephony or Telehealth issues

**Call Processes**

The coordinator will at all times communicate in a professional manner, respectful of the circumstance of the referrer, the stressful nature of critical incidents, and the role of ARV and AV in the State Health System.
The coordinator must remain mindful of the need for optimal communication styles, and of communication strategies that may be applied to ensure complete and clear communication of relevant clinical and risk related matters with the referrer.

- Always allow the referrer to complete statements – do not complete for them or “put words in their mouths”
- Reflective checking is valuable: “Thank you Dr X, I understand from your statement that the patient is ….. – is that correct?”
- Ask direct risk related questions: “Dr, Do you perceive any major risks or hazards in the transfer of this patient?”
- Leave the door open for further communication: “If you think of anything else that may be important or that arises after this call, please phone me back”

Where necessary, the ARV coordinator will conference call the referrer and receiver for further case discussion, advice or planning purposes. Conference calling should not be used simply as a mechanism for handover between referrer and receiver as this is not time efficient for either referrer or ARV staff. Streamlining processes for the referrer (including minimising phone calls) is part of the one-stop-shop goal of the retrieval service.

Consideration will be given to early inclusion of other parties in the conference call (e.g. AAV Flight Coordinator, Regional AV ops centre, receiving unit or Trauma Service, Duty Retrieval Physician, Flight MICA/Paramedic)

The coordinator will determine whether the request is for one or more of:
- Request for assistance with accessing a critical care bed or time critical intervention
- Request for assistance with inter hospital transfer
- Clinical Advice

The coordinator will assess the clinical and situational information provided, and formulate a plan in consultation with the referring party. Decision making in such circumstances is often complex. The coordinator will provide clinical and logistic advice as required to the caller. This advice may be to the requesting hospital, Retrieval Physician or paramedic escort. The coordinator may need to seek assistance in some areas of clinical medicine. Specialists in the receiving hospital should also be considered as sources of advice.

**Case review & Audit**

- All retrieval cases are reviewed on-line using the Audit facility within ARVIS. The process is one of peer review, with all staff contributing to case audits.
- Systematic analysis of the audited cases is incorporated into the regular ARV education sessions at least monthly.
- The record is reviewed from the perspectives of compliance with documentary standards, and clinical practice standards, and screened for the documentation of adverse events or incidents that may have resulted in risk or harm.
- All cases are also screened from the perspective of logistics – assessing the smoothness of a mission, its planning and execution, and the avoidance of unnecessary delays. Cases include both patient-transfer cases, clinical-advice-only cases.

**Cardiac Pacing**

Appropriately credentialed crew is required for (interhospital) retrieval of the following patient types:

- patients requiring **Cardiac Pacing** (Transvenous or Transcutaneous)
- patients with a high likelihood of requiring pacing - principally this will be patients receiving **Chronotropic Infusions** (Isoprenaline / Adrenaline) for bradycardia.

This subset of cardiac patients are generally high risk and unstable. A Dr paramedic skillset is therefore often required to provide pacing expertise. MICA paramedics do have the skillset to be able to perform transthoracic or transvenous pacing however experience may be limited and insertion of pacing wires is not within the paramedic scope of practice.

In transit pacing is an uncommon intervention, and individual assessment of crew-mix and capability should occur in each mission. Skill set of the crew will therefore meet the anticipated needs of the patient.
Transvenous wires are not currently part of the ARV standard equipment, will most often be inserted at the referring hospital if required, and their insertion requires individual physician experience and credentialing (ARV or referring hospital). In a situation where a small hospital does not have the resource or capability to initially stabilise a patient in this clinical scenario, coordinators should consider expedited emergency MICA transfer (road or air as appropriate) to a centre with capacity to provide resuscitation at least - rather than a delay for retrieval response. [This is analogous to the patient with uncontrollable haemorrhage in a small hospital, unable to provide intervention].

**Clinical Practice Guidelines**

The Clinical Practice Guidelines developed by AV for use in the field by MICA and Flight MICA paramedics are appropriate in general scope to the range of practice of medical Retrieval Physicians. These CPG’s are overseen by the Medical Advisory Committee and will be the initial reference point for ARV clinical practice.

The CPG’s are guidelines and do not strictly limit the scope of clinical practice of practitioners, who in a range of circumstances may reasonably work beyond or outside of the guideline. The application of guidelines will be reviewed through the case review and audit system, and appropriate feedback will be available.

Additions to, or alterations to guidelines will occur through the processes of the Medical Advisory Committee (MAC).

**Command & Control**

During air missions, the pilot is responsible for the overall safety and management of logistics. In flight the pilot is in control of all resources, and is responsible for all decisions in relation to the aircraft, flight path, safe altitude etc. Communication with the pilot must involve and proceed via the paramedic crew. The ARV coordinator is responsible for defining time criticality of a retrieval case. The ARV coordinator will determine the crew-mix that has the most appropriate skill set for a specific clinical scenario. Principle factors involved in this decision will be clinical complexity and patient instability (actual and potential).

**Contact and Availability**

The Retrieval Physician will be contacted by the ARV RASO, by phone. The Retrieval Physician will be available to discuss the case with the ARV Coordinator within 5 minutes.

All phone contact will occur via 1300 368 661 to enable voice logging for quality assurance processes. All fax contact will occur via the 1300 367 882 to facilitate attachment of information regarding the individual cases to ARVIS.

Calls to the referring hospital should be minimised. Requests by the retrieval physician for additional information, insertion of lines or preparation of drug infusions should be made through the ARV Coordinator, or by teleconferencing all involved parties. If the ARV Coordinator is coordinating multiple concurrent tasks he/she may ask the retrieval physician to communicate directly with the referrer.

The Retrieval Physician will at all times communicate in a professional manner, respectful of the circumstance of the referrer, the stressful nature of critical incidents, and the role of ARV and AV in the State Health System.

The Retrieval Physician, in conjunction with the RASO and ARV Coordinator should ensure that both the referring and receiving hospitals are informed of the estimated time of arrival (ETA) of the retrieval team. The retrieval physician should inform the RASO of ETAs on departing and arriving back at Essendon. (or on departing the referring hospital for road missions.)

**Continuity and Handover**

At the end of the shift, the Coordinator will handover to the Coordinator rostered for the next shift. Handover will be documented in ARVIS.

All cases which are incomplete or in progress must be communicated to the incoming staff. This ensures that the active coordinator is aware of the location of all ARV retrieval staff and teams, and of their level of fatigue or readiness for deployment. This is relevant from the perspective of potential mission diversion or re-prioritisation, delays and risk management; in addition an active retrieval team
may seek assistance from the current coordinator who must be aware of the mission, its complexities, plan, destination etc.
Any cases which are believed to be completed but where significant potential exists for re-referral on the subsequent shift should be communicated.
All cases where significant outcome risk, organizational risk, media attention or major public interest exist should be handed over to the next coordinator so they are aware of cases they may receive enquiry about (such cases should also be communicated to the ARV office).

**Coordinator Contact and Availability**
The Coordinator will be contacted by the ARV RASO by mobile phone.
The Coordinator will be available to discuss the case with the requesting party within 15 minutes. All phone contact will occur via 1300 368 661 to enable voice logging for quality assurance processes.
Where the ARV coordinator is not contactable by mobile phone, attempts will be made to contact them on home phone, email, workplace phone or other method. If unavailable for more than 15 minutes, the ARV admin on call is to be contacted.
For ongoing lack of availability, the following cascade of management actions apply:
Current coordinator stays on shift until relieved
Relief options (in order) are:
Another available coordinator is contacted by phone and recalled
On shift retrieval physician assumes the coordination role
On shift senior registrar assumes the coordination role, and the next day shift registrar is recalled early if available and if necessary
Negotiate commencement of the following coordinator shift earlier than rostered
Relieving coordinators will be supported by the admin on call as required.

See following flow chart:
Coordinator Unavailable/Not contactable Procedure

Coordinator unable to be contacted at shift change-over

Phone mobile X3
Phone home number (if applicable) X3
Send SMS requesting urgent contact
Email external email address

Coordinator unable to be contacted

Contact successful
Continue business as usual

Contact unsuccessful
Contact ARV Admin on Call to advise of issue

Current Coordinator extend shift (interim)

Option 1: Initiate search for a replacement Coordinator by contacting all ARV Coordinators (call, text, email).

Replacement found, continue business as usual

Replacement not found. Activate option 2.

Option 2: Contact Retrieval Physician on duty and request they take over coordination for the duration of their shift.

Solution Found

Retrieval Physician unavailable (tasked). Activate option 3.

Option 3: Retrieval Registrar on duty take over coordination duties until next Coordinator begins shift.

Solution Found

Retrieval Registrar unavailable (tasked). Activate option 4.

Option 4: Current Coordinator remain on shift until next Coordinator available to take over shift.

Email ARV admin to communicate outcome and prompt update of roster.
Crew Briefing
For all retrieval missions, the coordinator will discuss
- patient identifying details,
- all known diagnoses,
- previous and ongoing treatment,
- current vital signs,
- drug and infusion doses,
- any issues likely to occur during transport,
- any issues warranting immediate action
with the responding crew (doctor and/or paramedic) – preferably jointly and will provide a copy of
the ARVIS coordination report.
MICA road crew transfers within the metropolitan area should be considered as a retrieval option only
when the clinical situation requires an emergency level of response (re time criticality), or the setting
is analogous to a primary response. In other circumstances, it is more appropriate to task ARV staff
(according to hospital type) or to negotiate transfer by the referring hospital.

Crew Mix
The coordinator will determine the Crew-mix that has the most appropriate skill set for a specific
clinical scenario. Principle factors involved in this decision will be clinical complexity and patient
instability (actual and potential).

High Risk Patients
- A significant group of high risk patients are those who have a potential need for airway
intervention and ventilator support during a mission. This includes for example patients with
significant intracranial pathology. Such patients may be stable at the time of presentation but have
a significant risk of rapid deterioration (e.g. conscious patients with subarachnoid haemorrhage).
Retrieval of such patients should be performed by crews that have capacity to provide advanced
airway support (MICA or Doctor). If the patient is unstable or has existing significant
neurological signs, a two person crew must always be used, to ensure risk minimization in airway
intervention procedures and ongoing management of the patient in flight / transit.
- Current crew options include ARV retrieval physician, source hospital medical or nursing staff,
MICA Flight Paramedic, MICA Paramedic, Ambulance or Flight Paramedic and combinations of
these.

Critical Care Patients
- Normal crew recommendation for such patients (consistent with national guidelines and industry
governance norms) is two clinical staff. At least one must be critical care trained (e.g. MICA,
FMP, RetrDr) in all cases, and in some cases two critical care trained staff are appropriate (e.g.
very long jobs or very unstable/complex jobs).
- Wherever possible, interhospital transfer of an intensive care level patient is to be crewed by ARV
medical retrieval staff with an appropriate paramedic or nurse crew member. This is consistent
with an overall aim and accepted retrieval coordination standard to increase the level of clinical
care capability with each episode of care the patient receives.
- Whilst this is a guide and a recommendation (and in many senses ideal), it is also something that
needs to be considered on a per case basis – considering alternates, most efficient response
options, concurrent workload etc. There will be (exceptional) times that expediting a single-
clinical-crewed critical care retrieval is a better option (or the only option) depending on resource
availability and logistics. This does not mean that single person (eg FMP) crew response is an
acceptable option when 2 staff (e.g. Dr & FMP) are available.
- On rare occasions, a request may be made to a referring site to send a medical escort with a
critical care patient to augment otherwise limited crewing options.
Crew Mix Flexibility

- Desired crew mix is dependent on case complexity and actual or potential instability, and on matching crew skill set with known or anticipated clinical need.
- In some circumstances, the preferred crew option may not be available, e.g., no retrieval physician available, no MFP available, time criticality may preclude waiting for RP to arrive at airport if response time is prolonged.
- In some circumstances, the initially tasked crew officer may have reservations about their ability to comprehensively manage the patient. In these circumstances, the crew mix should be strengthened by addition or replacement with another crew member.
- Where additional resource is unavailable, and urgent expedited transfer presents the only reasonable chance of survival, a crew of lower skillset may be tasked to transfer on a ‘best efforts’ basis. In this scenario the ARV coordinator and AV clinician together support the crew and carry responsibility for clinical care outside CPG’s if necessary. Examples of such cases would be emergency transfer of a ruptured AAA by an ALS crew to a site where surgery is available, when MICA or Retrieval are not possible. Utilisation or coopting of referral hospital medical and nursing staff should be considered. An AV operation instruction: WIN/OPS/118 ARV: Critical Care Inter Hospital Transfers – ARV or AV skill set unavailable, outlines the process to facilitate movement. A copy is available via Navigator search function or at: (http://navigator.ambulance.vic.gov.au/portal/page/portal/PAGEGRP_MAS_PROCS/PAGE_OPS/PAGE_OWI/PORTLET_OWI/PORTLET_W1_CLINICIAN/ARV%20or%20AV%20Skill%20Unavailable.pdf)

Retrieval Physician Tasking

- Retrieval missions will be allocated to the most appropriate RP responder according to required skillset, physician location and mission activation urgency i.e., particular staff with specialised skills may be selected for individual missions with known special clinical challenges.
- Where clinical acuity indicates a need for medical crew, and there is no specific need for consultant level skillset, responding an (on site) consultant may remain an option for the coordinator, and in general staff should be tasked in shift order. It is important that consultant grade staff remain familiar with routine mission activities, and be tasked to a range of mission types – both ‘routine’ and highest acuity. This applies to both air and road missions.
- Tasking decisions towards the ‘end of shift’ need to consider both rostered time of shift end and clinician fatigue. It may be appropriate to delay some missions pending commencement of a subsequent shift.
- Registrars will be assessed early in their rotation to ARV and a decision made re solo missions, and the level of mission acuity that may be appropriate for them at particular times.
- ARV registrars may only be tasked for ECMO cases after 3 months service, and if they have reached an appropriate standard of capability at both clinical and mission leadership levels.

Death of Patient

All patient deaths during the care of an ARV physician must be notified to the Coordinator at the earliest possible opportunity.
The ARV coordinator will report the death to the ARV Admin on Call at the earliest appropriate opportunity. The case will then be flagged for immediate clinical review.
Deaths occurring in an AV vehicle (including Air, HATS and CPAV) must be notified to the Duty Manager). This will facilitate an appropriate destination for the body.
The coroner should be notified in appropriate circumstances.
Peer support is available to all staff involved in the care of a patient who dies during transfer.
The deceased’s family will need to be notified of the death.
The death certificate may be completed by the referring doctor or ARV staff if appropriate. Following is the link to the birth, deaths and marriages website to obtain a death certificate and lodge same (attach an electronic copy to the ARVIS record):
http://www.bdm.vic.gov.au/home/medical+practitioners+online
Debriefing (operational)
Retrieval physicians should take the opportunity to formally or informally discuss and debrief each mission with other team members after each case. The ideal time for this to occur is at the end of the retrieval mission and on return to base to the coordination centre. Discussion with the coordinator presents a mechanism to acknowledge good practice, highlight communication and to look for improvement opportunities.

Defined Transfer

ICU Defined Patient Transfers
This guideline relates to the DHHS Time Critical Defined Transfer Guideline. Should there be need for a patient to access an ICU bed in the setting of no appropriate ICU bed being declared available on the REACH Website, a defined transfer may be authorised by the ARV Administrator on duty.

This process applies for patients needing retrieval to a site where definitive care can be provided, and assumes that such care is not available at the point of referral. The process assumes that the patient will gain a higher level of care through this transfer. A patient should not be transferred under this policy if all that is achieved is the same standard of care in another setting e.g. transfer of an intubated overdose patient from ED in a metro centre with ICU consultation to the ED of a tertiary centre.

Choice of destination will aim to ensure over time that equitable distribution of patients occurs under this process. However on a per-episode basis, patients will be transferred preferentially to sites that have exit blocked patients in ICU. The logic underpinning this guideline is that such sites can most readily create ICU capacity by expediting appropriate discharge of a suitable patient out of ICU to a ward bed.

The ARV coordinator will liaise with receiving hospital bed manager and referring and receiving clinical staff.

Decisions about which hospital is to receive the patient will be made after consideration of:
- Capability and capacity of the referring health service.
- Nature of the surgical/other intervention required by the patient.
- Capability and capacity of the potential receiving health service.
- Nature of the clinical condition.
- Degree of clinical urgency.
- Known or anticipated critical care system demands.
- Normal referral and historical clinical relationship patterns.
- Geographical proximity.
- Needs and consideration of the patient’s family.

Cardiac Defined Transfer
See DHHS published guideline. (link)

Demand for acute and interventional cardiology and CCU services is frequently high and there may be periods when demand for cardiac beds exceeds the immediate supply. These guidelines set out principles and procedures to be followed by ARV and Health Services when there is insufficient capacity in appropriate cardiac specialist services to receive cardiac transfers in clinically appropriate timeframes.

In such circumstance, cardiac patients who have time critical clinical needs (as determined by clinical discussion between referrer, ARV, and a receiving cardiology unit), are located in a health service where such services are not available, or for whom an appropriate available CCU bed cannot be identified, may be transferred to a nominated specialist cardiac facility as described by the process below.

Determining Receiving Hospital Capacity
The status of availability of CCU level beds for patients needing transfer for acute cardiac care is derived directly and in real-time from the REACH display.

The REACH website provides functionality for sites to display current CCU capacity. Data must be updated at 08:00, 12:00, 16:00 and 20:00 daily – as for the ICU and HDU components of the web site.
Where a patient has a need for **time critical procedural intervention** (e.g. PCI) destination identification will be guided by CCU level bed availability however access to the critical overriding procedural need (and its urgency) will remain the key driver for destination selection.

**Placement of Defined Cardiac Patients**

If no suitable bed can be located for a time critical patient after review of the REACH Website, a defined cardiac transfer procedure will be initiated by ARV.

The defined transfer process will commence with an assessment by the ARV Coordinator to determine the most appropriate receiving hospital for the patient. This assessment will be based on the standard assessment criteria that include:

- Capability and capacity of the referring service.
- Degree of clinical urgency.
- Known or anticipated critical care system demands.
- Normal referral and historical clinical relationship patterns.
- Geographical proximity.
- Consideration of the patient’s family.

In the absence of other major clinical or social influencing factors, patients will be distributed on a simple geographical basis by ARV.

**Authorisation of Cardiac Defined Transfer Process**

If a defined transfer process is required, authorisation for transfer will be obtained before ARV retrieves the patient to the hospital assessed as the most appropriate location. Authorisation for a defined transfer will occur though the following process:

- Decision will be authorised by the ARV Director or delegate (i.e. the ARV Coordinator).
- ARV will notify the receiving hospital bed manager who will communicate and operationalise hospital response and actions.

**Defined Transfer Procedure**

Once the defined transfer has been authorised, ARV will:

- Initiate a teleconference between ARV Critical Care Coordinator and the receiving hospital cardiology clinical staff and referring hospitals.
- Coordinate logistics of patient transfer with teleconference participants; including, where in the hospital the patient is to be received and the estimated time of arrival at the receiving hospital.
- In ARVIS, make a record of the decision to enact a defined transfer and the reasons why the decision was made.

**Neurosurgical Defined Transfer**

See DHHS published guideline. ([link](#))

Demand for (non-critical-care) neurosurgical services is frequently high and there may be periods when demand for neurosurgical beds exceeds the immediate supply. These guidelines set out principles and procedures to be followed by ARV and Health Services when there is insufficient capacity in neurosurgical hospitals to receive neurosurgical transfers in clinically appropriate timeframes.

In such circumstance, neurosurgical patients who have time critical clinical needs (as determined by clinical discussion between referrer, ARV, and a neurosurgical unit), and for whom an appropriate available neurosurgical bed cannot be identified, may be transferred to a nominated neurosurgical facility as described by the process below.

**Placement of Defined Neurosurgical Patients**

<table>
<thead>
<tr>
<th>Referral region</th>
<th>Destination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metro</td>
<td>Nearest Appropriate</td>
</tr>
<tr>
<td>Barwon SW</td>
<td>Geelong Alfred Health</td>
</tr>
<tr>
<td>Grampians</td>
<td>Ballarat Western Hospital Royal Melbourne</td>
</tr>
<tr>
<td>Loddon Mallee</td>
<td>Bendigo Austin Hospital</td>
</tr>
<tr>
<td>Hume</td>
<td>Northern Hospital St Vincent’s Hospital</td>
</tr>
<tr>
<td>Gippsland</td>
<td>Box Hill Hospital Frankston Hospital Monash Medical Centre</td>
</tr>
</tbody>
</table>
Referrers may choose to access neurosurgical services at any preferred destination hospital. If no suitable bed can be located for a time critical patient after consultation with (at least) a geographically recommended receiving destination (see table) a defined transfer will be facilitated by ARV. The defined transfer process will commence with an assessment by the ARV Coordinator and Director to determine the most appropriate receiving hospital for the patient. This assessment will be based on the standard assessment criteria that include:

- Capability and capacity of the referring health service.
- Degree of clinical urgency.
- Known or anticipated critical care system demands.
- Normal referral and historical clinical relationship patterns.
- Geographical proximity.
- Needs and consideration of the patient’s family.

In the absence of other major clinical or social influencing factors, patients will be distributed on a simple rotational basis by ARV.

### Authorisation of Neurosurgical Defined Transfer Process

If a defined transfer process is required, authorisation for transfer must be obtained before ARV retrieves the patient to the hospital assessed as the most appropriate location. Authorisation for a defined transfer will occur through the following process:

- Decision will be authorised by the ARV Director or delegate (i.e. the ARV Coordinator).
- ARV will notify the receiving hospital bed manager who will communicate and operationalise hospital response and actions.

### Defined Transfer Procedure

Once the defined transfer has been authorised, ARV will:

- Initiate a teleconference between ARV Critical Care Coordinator and the receiving hospital neurosurgical clinical staff and referring hospitals.
- Coordinate logistics of patient transfer with teleconference participants; including, where in the hospital the patient is to be received and the estimated time of arrival at the receiving hospital.
- In ARVIS, make a record of the decision to enact a defined transfer and the reasons why the decision was made.

### Delay

Unacceptable case delays must be escalated to ARV Admin if:

<table>
<thead>
<tr>
<th>Circumstance</th>
<th>Threshold delay or expected delay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning delay (management plan not finalized)</td>
<td>&gt; 90 minutes</td>
</tr>
<tr>
<td>Time critical (immediate response – 30 min)</td>
<td>&gt; 60 minutes</td>
</tr>
<tr>
<td>Acute response (retrieval dispatch &lt; 90 min)</td>
<td>&gt; 3 hours</td>
</tr>
<tr>
<td>Non acute response (retrieval dispatch &lt; 3 hrs)</td>
<td>&gt; 8 hours</td>
</tr>
<tr>
<td>Scheduled response (&gt; 4 hours)</td>
<td>&gt; 12 hours</td>
</tr>
</tbody>
</table>

### Delays and “Ramping”

Ramping and queuing of critical care transfer patients at a receiving hospital is unacceptable and is to be immediately escalated to the coordinator who will raise the issue with senior staff at the hospital. If unresolved, the matter must be escalated to ARV Admin urgently.

### Disaster Response

ARV may be involved in the management of multi victim incidents and more extreme disaster events (e.g. natural disasters, pandemics etc) principally from the perspectives of:

- Critical care bed access
• Activation and management of the HICT website (to display impact of events on health services, and their surge capacity)
• Interhospital transfer
• Surge management in critical care units
• Maintenance of normal functional capability
• Activation of retrieval teams and potentially medical response in the field.

Events may be short lived or may be sustained.

The ARV coordinator may be notified of relevant events via the 1300368661 ARV contact number, and will immediately escalate the issue to ARV admin. It is expected that ARV admin will also receive notification via the AV Emergency management alert system via pager, sms and e-mail. The ARV response will vary depending on the nature of the incident however will normally include:
• Assessment of availability of additional RASO, retrieval and coordination staff for the possible duration of the incident (utilising google forms and group sms).
• Communication of resource availability to relevant authorities
• Review of equipment status to meet potential need
• Consideration of standing up a 24 hour service for coordination
• Testing of the HICT system on REACH – (link)
• Responses as defined by the AEOC, AV ERP and sub plans and SHERP

Documentation of Coordination
All coordination activity will be documented and included in the ARVIS system – this is the ARV “medical record”, and is the formal document which records your case assessment, advice, ‘prescriptions’ etc.

As for all medical records, documentation should be concise and contemporaneous. Recording of clinical matters and advice is the sole responsibility of the retrieval coordinator. If workload does not permit direct IT entry of progress notes, handwritten notes should be kept and added to the ARVIS record as a summary note when feasible. It is not appropriate to rely on RASO documentation or the recordings of telephone conversations – recordings are not 100% accurate and will miss non-telephone conversations.

RASO staff should document the fact that communications has occurred (per episode) and the nature, not detail, of the communication eg “clinical advice”, “crew briefing” etc.

RASO staff will document detail of non-clinical communications and case progress such as logistics arrangements, notification of ETA etc.

Documentation of Retrieval
All cases will be documented utilizing the ARV digital clinical information system (Vitro).

As for all medical records, documentation should be concise and contemporaneous. A copy of the form is printed at the destination site and provided for receiving clinical staff.

Guidelines for completion of the record are available.

Double Loading of Aircraft
Critical Care ARV patients being retrieved by fixed wing aircraft normally require standard crewing with two clinical staff. As a general principle, ARV does not double load in missions that involve transfer of a critical care patient unless the second patient loaded has independent crew resource suitable for their needs. (NB for this purpose a critical care patient is one who is anticipated to require admission to an ICU, HDU or CCU and has a complex or potentially life-threatening condition, has significant potential for deterioration or instability in transit, or is a major trauma patient).

Where double loading of high risk or unstable critical care patients is being considered, discussion will occur between the ARV coordinator and the ARV admin-on-call; for stable patients at low risk of deterioration, escalation is not required.

Such discussion will focus on safety and risk, will involve AAV and will consider factors such as:
• Reason for urgency and double load vs second transfer
• Patient(s) acuity
• Current and previous medical stability of both patients
- Likelihood of deterioration in flight
- Ability of proposed crew to manage such deterioration and provide continuous care for a second patient
- Time delay in loading 2 patients
- Road ambulance services being able to pick up and transport patients to the airport without delay
- Presence of clinical risk to another patient such as infectious disease
- Patient psychological status and risk
- Appropriate available staff skill set or additional Medical equipment required
- Weather and flight planning and logistics
**Drug Orders:**

**Verbal/Telephone**

ARV telephone orders may be provided only in the setting of an urgent intervention in a critical or transfer setting when a medical officer is not available in the referring health service. ARV staff must check that all relevant medical history, drug allergy advice, and detail of the current clinical setting has been provided accurately by referring hospital staff. The following information must be recorded on the ARV-modified NIMC (below image), and drug orders entered only in the Telephone orders section highlighted. Verbal orders must be provided to 2 registered nurses at the referral hospital. A copy of the signed form is to be faxed or scanned/emailed to the referral hospital, and a copy scanned and attached to the ARVIS record.

- **Family Name**
- **First Name**
- **Hospital Name & UR**
- **ARV Case Number**
- **Gender**
- **Date of Birth**
- **Referring Hosp RN1**
- **Referring Hosp RN2**
- **ARV Coordinator Name:**
- **Date:**

Drugs and Poisons regulations that relate to oral instructions issued by medical practitioners for administration of drugs include sub-regulations 46(1) and 47(4), taken from the current Drugs, Poisons and Controlled Substances Regulations:

46 (1) A registered medical practitioner or dentist who orders the administration of a Schedule 4 poison, Schedule 8 poison or Schedule 9 poison to a person—

(a) must provide that instruction in writing in a legible and durable form; and

(b) must date and confirm that order with his or her signature.

47(4) A registered medical practitioner, dentist, nurse practitioner, an authorised registered midwife, an authorised optometrist or an authorised podiatrist who issues oral instructions in accordance with subregulation (1)(c), (2)(c) or (3)(c) (as the case requires) must as soon as practicable—

(a) confirm those oral instructions in writing; and

(b) include them or provide them for inclusion in the treatment records of the person concerned.

**Referral site drugs administration or supply**

When providing care at a referral site, ARV medical staff should sign off on hospital orders charts for all drug orders they initiate, including dispensing or preparation of infusions or other drugs supplied for in-transit anticipated use.

**Drug Stocks: rare items**

Where urgent need occurs for drugs that are not normally carried by ARV, a process has been established to source items from the Alfred Hospital. The ARV coordinator should discuss the request with the duty pharmacist at the Alfred, and make arrangements for collection of the item.
Payment is managed via the ARV office on the next business day; the coordinator is required to advise the ARV Business Manager of such cases.

ECMO
Patients with ECMO. Alfred Hospital and RCH provide transport ECMO services collaboratively with AV. ARV are responsible for logistics and platform coordination, and the receiving hospital for ICU staff and equipment. An MOU exists between AV and these hospitals outlining these responsibilities and obligations. ARV contact for adult ECMO is the Alfred ICU.

Key concepts include:
Optimal communication between all parties involved in retrieval work is essential. To this end, ARV uses teleconferencing and videoconferencing technologies extensively. (All calls to and from ARV are recorded for quality purposes)
Where patients are referred to ARV regarding potential ECMO transfer/commencement, or where they meet general ECMO inclusion criteria, the ARV coordinator will initiate a teleconference involving the Alfred Hospital ICU consultant.
Where the Alfred hospital receives direct referral of patients for possible ECMO transfer, the ICU consultant will contact ARV to ensure commencement of a teleconference involving the ARV coordinator from the outset.
All ECMO retrieval staff will be fully credentialed.
Decisions will be made jointly and collaboratively. Issues that cannot be resolved will be escalated to the ARV and Alfred ICU directors (or delegate)
Prior to any ECMO mission, the ARV coordinator will discuss the case with the ARV director or delegate, and subsequently convene a “Summary Teleconference”. This will be attended by all involved clinical and logistics parties or the case must not proceed. In this teleconference, the plan including contingencies will be discussed and agreed.

During ECMO transfers:
The ARV coordinator is the clinical ‘control point’ for all retrievals. They are responsible for defining time criticality of a retrieval case, and for overall coordination of crewing, logistics and resource.
All case communication will occur through the ARV RASO / coordination office.
All transport coordination will be provided by ARV utilising AV transport platforms. Urgency of outbound legs will be discussed with the ARV coordinator who will coordinate platform responses via AAV, ERTCOM or NETCOM.
Preferred road platform is the larger NEPT/HATS vehicle which has appropriate seating and is crewed with a critical care RN plus driver.
Standard crewing will be: Paramedic, ARV retrieval physician, Alfred Team (Intensivist(s), +/-ICU RN).
Clinical leadership will be provided by the senior intensivist.
Operational leadership and environmental guidance will be provided by the ARV retrieval physician.
Patient movements and transfers will be minimized, and will occur in well-lit, protected environments (e.g. a hangar rather than open tarmac).
During air missions, the pilot is responsible for the overall safety and management of logistics. In flight the pilot is in control of all resources, and is responsible for all decisions in relation to the aircraft, flight path, safe altitude etc.
Transfers of up to 4 hours travel time are normally performed by road platform although air transport to the referring hospital (for response rapidity) may be appropriate. All ECMO transfers must be discussed with ARV Director or delegate.

Emergency Retrieval Road Response
Code 1 responses (lights and sirens) should be reserved for cases where a patient is time critical or actively unstable. In general, patients who are intubated, fully resuscitated and supported are better managed by steady smooth transport rather than emergency transport where time saved is in fact relatively insignificant. Where traffic conditions indicate likely unacceptable out of hospital time for an otherwise ‘stable’ critical care patient, use of lights and sirens may be a reasonable option.
During a Code 1 response, not only is the speed increased, so is the risk for collisions. Other road users sometimes behave in strange unpredictable ways when they finally notice the siren or lights. The following guidelines are provided for ARV team members (including ECMO crews) during a Code 1 Drive.

Code 1 must be authorised by the Co-ordinator. A drive can be upgraded to a Code 1 by crew, but must be authorised/agreed to by the Co-ordinator via phone/radio.

- Speed is limited to <30kms over the speed limit OR a ‘reasonable’ speed over the limit.
- There are technically 2 types of Code 1 drives.
  1. Constant lights and sirens at fast speeds the entire trip, or
  2. Lights and sirens at times to push through traffic to minimise out of hospital time or to improve response time. That is, driving normally within traffic, then lights and sirens are switched on to get through a red light or traffic congestion. There is little speeding in this instance.

The response vehicle should keep right (unless soon to be turning left or exiting from the freeway). Traffic (should) merge to the left to facilitate safe passage on the right for Emergency vehicles. Some vehicles may be unaware of emergency vehicle presence and/or failure to give way.

- Tram tracks can be used with care. This environment increases the hazard potential (pedestrians, sliding on tram tracks, bollards, trams etc).

During a retrieval emergency response, if a motor vehicle accident or other incident is encountered and there is no other AV resources present, you MUST

- Stop to render assistance and call 000 immediately.
- Advise the ARV Co-ordination Centre of the delay.
- Provide a SitRep. ETHANE is a helpful acronym used within the ambulance service to provide situation reports:
  - E Exact Location of incident
  - T Type of incident (eg motor vehicle collision)
  - H Hazards (both presenting and potential eg power lines, trains on tracks etc)
  - A Access (best access to this location)
  - N Number of casualties injured and deceased
  - E Emergency services required and note that you are part of ARV

What is expected of you as a team member during a Code 1 Drive:

- It is expected that you will also be watching the traffic conditions and responsibly alert the driver to any hazards on the road that you believe the drive is not aware of. It is advised that you provide advice alerts at normal speech levels, using specific and explicit terms such as: “Hazard - Pedestrian front left”.
- Please also assist at intersections by looking left as we slow to 5kms per hr and advise “clear left” ONLY when the left is clear off ALL traffic or when all lanes of traffic have a stationary vehicle at the front of the queue. Be alert for that drivers behaving unpredictably.
- Such communications are common, informal and are advisory only - responsibility for safe driving rests with the driver. If you are unsure, remain silent.
- During the drive, it is best that other conversation is eliminated. You may discuss driving conditions, patient condition and/or what steps are to be taken when we arrive on scene.

Paramedics generally enjoy Code 1 driving and understand passengers also find it stimulating. It is worth noting that any adrenalin surge you may experience during the drive may stay with you when you reach the patient. You may need to take a breath on arrival to gather yourself, so you can give your patient and hospital staff your best care and attention.

**Equipment**

- Standard ARV equipment is authorized and approved for use and loading in all AV road and air platforms. Equipment should be restrained appropriately to avoid risk during vehicle movement. Operational Work Instruction outlines the responsibility of AV staff to allow loading and use of ARV (and AAV) specialised equipment.
- Daily checking of equipment is the responsibility of the morning shift registrar.
- Twice daily checking of restricted drugs is the responsibility of the registrar and retrieval consultant.
• Manuals for all equipment are available in the ARV office.

**Retrieval Kit Management**

• Retrieval kit checking occurs DAILY at 0800hrs & after the completion of each retrieval
• There are 4 kits in total to check
• The day shift Retrieval Physician– will check ALL Biomedical equipment and the RED and BLUE bags and the YELLOW drug bag.
• An equipment checklist is used to check each kit is correctly stocked. Anything found missing can be sourced from the medical / equipment storeroom.
• Restocking - when restocking items, if there is found to be 2 or less of a particular stock item remaining in the storeroom, you must flag that item for ordering.
• IN HOURS - contact the ARV Business Manager. The BM will attempt to source the required item – however if it is ‘out of stock’, there will be a time lag between ordering and delivery. If the BM is not available, a message left with the ARV Admin Assistant will be passed on.
• AFTER HOURS – write the item description on the whiteboard in the storeroom and it will be ordered on the next business day.

**Drug Management**

• The restricted drug stock kept in the safe is to be checked twice daily, at 0800 and during the afternoon shift between 1800 & 2000, each day of the week.
  o ARV medication requirements will be ordered via iProcurement by the Business Manager ARV or delegate at the request of the Team Manager –Fixed Wing and Flight co-ordination
  o ARV pre stocked non-restricted drug bags are stored in locked ARV kit cupboards in the secure Medical main storeroom.
  o Restricted and non-restricted medications used by ARV will be recorded in the Restricted and Non Restricted medication registers maintained in the Medical main storeroom.
  o Replacement Drugs can be obtained from the main drug cupboard.
  o Restricted items are held in the drug safe and must be checked in & out by two people. This can be done by a FP &/or a MFP, and / or the FC.
  o Drug Bags (Yellow)
    ▪ All expiry dates for drugs in the packs must be checked on the first of every month.
    ▪ For drugs which are normally refrigerated, the date when they should be discarded should be recorded on the ampoule.
    ▪ This would normally be 1 month for suxamethonium, 3 months for rocuronium and pancuronium.
    ▪ The ARV drug bags are to be secured using tamper evident tags.

**Biomed Equipment Management**

Ventilators should be checked using a circuit & test lung with O2 cylinder located in storeroom. Monitors should be turned on and attachments checked.
Syringe driver – monthly battery maintenance is the responsibility of the registrar
iSTAT analysers – calibrated weekly
CMAC Videolaryngoscope battery maintenance and cleaning is to be completed by Registrars on a monthly basis
All ventilators, monitors and syringe drivers must be on charge while in the storeroom.

**Faulty Biomed Equipment**

• Any equipment malfunction/fault must be recorded in the Maintenance Request/Defect Report book located in the ARV Admin Office.
• The faulty equipment and the completed paperwork is to be left in the large box (purple lid) in the ARV main office.
• A/Hours - an email is to be sent to AV Equipment Officer Email, cc ARV Business Manager and Tanya Flynn, ASO. This will be followed up on the next business day.
• Under no circumstances should faulty equipment be left in the packs or put back on the shelf.

On completion of a mission the kit must be returned to base and restocked by the retrieval physician so that it is immediately task ready.

Handover at destination
A clinical handover includes the presentation of relevant history, examination and investigations. It should also include current clinical progress, including patient response to any interventions performed.
The number of handovers should be minimised to reduce the risk of important information being ‘lost’.
All members of the ‘receiving’ team should have access to the handover. At the referring hospital, this includes the retrieval physician and the paramedic. At the destination hospital this includes medical and nursing staff. The ‘destination’ handover should be documented on the patient care record.
The handover should occur in a manner that is safest for the patient and is also efficient for staff. In general, this is whilst the patient is on a hospital bed, as opposed to an ambulance stretcher.
Prior to formal handover, the patient is to be moved to the hospital bed, attached to a ventilator with piped oxygen and power, and have all syringe pumps and monitors connected and checked. The patient’s clinical status should be reviewed, and the current level of stability verified – or appropriate interventions initiated.
Handover of clinical care can pose a great deal of risk to the patient. It is therefore necessary that the ARV retrieval physician assert control over the situation by using the following: “I.R.M.I.S.T” handover framework:

• Introduce self & patient (immediately on entering the handover environment)
• Retrieval reason- (From which referrer. For what reason).
• Mechanism of injury/HPC
• Injuries/Interventions-(Top to Toe Summary: e.g. “ICH, c-spine immobilisation, right pneumothorax, Pelvis splint OR in the case of a medical patient. E.g. Size 8 ETT at 24cm, NGT, RIJ CVC, bilateral 18G cannulae, R radial arterial line, Urethral catheter”).
• Signs/Symptoms
• Treatments- Sedation, Paralysis.

In an unstable patient, sufficient information to facilitate resuscitation may be given initially, followed by a more complete handover as the situation evolves. Explicit statement of the degree of urgency or instability is required, e.g. “This patient is extremely unstable with unstable hypotension. We need to do xyz prior to transfer. Please arrange abc now”
Clinical responsibility for the patient is shared between referrer and retrieval crew or between retrieval crew and receiver until the patient has fully transitioned. Thus at a referral site, local staff may assume control of a critical incident, and at a receiving hospital, the retrieval staff may continue control of a clinical event where this is in the best interests of the patient and they are the most appropriate person to provide direction of care. An important principle in such scenarios is explicit communication between staff to determine responsibility for clinical decision making or termination of care. This should be established by applying standard CRM principles.
At these handover interactions, retrieval physicians are the visible face of Ambulance Victoria and Adult Retrieval Victoria. Professional behaviours are expected.

IABP
For IABP, some referring hospitals have historically provided IABP equipment and staff, ARV organizing logistics and additional staff if required. In general the preferred arrangement is for ARV to coordinate IABP transfer with pump and technical support from Perfusion Services Ltd, with whom ARV has an MOU and clearly developed systems and standards designed for the transport
environment. Contact Perfusion Services via: 95856011, pager 96253184 or 1800641581 (James McMillan).

- The ARV coordinator arranges the case via the above number.
- Preferred platform is HATS
- ARV provides the doctor name and ETA and agreed meeting point. Perfusion Services provide the name of the perfusionist and a mobile contact number.
- If either party is delayed, this will be communicated to our coordination centre (1300368661) who will alert all affected parties (including transport platforms if involved)
- The patient remains in the clinical setting at the referral point until assessed by ARV medical staff and perfusionist
- Perfusionist, ARV Dr, and Paramedics agree transfer process
- In-mission delays are communicated via ARV coordinator to the receiving hospital as necessary

Transfers of up to 4 hours travel time are normally performed by road platform although air transport to the referring hospital (for response rapidity) may be appropriate. Interstate or air IABP transfers must be discussed with ARV Director or delegate.

**Incident reporting**

The purpose of the ARV Incident Report is to record any issues, unusual situations or variations to normal practice relating to adult retrieval activities across the state.

- A multidisciplinary group will review the information captured on this form. This will ensure that circumstances around an identified case are explored, any suggested actions are considered and improvements to the system are introduced if required.
- Feedback regarding outcome of a report will be provided to the reporter in all cases.
- At present default (mandatory) reports would include:
  - patient death in ARV care
  - staff injury
  - near miss / event with potential for patient harm (level 2 variation)
  - actual patient harm due to error (level 1 variation)
  - other critical risk (logistic or clinical)

Issues or problems which may arise must be handled in a collegiate and professional manner, with the patient well-being and clinical outcome the over-riding consideration. Issues that cannot be simply resolved must be escalated to the Director ARV or the Clinical Lead urgently.

Regional AV logistics or other issues may be escalated via the Rural Clinician to the relevant Manager as required.

**Interstate Retrieval Procedures**

Adult Retrieval Victoria (ARV) is responsible for adult retrieval services in Victoria. From time to time situations occur where a patient in Victoria requires retrieval to an interstate destination, or where ARV is required to retrieve a patient from interstate to a Victorian hospital.

**Principles**

In these circumstances there are several principles that must be followed:

The clinical care of the patient is the primary consideration, and decisions made must not compromise patient care or outcomes. NB: The clinical care of the patient may be influenced by numerous factors, including (time) availability of in-state retrieval services, weather, platform availability, platform logistics e.g. weight limits.

The usual domicile of the patient and relevant relationships they have with clinical services are significant. The patient’s wishes must be considered, for example a patient request to be close to supportive family may mean a cross border transfer for someone living close to a State border.

**Coordination responsibility**

Responsibility for coordination of a retrieval case fundamentally rests with the State in which the referral hospital is located.

Exceptions to this are:
Patients located in southern NSW including Albury, Finley, Deniliquin and Barham, where long
standing referral and secondary care links exist into Victoria.
Some patients of Mildura Base Hospital - whose primary social support links or relevant immediate
past clinical care links are in Adelaide (assumes Adelaide destination hospital).

**Interstate communication**
Where ARV is coordinating a proposed patient retrieval from a Victorian referral hospital to an
interstate destination hospital, a teleconference must occur between the ARV Critical Care
Coordinator (CCC), the interstate Retrieval Services Coordinator (Adult), and any additional
stakeholder (receiving and referring clinicians, retrieval team members, aviation service providers
etc).

**Retrieval to an interstate destination**
Patients will normally be retrieved by the receiving State retrieval service, however situations may
occur where the referring State transports a patient interstate due to clinical platform logistics or
availability e.g. ARV retrieves a patient from Mildura to Adelaide. ARV cases, with a planned
interstate destination utilising ARV staff and AV assets, must be escalated to the ARV Director or
delegate prior to commencement of missions.

**Contact numbers**
SA Coordinator (RAH Retrieval Service Air Medical Consultant) (08) 8222 4222
NSW Medical Retrieval Unit (02) 1800 650 004
Tasmania (03) 6336 5799

**Medical Imaging**
ARV currently has access to several different radiology platforms which allow viewing patient scans
and images from various hospitals around the state.
The existing systems are –
- KPACS (now installed on the CC machine and will launch when you log in. This system is
  required to be open in order to receive images as images are required to be pushed to ARV)
  Password:imed
- Bendigo – available via www.bendigoradiology.com.au Username: webarv, Password:
  Welcome1
to change every three months so will be updated on lists available in the coordination centre and
  emailed to the ARV Coordinators group
- Wimmera- Username arvteam Password arv1

The Capability Notes section in the hospital profiles within REACH/ARVIS include details about
which sites have access to radiology/telehealth and which system you need to use to access the
required platform.
User guides for each of the above systems are available in the coordination centre.
Radiology access to the following sites is available via the various systems, as listed below:

**KPACS**
- Alfred Health
- Austin Health
- Ballarat Health
- Barwon Health
- Bendigo Health
- Eastern Health
- Peninsula Health
- Peter MacCallum
- Royal Children’s
- Royal Melbourne
- Royal Women’s
- Monash Health
- St Vincent’s
- Western Health
Morbid Obesity
Patients with morbid obesity (arbitrarily defined as: weight over 140kg, or BMI over 45) who require mechanical ventilation for management of pulmonary pathology, or who require mechanical ventilation and have other significant co morbidity, should routinely be crewed by ARV doctor and MICA. These patients must be considered clinically very complex and at significant risk for transfer. For all patients over 120kg obtain measurement of: height, width and girth, and use the AAV form to be found in the FCC and fax this to the referral hospital for them to complete and fax back to us prior to tasking decisions.

Road Platforms
All AV emergency ambulance vehicles have had stretchers upgraded to a 230kg capacity. These stretchers are FERNO 50E brand and have green/yellow fluorescent legs. The distance between the two side rails is 49cm. It is not uncommon to transport obese patients with the torso/abdomen within the side rails but the arms (and some adipose tissue) overhanging them and strapped in.

CPAV (Complex Patient Ambulance Vehicle)
- There are 5 of these vehicles in Victoria:
  - Metropolitan Melbourne x2 (although usually one per shift)
  - Geelong x 1
  - Sale x 1
  - Bendigo x 1
They have specialised equipment for moving very large patients on a wide stretcher. They have the ability to weigh their patients and have a stretcher capacity of 450kg. Their largest clients in Victoria are around 330kg and these patients overhang their wide stretcher.

HATS: Normally use the same FERNO 50E stretchers as the rest of AV – 230kg capacity, however HATS also have additional bariatric capability (larger stretchers).

Crewing levels in these vehicles may vary on location – it is important to check crewing with the AV duty manager and to ensure paramedic crew is available.

Fixed Wing
Victoria
Fixed wing aircraft have a maximum load capacity of 160kg on the standard stretcher, and 220kg on the bariatric stretcher (the bariatric stretcher can only be used in CPAV road vehicles).

NSW
RFDS standard planes have a capacity to lift 140kg without equipment or a bridge. There is a plane based in Dubbo that has a capacity of 180kg (without equipment).

South Australia
MedSTAR’s RFDS planes can transport up to 180kg on their stretchers if the side rails can be locked in the upright position.

**Rotary Wing**

There are 5 AW139 helicopters located throughout the state of Victoria. Two are located at Essendon Fields and the remaining three are located at Warrnambool, Bendigo and LaTrobe Valley airport. The weight limit is for the stretchers is 300Kg. The size of the patient on a standard stretcher is likely to limit this option rather than weight restrictions as above.

All patients greater than 120kg must be discussed with the flight coordinator to determine appropriateness for RW transfer.

Available resources for critical care management of bariatric patients

<table>
<thead>
<tr>
<th>WEIGHT LIMIT</th>
<th>BEDS</th>
<th>OPERATING TABLES</th>
<th>LIFTING EQUIPMENT</th>
<th>MRI SCANNER</th>
<th>CT SCANNER</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 200kg</td>
<td>Melb Private Sale</td>
<td>Melb Private Western</td>
<td>Melb private Epworth Free Knox</td>
<td>Albury LaTrobe Wangaratta Austin Melb Private Western Ballarat</td>
<td></td>
</tr>
<tr>
<td>≤ 300kg</td>
<td>Warringal St Vs Geelong Epworth Free Dandenong Maroondah Ballarat</td>
<td>Dandenong Warringal Western Wangaratta Maroondah</td>
<td>Shepparton St Vs Western Epworth Rich Wangaratta</td>
<td>Warringal St Vs</td>
<td>Alfred (Width-78cm Height-66cm)</td>
</tr>
<tr>
<td>&gt; 300kg</td>
<td>Shepparton St Vs Western Ballarat Austin Maroondah</td>
<td>Shepparton St Vs SJOG Geelong Epworth Free Ballarat Sale Epworth Rich Austin</td>
<td>Western Ballarat Austin Maroondah</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Organ Donor Transfers**

ARV will assist in transfer of patients for consideration of end of life management and/or organ donation where required. Circumstances may arise where patients in a regional setting have been assessed as being suitable for organ donation due to impending death, likely irreversible cerebral insult or other situation. In such settings, appropriate policy and protocol will be followed by referring and receiving staff in formulating decisions and recommendations, and appropriate communication and consent will be in place.

A teleconference will occur in such cases involving consultant grade staff at referring site, receiving site, the ARV coordinator and ARV admin on call.
The on call DonateLife Victoria Medical Consultant and/or Donation Specialist Nursing Coordinator (Donor Coordinator - 9347 0408) will assist in the logistics of the patient transfer, including communicating with clinical staff at the referring and receiving hospitals and participation in the teleconference. Otherwise, case logistics will be routine, and such cases will receive appropriate prioritisation.

**Paediatric Transfers (PIPER)**
The Paediatric Infant Perinatal Emergency Retrieval Service (PIPER) is based at RCH and is responsible for coordination of paediatric and obstetric critical care transfers. ARV may be requested to provide assistance in coordination or transfer of paediatric patients particularly at the older end of the paediatric spectrum. Generally such requests would be accommodated within available resource, and assistance provided. In cases involving younger children, consideration must be given by the ARV coordinator to the skill set of the retrieval physician. In general it is expected that overflow paediatric critical care load would be referred to ARV for case management and coordination within AV, and subsequent crew and platform decisions would be addressed in standard fashion.

**Palliation & Non-Transfer**
Some patients referred for transfer are critically unwell with illness which is inevitably terminal. The coordinator will consider such requests from the perspective of clinical appropriateness, and psychosocial impacts. After considering the clinical scenario, including where the patient currently is and what level of care can be provided, in some cases, it may be better practice for the patient to remain where they are, and to die in their own community in the presence of family and friends. This may be preferable to retrieval to a distant hospital for futile care.

Situations arise where a retrieval physician may also make such a conclusion after assessment of the patient – these situations must be discussed with the coordinator.

**Paramedic Consultation and Authorisation**

**Blood Authorisation**
Several of the AV Clinical Practice Guidelines require consultation between Flight MICA Paramedics prior to specific interventions, and authorization by the ARV coordinator. These include:
- Administration of ONeg blood,
- Use of NorAdrenaline in doses exceeding 25 mic/min

In such cases the coordinator must make an assessment of the case and provide authorization and / or other clinical advice as is appropriate.

Familiarity with AV paramedic CPG’s and the skill set of paramedics is essential to this role (and the provision of advice to the AV Clinician or crews). See: “paramedic skillsets” in this manual or the AV CPGs on Endeavour (intranet).

In the “Red Cell Concentrate” CPG:D10 primary indications for Paramedic Transfusion are:
- Hypovolaemic shock and 40 ml / kg crystalloid resuscitation already administered
- Hypovolaemic shock and measured anaemia (Hct < 30)
- Measured anaemia (Hct < 27) in patients with cardiac or neurological injury / disease
- Severe measured anaemia (Hct < 21)

Coordinators should keep in mind:
- Ambulance CPG’s require administration of 40ml/kg crystalloid and evidence of hypovolaemic shock prior to request for blood transfusion authorization.
- Authorisation should not be provided if these criteria are not met
- Hypotension due to causes other than hypovolaemia must be considered e.g. tension pneumothorax, drug effects in RSI, drug ingestion, normal body habitus, other
- Blood transfusion may not be authorized without specific assessment of the patient (ie cannot be authorized on the basis of an unverified sitrep or an assessment of the patient by any person other than the requester)
• In all cases a full set of clinical observations including end organ assessment of shock (pale, cold, clammy, altered conscious state etc) MUST be recorded
• The utility of haemoglobin levels in the decision making for authorization of transfusion in the acute haemorrhage setting is very limited
• The assessment of hypovolaemic shock and inherent perfusion failure is difficult in the prehospital environment. The clearest signs of end-organ hypoperfusion include decreased urine output, acidosis, altered conscious state, elevated lactate level.
• BP goals in trauma resuscitation must consider these signs, as well as entrapment / delayed extrication, and prolonged transport times.
• BP goals for penetrating trauma are generally lower than for blunt trauma in the absence of major head injury
• It is unlikely that prehospital blood transfusion would be indicated with a blood pressure greater than 80-90 systolic or shock index <1 (HR/SystBP) in this setting particularly if the patient does not have significant head injury.

Use of prehospital uncrossmatched blood may present hazards.
• Overtransfusion of cold, banked blood may be hazardous particularly in the prehospital setting
• The potential benefits must be carefully weighed against risk.
• Administration of blood should not contribute to extended pre-hospital time.
• Chronic anaemia does not generally require immediate transfusion.

ARV will audit all requests for blood transfusion authorisation.

Prehospital Thrombolysis
AV has implemented PHT in a pilot program.
This is supported by a CPG for management of patients with clear STEMI who > 30 minutes from a thrombolysis centre or >30 minutes from a PCI centre.
In standard / uncomplicated cases, Tenecteplase will be administered by MICA.
ARV will be involved in this initiative in several ways:
1. **Patients who receive PHT and are transferred to a non-PCI centre**
   a. In such cases, the AV clinician will provide ARV with case information
   b. Such cases are managed via the pre-hospital notification pathway, and will be followed up by ARV within 60 minutes
   c. This follow-up will identify any need for outreach / support or for early coordination of transfer on to a higher level of care (facilitated by ARV)
2. **Patients who have a STEMI and do not meet the criteria for PHT (e.g. are within 30 minutes of a thrombolysis facility)**
   a. In such patients, where AV paramedics anticipate potential need for on-transfer of a STEMI patient from an initial facility, ARV will be advised by the AV Clinician
   b. Such cases are managed via the pre-hospital notification pathway, and will be followed up by ARV within 60 minutes
   c. This follow-up will identify any need for outreach / support or for early coordination of transfer on to a higher level of care (facilitated by ARV)
3. **Some patients with STEMI may have relative contraindication or precautions for thrombolytic administration. In all such cases, the MICA paramedic will contact ARV to discuss the case.**
   a. In these cases, the ECG will be sent to the ARV Fax/Email (arv.faxemail.ambulance.vic.gov.au) address, and the AV Clinician will flag the case with ARV.
   b. Once the ECG is retrieved, ARV will recon tact the AV Clinician who will conference the MICA paramedic for case discussion.
   c. The ARV coordinator will follow the above CPG, review the ECG and complete the ARVIS case details. After which they must complete the paper thrombolysis audit form.
d. If cardiologist consultation is required, this should be with staff at the nearest appropriate cardiology destination as per standard ARV consultation processes.

e. Destination will generally be the nearest ED, and the AV clinician will provide standard advice to the receiving unit.

f. In some cases transfer on to a PCI centre or Tertiary centre may be advised and will be facilitated by ARV

g. Completed documentation should be forwarded to the ARV office

These processes are interim during the implementation and trial of PHT and may be modified in response to the trial outcomes.

**Patient preparation and packaging**

Depending on sending hospital resources and expertise, patients may require little or extensive interventions by the retrieval team before they are suitable to be transferred. Requests to the sending hospital e.g. drugs pre-prepared in 50ml syringes should be made through the coordinator.

The patient must be reassessed before transport begins, especially after being placed on monitoring equipment and the transport ventilator (if used). Transport preparations must not overshadow or neglect the patient’s fundamental care. An example of a brief check on the patient is listed below.

- Airway is secured and patent.
- Ventilation is adequate; respiratory variables are appropriate.
- All equipment alarms are switched on.
- The patient is haemodynamically stable.
- Vital signs are displayed on transport monitors and are clearly visible to transport staff.
- PEEP/CPAP (if set) and FiO2 levels are correct.
- All drains (urinary, wound or underwater seal) are functioning and secured.
- The underwater seal drain is not clamped.
- Venous access is adequate and patent.
- Blood products and IV fluids are available.
- IV drips and infusion pumps are functioning properly.
- The patient is safely secured on a trolley.
- The charge status of all electrical equipment has been checked.

**Peak Workload Strategy**

ARV workload by its nature is variable in intensity and volume. Under normal circumstances, the current systems cope with standard loads however there are peaks of activity which can at times be sustained (e.g. in winter). In such situations it is important that Coordinators and RASO’s identify critical workload volumes and identify strategies to manage this load. The advised process is as illustrated in the table below.

In all cases of peaking workload, the above strategies should be implemented at the earliest opportunity and continued informed communication with the ARV Admin on call should be maintained, either by phone or email.
Perinatal Emergency Retrievals

The Perinatal Emergency Referral Service (previously PERS) is integrated in the PIPER service and is a state-wide service providing maternity care providers in Victoria with a coordinated and timely safe approach for:

- Providing access to optimal expert clinical advice about perinatal emergencies.
- Providing access to obstetric and neonatal resource information.
- Facilitating perinatal emergency transfers to appropriate facilities when required.

In cases where there is likely rapid deterioration in maternal condition without specialist intervention, such as occurs with major post-partum haemorrhage, uterine rupture, or acute respiratory failure, or where the mother is or is likely to become critical, PERS will refer case coordination responsibility and management of the mother to ARV.

In such cases:
The PERS consultant will contact the ARV critical care coordinator and provide a handover of the clinical status.

Both consultants will discuss the priorities and clinical needs of the case (including but not limited to):

- Pregnancy specific care needs for the mother
- General care requirements of the mother
- The type of preferred destination unit for the mother
- Neonatal care considerations (involve NETS if required)

## Strategy

<table>
<thead>
<tr>
<th>Time Out</th>
<th>In Hours</th>
<th>After Hours</th>
</tr>
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<tbody>
<tr>
<td>(When workload is peaking, multiple cases, limited resource)</td>
<td>Coordinator to request that the Admin on Call meet in the EOC with the Coordinator and RASO to review the current cases in progress and to, 1. Rate the risks, 2. Assign ‘urgency’ of cases and to, 3. Determine the resource needs of each job and prioritise actions to be taken.</td>
<td>Contact ARV Admin on Call and teleconference to discuss the current situation and assistance required.</td>
</tr>
</tbody>
</table>

| Additional call taking resource | Contact the ARV Business Manager who will organise additional support from within the ARV office staff group. | Contact the ARV Admin on Call who will- 1. Authorise / organise to recall additional clerical staff depending on availability. 2. Authorise the use of on site RP staff, depending on tasking/availability. |

| Additional coordination resource | The ARV Admin on Call will provide direct assistance (if appropriate) or mobilise in-house or on-call clinical advisor, retrieval physician or registrar staff to assist. | During extreme workload periods, a second on call coordinator may be rostered. |
ARV will coordinate an appropriate crew response for the case (often consultant grade).
ARV will coordinate appropriate transport for the patient
ARV will access an appropriate critical care bed for the patient (at a centre which provides obstetric care normally). Tertiary destinations may include RMH (with RWH support), Austin Health (with Mercy Hospital support) or Monash Medical Centre Clayton. Sub tertiary hospitals may be appropriate for both critical and obstetric care depending on acuity (including Box Hill, Sunshine, Geelong, Northern, Ballarat, Bendigo Hospitals).

the following hospitals are known to provide obstetric cover with a collocated intensive care unit:
The PERS consultant will remain aware of the case and provide consultation and input via intermittent briefings from the ARV coordinator, or through involvement in teleconferences
The outcome of the case and / or transfer will be communicated to PERS by ARV.

Platform Options
There are several modifying factors in platform selection:
1. Platform activation time
2. Return destination
3. Crew activation time
4. Secondary ground/air transfer times
5. Clinical Issues e.g. equipment and space needs

Failure to resolve platform or crew response decisions within a reasonable time period (60 minutes) requires escalation of the issue to ARV admin-on-call, AAV manager, AV DM, or others as appropriate.

General Recommendations re range of service / retrieval response

In ARVIS, platform alerts are based on the following business rules:
- If GIS distance from ref hosp to dest hosp > 175k = FW
- If GIS distance from ref hosp to dest hosp 100-175 and urgency = Time Critical or Acute = RW
- If distance 50-100k and urgency = Time Critical = RW
- Else = road

Road Platforms
The current options for road transport platforms include – emergency ambulance, CPAV, HATS, non-emerg vehicle. Due to current staffing and crewing structures the standard approach to road vehicle choice is as follows:
1. HATS (with driver + Crit Care Nurse crew) is preferred option during periods of availability, and if response time is appropriate. HATS are required to deliver the retrieval doctor and kit back to base after the completion of the patient transfer.
2. If HATS is not available the ARV Coordinator contacts the AV Clinician
3. In consultation with the ARV Coordinator the Clinician will provide the most appropriate resource to accomplish the retrieval. In most cases this will be an AGP with at least one ALS qualified paramedic aboard
4. Use of MICA crews for retrieval work decreases MICA availability for primary response and is therefore undesirable and should only be considered when retrieval medical crewing or HATS RN transfer is unavailable or inappropriate, or if a critical timeframe exists.
5. If the ARV Coordinator determines that the retrieval requires MICA skill sets to assist the retrieval physician (uncommon), the Clinician will organize a CSO/SRU to accompany or a MICA vehicle to do the transfer.

6. The Clinician may consider the use of a CPAV or Netcomm vehicle if they are able to resource either unit with an ALS qualified or MICA paramedic.

7. In booking road platforms via 000, the ARV coordinator is requested to provide advice on patient acuity and timeframe for waiting. It is important to remember ARV cases are normally high acuity and need rapid transfer within 60 minutes. Providing a 000 operator with a rating of ‘medium’ acuity and a longer timeframe for wait (>60 minutes) may result in tasking of a low-medium acuity non-emergency ambulance (ie not HATS / with no RN crew). This is not appropriate for ARV patients in general.

8. If required, the ARV Coordinator can liaise with the Clinician to determine clinical requirements prior to contacting the Clinician to organize the retrieval.

9. Retrieval physician response to a referring hospital occurs in the ARV rapid response sedan or with the responding HATS / ambulance crew (or occasionally by taxi). The ARV vehicle is driven by a paramedic or dedicated driver and is available for transport to airport or directly to hospitals and may be operated in an emergency response mode (lights and sirens) where necessary.

Activation of HATS is performed via the RASO contacting NPT (private ambulance service) on 1300 628728 (The RASO will fax a booking form to Netcom also).

HATS tasking detail - Please note:

- HATS vehicles being utilized for ARV retrieval cases can operate under a variation of the Non Emergency Transport guidelines and regulations. This allows transport of patients who are of higher acuity and who are outside the guidelines for usual NEPT RN-only-crew. This includes any mission which is ARV coordinated and is crewed by an ARV retrieval team – for the purposes of such missions, AAV Flight MICA Paramedics are ARV retrieval teams.

- This variation does not extend to planned emergency transport i.e. if a transport is expected to require use of lights and sirens, HATS may not be used. This is in distinction to the scenario where a HATS transfer is normally not required to involve lights and sirens but can be converted to Signal1 after discussion with the AV Clinician. ARV staff should not promote Signal1 transfers via HATS unless clinical indications are clear – HATS drivers do not normally drive under these conditions, and time savings in the context of a several-hour-retrieval-mission is usually insignificant.

- HATS skillset: The nursing staff on HATS vehicles are critical care trained RNs. They do not carry drugs, and have access to standard ALS equipment. HATS nurses may continue administration of most agents in transfer (including GTN) and may administer prescribed drugs, but generally cannot initiate drugs.

- ARV patients sent without ARV doctor or FMP (RN only) via HATS must meet the non-emergency guidelines. Classification of a patient as an Emergency Patient, removes the option for HATS RN lone crewing. Criteria are:
  - Moderate to severe respiratory distress
  - Respiratory rate > 30/min, and other signs of respiratory distress
  - Decreased perfusion
  - Blood pressure < 100 mmHg systolic. (not chronic)
  - Pulse < 50 or > 120/min. (not chronic), paced patients or with temporary pacing wire
  - Decreased conscious state
  - GCS < 13. (not chronic)
  - Chest pain or acute coronary syndrome (pain within 2 hours, failed thrombolysis))
  - Suspected stroke
  - Sub arachnoid haemorrhage
  - Acute abdo or back pain (<24 hours) and age over 60 ?AAA
  - Uncontrolled Gastro-intestinal bleeding
  - Suspected meningococcal or other severe septicaemia
- Major Trauma patients: Patients with criteria for major trauma transfer
- Obstetric patients

Platform Tasking Flowchart (AAV platforms)
Prioritisation of Tasks
In some cases, requests for assistance finding a bed or transferring a patient come before all relevant investigations are available. This information may be necessary to determine appropriate bed, or of need for transfer, eg CT head, troponin levels. If clinically appropriate, some decisions and actions can be deferred until that information is available. In other circumstances, decisions need to be made with incomplete information. Some health services are unable to provide what some would consider basic investigations (eg blood gases)
The coordinator will determine what are the highest priority patient factors in facilitating bed access.
- Does the patient require a time critical intervention (eg hot angiogram, neurosurgery, ruptured AA)? This may be a more important consideration than whether an ICU bed is immediately available for the patient.
- For Cardiology patients: Do they (or are likely to) require access to (hot) angiography or monitoring?
- For ICU: Do they require tertiary level care? Do they (or are they likely to) require access to specialised services (eg dialysis, thoracic surgery)
- For drug overdose patients: There is likely to be a need for psychiatry services after ICU discharge.
For patients primarily requiring an urgent intervention, this should not be delayed while finding and ICU / CCU bed. If the intervention can be done in a hospital with a suitable bed, this will reduce the need for secondary transfer.

Public relations
The coordinator and retrieval physician must remain mindful of the need for optimal communication styles, and of communication strategies that may be applied to ensure complete and clear communication of relevant clinical and risk related matters with the referrer.
- The retrieval physician must be aware of the high visibility nature of their work, and the fact that they are often interacting with systems and individuals under pressure.
- A proportion of the work of ARV is considered ‘newsworthy’, and the involvement in cases that may be considered such should be raised with the ARV office in the first instance. The office may then liaise with press agencies via the corporate communications area of AV.
- Individual staff members must be aware of and compliant with standard AV and public service policies in regard to confidentiality and release of material to the media.

Receiving Hospital
The coordinator will contact appropriate units based on the availability displayed on REACH. Initial requests should go to the lowest level hospitals able to deal with the current (and likely) clinical situation. This will ensure beds may be available for future more complex patients who may not be clinically suitable for the less complex hospital. For example, admitting an elderly, haemodynamically stable NSTEMI to a tertiary hospital rather than an urban ICU, may impact on ability to manage a (potential) young patient with STEMI and ongoing pain despite thrombolysis.
Geographic factors should be considered, because of impact on family and ambulance resources. This should involve consideration of regional base hospitals as appropriate.
If the requesting hospital has easy helipad access, and the patient is suitable, consideration may be given to metro hospitals with better helipad access – this increases efficiency of the transfer process and resource use and is of particular relevance in trauma patients.
The destination and handover point within a receiving hospital is generally a critical care unit including ED and OR. Reception in medical imaging (eg CT, angiography etc) is strongly discouraged as such units are poorly arranged for handover, stabilisation, and transfer onto receiving hospital equipment and monitoring. ARV retrieval staff are not expected to provide ongoing care for patients at a destination whilst such investigations proceed – patients should be formally handed over to receiving hospital staff prior to commencement of such procedures.
Receiving Hospital Clinician

- The ARV coordinator is to discuss all ICU/HDU retrieval cases with a receiving hospital ICU consultant. It is not appropriate for cases to be unnecessarily ‘filtered’ or delayed by preliminary conversations with receiving hospital registrars.
- Major Trauma transfers are to be discussed with the duty ED Consultant at RMH or Alfred Hospital.
- Systems vary for cardiology referral, however in general discussion should occur with a senior registrar or consultant.

Destination Determination: patient-in-extremis

- Where a patient is in extremis or is significantly unstable and has need for a time critical procedural intervention (e.g. PCI, emergency surgery) then access to the critical procedure is the key driver for destination selection.
- The availability of a post-op critical bed is a secondary consideration.
- In such circumstances, careful consideration of destination unit within the receiving hospital must occur and must be discussed with senior staff at the receiving hospital and a decision made based on the needs of the patient and the logistic capability of the receiving hospital.
- Although the destination unit for a patient remains the decision of the receiving hospital, the ARV coordinator will advocate for the most appropriate destination based on their knowledge of the patient’s immediate clinical needs and will communicate with receiving consultant grade staff.
- This is most relevant to patients with uncontrollable haemorrhage who require urgent operative intervention, and for whom direct transfer to an operating theatre may be advocated. The same principle applies to the patient with an acute coronary syndrome complicated by cardiogenic shock, for whom delivery to the cardiac catheterisation lab may be more appropriate than delivery to an emergency department.

Registrar Scope of Practice & Shift Structure

The ARV registrar provides service in a supported supervised role. The induction and training process is detailed in the ARV Governance Framework and AARPC Course Document. Clinical practice is supervised primarily by the ARV Coordinator, and supervision may be direct, remote, via phone or via telehealth platforms.

In the coordination setting, the registrar role is largely to observe and gain experience which must be fully supervised preferably with the duty coordinator listening to all calls and coaching the registrar, or at times with the coordinator delegating direct and defined tasks.

The standard 4 registrar roster has a day, evening and night shift.

Early: 0700-1400
Mid-morning: 1100-2100
Late: 1300-2300
Night: 2200-0600

The night shift registrar role is fundamentally an ‘on duty’ role i.e. it is not intended that the registrar sleeps overnight and is treated as an on-call staff member. The 0600-0800 period may be covered (when rarely required for a new despatch) by night reg overtime, consultant recall, or by calling in the day reg early. Night shift registrar roles:

- Retrieval response (see tasking notes below)
- Coordination assistance:
  - The night registrar should take part in the 2200 coordinator handover and may be allocated tasks at this point
  - They will also listen in on all new calls that the coordinator receives overnight, and
  - May be allocated tasks within a framework of supervised practice by the coordinator. This may include planned screening of follow up calls based on ‘scenario’ discussions with the coordinator (eg if this – then do xyz, if that – then do abc). The direction provided by the coordinator must be explicit. Good examples are:
    - Checking on patients clinical response to treatment
o Gathering simple clinical information that may have been overlooked in the initial interaction e.g. patient weight/size measurements.
o Providing clinical updates to the receiving centre
o The intention of this is to relieve night coordinators of some more routine activities but not to reduce overall consultant-based decision-making, case supervision or quality of service.
o The coordinator must be informed of the completion of these tasks.
o The night registrar must not take their own ARV cases without the coordinator being on the line at all times.

**Retrieval Logistics & Activation**

Case urgency is determined by both patient acuity and the capability of the referral site. ARV will activate a retrieval response as early as is practical in each case and urgency of that response should be appreciated by all staff.

A proportion of ARV cases are time critical and require the most rapid response. The urgency of cases needs to be considered from the perspective of risk exposure, potential for deterioration, capability of staff, and isolation of site. Similarly patient stability requires careful contextual consideration. It is important that retrieval coordinators classify urgency and stability in the context of the referrer (as opposed to the coordinator every-day exposure to critical care patients and ICU settings).

Early activation is imperative to optimise system efficiency and responsiveness. Activation may occur prior to the known availability of a destination (receiving) hospital. Retrieval physicians may be despatched before the coordinator is able to give full details of the task.

ARV departure response times of 20-30 minutes will be aimed for in time critical cases and all standard acute cases within 60 minutes. Some cases are non-acute and are dispatched within 180 minutes, or occasionally scheduled for more delayed departure.

It will therefore normally be impractical for retrieval physicians to be on call from a site that is more than 30 minutes from the metro centre or Essendon airport.

**Safety**

- Recurrent aircraft safety training will have a positive impact on flight crew emergency preparedness. Aircraft loading and unloading competency is vital to safe operations on scene, at helipads, and at airports. Mission profile, patient acuity, and aircraft performance all impact the decision to perform hot or cold loads and unloads.
- In addition to aircraft safety, crew and patient safety must be considered. Once the patient and equipment have been secured on-board the aircraft, the air medical crew must ensure access to the patient for any interventions that may be required at altitude.
- In all platforms direct access to emergency and resuscitation equipment must be maintained. For ventilated patients, a bag-valve-mask system must be immediately available and accompany the patient at all times.
- Safety considerations and aircraft operations are essential components in the initial training and continuing education of all personnel working in and around rotary-wing and fixed-wing aircraft. The perspective and knowledge of an experienced pilot is a critical factor in the training of air medical crew members
- The flight crew members must work collaboratively with other services, including ground ambulances to assure that all actions in and around the aircraft are safely carried out.
- In general, ARV is not involved in “hot” loading or unloading. The pilot is responsible for providing security of the main and tail rotors during all load/unload operations.
- A helmet should be available for the Retrieval physician when flying in a helicopter.

**Staff Welfare**

The nature of retrieval and coordination work can be stressful and difficult. Ambulance Victoria offers all staff access to peer support and counselling services. These may be accessed by individuals or via ARV management

Peer Support: contact via Corporate Paging (for duty peer support officer) 9483 8009; Phone: 0419 002 956 Email: peer.support@mas.vic.gov.au
The following paper provides a succinct set of recommendations in regard to early psychosocial intervention and support, and post-event ‘debriefing’:

Early Psychosocial Intervention Following Traumatic Events (link)
Jonathan I. Bisson Mark Brayne Frank M. Ochberg George S. Everly

- Shortly after a traumatic event, it is important that those affected be provided, in an empathic manner, with practical, pragmatic psychological support. Individuals should be provided with information about possible reactions they might have; what they can do to help themselves (coping strategies); how they can access support from those around them (particularly family and community); and how, where, and when to access further help if necessary.
- It is important that provisions be made for individuals to obtain the appropriate early support after a traumatic event. However, any early intervention approach should be based on an accurate and current assessment of need.
- Individuals who experience continued symptoms a month or more after a traumatic event can benefit from psychological intervention. If an individual’s reaction is extreme, formal intervention can be beneficial when applied earlier.
- We encourage exploration of a psychological first aid approach that takes explicit account of people’s natural resilience, built on what might be termed psychological triage and proper stepped or stratified care. People cope with stress in differing ways, and no formal intervention should be mandated for all exposed to trauma. Use of trauma support should be voluntary, other than in cases where event-related impairment is a threat to an individual’s own safety or the safety of others.

The general approach for ARV staff is:
- Identify complex/distressing case
- Discuss with individual involved early face to face or via telephone using the AV tool if necessary
- Confidentially advise ARV admin or Clinical Lead of concerns
- Provide follow-up phone call/email in 2-4 weeks
- Put in touch with AV VACU if they require professional support.

Stroke – Endovascular Clot Retrieval
Statewide service protocol for Victoria
Released by Department of Health and Human Services, State of Victoria, February 2016.

In September 2015 the Royal Melbourne Hospital was selected as the first designated Victorian ECR provider. Monash Medical Centre was selected as the second ECR provider, expected to become operational in mid-2016. The fundamental criteria for ECR consideration includes the logistic possibility of commencement of the procedure at the ECR within a 6 hour window from symptom onset.

Recommended Imaging for acute stroke:

| Non-contrast CT brain |
Diagnoses intracerebral haemorrhage, established ischaemic stroke, mimics (such as a tumour), subtle early ischaemic changes and hyperdense thrombus in the arteries

Note: In addition to standard axial views, 1 mm thin slice reconstructions improve detection of hyperdense thrombus and should be a standard series.

<table>
<thead>
<tr>
<th>CT angiogram (aortic arch to brain vertex)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirms diagnosis in non-lacunar ischaemic stroke</td>
</tr>
<tr>
<td>Increases appropriate use of tissue plasminogen activator (tPA) for mild/&quot;rapidly improving&quot; patients with occlusion</td>
</tr>
<tr>
<td>Provides immediate knowledge of carotid stenosis and proximal vasculature</td>
</tr>
<tr>
<td>Provides critical information if considering transfer for ECR</td>
</tr>
<tr>
<td>For intracerebral haemorrhage CTA can demonstrate underlying vascular malformation requiring intervention and risk of ongoing haematoma enlargement – ‘spot sign’ ongoing contrast extravasation.</td>
</tr>
</tbody>
</table>

When to perform CT angiography:
- time of onset within six hours, with a longer window for suspected basilar occlusion
- potentially treatable clinical deficit
- there is no requirement to wait for creatinine results unless there is known kidney disease with eGFR < 30 mL/min (CTA is OK if the patient is already on dialysis; consider risk-benefit if eGFR < 30 mL/min)

<table>
<thead>
<tr>
<th>CT perfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improves diagnostic sensitivity for ischaemic stroke</td>
</tr>
<tr>
<td>Indicates brain tissue viability (extent of irreversible injury and tissue at risk)</td>
</tr>
<tr>
<td>Recommended whenever possible to reduce the incidence of futile ECR</td>
</tr>
</tbody>
</table>

**Intravenous thrombolysis**

Intravenous tPA should be administered to all eligible patients in parallel with CTA/perfusion acquisition and ECR decision making to avoid delays.

**Decision to pursue ECR**

Rapid decision making regarding thrombolysis and identification of large vessel occlusion is required to detect patients potentially suitable for ECR (guidelines below).

**Metropolitan hospitals:**

Hospitals without on-site ECR availability should initiate a direct call between the referring consultant (which may also involve the on-site registrar) and receiving consultant stroke physician at the ECR centre. The ECR centre(s) have stroke physician availability at all times. Metropolitan centres acting as non-designated ECR providers will default to this pathway if they are unable to provide ECR locally.

**Regional hospitals** (Victorian Stroke Telemedicine (VST)-enabled hospitals):

Sub regional hospitals will initially transfer stroke patients to regional stroke centres for consideration of thrombolysis and potential referral for ECR. The VST program will support the regional hospitals. The contact number for the VST physician on call to discuss ECR is: 1300 835 363

For these sites, the VST stroke neurologist will assist in identifying likely ECR candidates and advise on transport requirements. They will then liaise with the ECR centre neurointerventionist to confirm ECR suitability.

<table>
<thead>
<tr>
<th>Guidelines for endovascular clot retrieval (ECR) eligibility</th>
</tr>
</thead>
</table>

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Ischaemic stroke with proven large vessel occlusion on CTA
- internal carotid artery (ICA)
- middle cerebral artery (MCA)
  - M1 segment – between the carotid terminus and MCA bifurcation
  - early M2 segment – after bifurcation but proximal within the Sylvian fissure

Independent premorbid function (modified Rankin score 0–2)

Ability to start procedure within six hours of stroke onset – discretion for basilar artery occlusion and selected anterior circulation patients beyond six hours (CT perfusion is strongly recommended for these cases) as per current national/international guidelines*

Intravenous thrombolysis commenced if eligible

Accessible to clot retrieval – assessment by neurointerventionist (requires remote picture archiving and communication system (PACS) access at all referral sites)

**Transport / Retrieval:**

Hospitals will normally arrange transport directly via Ambulance Victoria, guided by an ECR centre stroke physician.

**Mode of transport:**

Patients can be transported to the ECR centre by ambulance (Ambulance Victoria) or with Adult Retrieval Victoria’s support. The ECR stroke physician or VST stroke physician will determine which method is appropriate based on the clinical condition of the patient.

The following situations require discussion with **Adult Retrieval Victoria:**
- reduced consciousness (a significantly reduced Glasgow Coma Score (GCS) not due to aphasia)
- agitation requiring sedation or intubation
- respiratory compromise requiring intubation
- haemodynamic instability.

Clinically, these patients are likely to have a basilar artery occlusion or a massive hemispheric infarct. Contact with Adult Retrieval Victoria should be initiated by the referring centre, on the advice of the VST on-call or on-site neurologist. Adult Retrieval Victoria will then coordinate the patient’s transfer

Other patients may be transferred by routine AV processes (referring hospital initiates transfer via 000 after discussion with ECR receiving physician. Ambulance Victoria will determine the most appropriate mode of transport for the time-critical transfer of patients.

**Note:**
- Routine intubation is not required for transport of patients with anterior circulation ischaemic stroke, whether by road or air
- Studies indicate that general anaesthesia is associated with a worse patient outcome
- GCS has limited utility in assessing airway function in stroke and should not be used for this purpose
- Intracerebral haemorrhage and basilar occlusion have a different risk profile and may require intubation for transport
Tarmac Handovers
Tarmac transfers are generally inappropriate at the referral site, and patients should normally be retrieved from the referral hospital. This allows for controlled handover, assessment of the patient, checking of all equipment, connections, placements etc. All cases where there are tarmac handovers for critical care patients will be formally reviewed. (Exceptions to the guideline may reasonably exist e.g. an uncomplicated AMI being transferred urgently for PCI – in such a case the risks associated with tarmac handover are low, and the time benefit may be great).

In particular, unintubated patients with neurological compromise and those with cardiovascular instability are at high risk and crew (paramedic or medical staff) should assess the patient in the referral hospital prior to transfer to an airport.

In general, the crew performing the retrieval should continue with the patient through to destination. This is consistent with the quality commitment to care continuity and the known risks of multiple handovers in critical and unstable patients. There are instances where variation to this guideline may be reasonable in transport of a patient from airport to receiving hospital in the final leg of a retrieval, however this should not be considered routinely acceptable. Any crew change or handover should not involve a reduction of crew skill mix or capability unless formally approved by the ARV coordinator.

Trauma System & Retrieval
ARV facilitates the Statewide Trauma Advice and Referral System.
All consultations for advice and/or transfer of adult patients with presumed major trauma are to be directed via ARV, as outlined in the Victorian State Trauma System guideline for Interhospital Major Trauma Transfer.
Adult calls will be assessed and managed as standard referrals and either conference directly or subsequently discussed with the preferred trauma service

State Trauma System Guidelines (see also: Trauma Victoria)
Pre-hospital major trauma is identified according to specified physiological and anatomical criteria. Ambulance services should triage adult major trauma patients and suspected adult major trauma patients directly to an adult Major Trauma Service (The Alfred and the Royal Melbourne Hospital), when the travel time is less than 45 minutes. Guideline detail is available at Trauma Victoria PHTG.
If a Major Trauma Service is not within 45 minutes travel time, then the patient should be triaged to the next highest-level trauma service within 45-minute travel time, from the accident site. For helicopter transports, if the flight time is more than 45 minutes and the patient has signs of persisting hypovolaemic shock despite resuscitation, consultation with the ARV coordinator for blood transfusion authorisation and destination planning will occur (this may include diversion to a regional trauma service (RTS) if that service has immediately available capability – OR, surgical, blood bank, to complete damage control or life-saving interventions). If the patient does not have signs of persisting hypovolaemic shock, they will be transported directly to an MTS.
Where a person has an isolated head injury with an altered conscious state (GCS < 13) and is over 65 years of age and has sustained their injury as a result of a low fall (< 1 m) is located in the metropolitan region then the patient should be transported to the nearest metropolitan neurosurgical service (MNS) or MTS.
Where a major trauma patient appears to be in an immediately life-threatening situation during transport, the patient be diverted to the nearest designated trauma service for stabilisation, with subsequent transport to a MTS at the earliest appropriate time.
Where a patient is triaged initially from an incident site to a rural non-Major Trauma Service for stabilisation, ARV will be notified by the Ambulance clinician. Such cases will be followed up by the ARV if no contact is received from the receiving hospital within 60 minutes. Consideration of appropriate medical retrieval or interhospital transfer to a Major Trauma Service can then occur from the initial call.
**Major Trauma Interhospital Transfer**

Criteria for IHT of presumed major trauma patients are defined by the State Trauma System Interhospital Major Trauma Transfer Guideline (IHTG). Presence of abnormal vital signs, specific injury, or deterioration in a patient with a high risk, should initiate referral and assessment for transfer.

**Vital signs**
The injured patient meets the following criteria.

<table>
<thead>
<tr>
<th>AGE</th>
<th>INTER-HOSPITAL VITAL SIGNS MAJOR TRAUMA</th>
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<tbody>
<tr>
<td></td>
<td>AGE</td>
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<td></td>
<td>RR</td>
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<td>HR</td>
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<td></td>
<td>BP sys</td>
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<tr>
<td></td>
<td>SpO2</td>
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<td></td>
<td>GCS</td>
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</tbody>
</table>

If the trauma patient has any one of the above signs present, then potential major trauma is identified and activation of early consultation and potentially retrieval should begin.

**Isolated head injury in older people**
Where a person has an altered conscious state (GCS < 13) and is over 65 years of age has sustained their injury as a result of a low fall (< 1 m) then the patient should be managed in or transferred to a metropolitan neurosurgical service (MNS) or MTS. If the patient is already being assessed in an MNS, then there is no requirement to transfer to an MTS. Data from the Victorian State Trauma Registry demonstrates that outcomes for this subset are comparable when care is delivered in an MNS as when provided in an MTS.

**Injuries found or suspected**
The presence of any one of the following physiological or anatomical injuries constitutes major trauma for the purpose of inter-hospital transfer. These injuries cover threats to life, limb or eyesight.

- All penetrating injuries
- Excluding isolated/superficial limb injuries
- Blunt injuries
- Serious injury to a single region such that specialised care or intervention may be required, or that life, limb or long-term quality of life may be at risk
- Significant injuries involving more than one body region
- Specific injuries
- Limb amputations or limb-threatening injuries
- Serious crush injury
- Major compound fracture or open dislocation
- Fracture to two or more of the following: femur/tibia/humerus
- Fractured pelvis

**Specialised trauma transfer indications**
There are certain indicators in the Specialist trauma guidelines whereby transfer to either an MTS or a specialised unit is necessary. The acute nature of these injuries often requires definitive specialist care with minimal delay.

- Burns
  - Burns to more than 20% of the body for an adult or 10% for a child
  - Suspected respiratory tract burns
  - High-voltage electrical injury
- Specialised burns units providing optimal care for severely burned patients are situated at The Alfred (adult) and the Royal Children’s Hospital (paediatric). Trauma services at all levels may
receive patients with major burns injuries for resuscitation and initial stabilisation. Staff should be familiar with the burns trauma transfer guidelines, which highlight the differences between patients requiring immediate transfer and those requiring non-urgent transfer. Advice and consultation can always be sought from ARV or PIPER.

- **Traumatic Brain Injury**
  - Neurological deficits
  - Skull fracture
  - Abnormal CT scan findings

- **Spinal trauma**
  - Significant spinal fracture
  - Minor spinal cord or nerve-root injury
  - Presence of neurological deficits

  In isolated spinal cord trauma, the patient should be transferred from a primary hospital (including an MTS) directly to the Victorian Spinal Cord Service at Austin Health at the earliest appropriate time, preferably in less than 12 hours. All spinal cord trauma in paediatric patients should be transferred and managed at the Royal Children’s Hospital.

- **Paediatric trauma**
  - Any of the above conditions when in children will initiate transfer
  - All paediatric major trauma is transferred to the Royal Children’s Hospital.

- **Obstetric trauma**
  - Evidence of fetal distress and fetus beyond 24 weeks’ gestation
  - Possibility of trauma to the uterus
  - All obstetric major trauma patients should be transferred to the Royal Melbourne Hospital where they will have urgent obstetric assessment.

**High-risk criteria**
The presence of a high-risk mechanism of injury or a comorbid factor places the patient at risk of major trauma complications. Patients in this category should have a complete trauma evaluation conducted and be observed for a period of time.

If physiologically stable patients with only a high-risk mechanism of injury or a comorbid factor are triaged as major trauma patients, this may result in unnecessary over-triage.

If deterioration in a patient’s condition occurs, then ARV should be contacted to discuss the case and possible activation of retrieval services and transfer to a MTS.

**High-risk criteria for major trauma involves:**
- ejection from a vehicle
- motorbike rider or cyclist impact > 30 km/h
- fall from a height > 3 m
- struck on the head by an object falling > 3 m
- explosion
- high-speed car accident > 60 km/h
- pedestrian impact

AND
- age < 10 or > 55
- pregnancy
- significant comorbidity

**Splenic Trauma recommendations**
The state trauma committee has endorsed interim guidelines for management of splenic injury (July 2016). These are summarized below, and will be provided in a final referenced version asap:

- Non-operative management is best practice for the majority patients with traumatic splenic injury in the developed world. The goal of all management of traumatic spleen injuries is preservation of the spleen if possible and non-operative management should always be considered in all patients with a confirmed splenic injury.
Non-operative management of traumatic spleen injury is successful in approximately 95% of children.

Evidence conclusively indicates the transition to non-operative management of spleen trauma through the increased use of CT has been achieved without increasing mortality, morbidity and hospital stays.

The removal of the spleen is associated with a number of complications including bacterial infections (including overwhelming post-splenectomy infection), deep vein thrombosis, pulmonary embolism and coronary artery disease. A significantly elevated risk of solid and hematologic cancers has also been shown in several studies. Recovery after splenectomy is prolonged in comparison to non-operative management.

In all haemodynamically stable patients, non-operative management of splenic trauma should be considered the primary management strategy.

In haemodynamically unstable patients, urgent transfer to a Major Trauma Service may provide the potential for splenic artery embolisation to preserve the spleen, and so avoid splenectomy.

Patient selection for non-operative management of traumatic spleen injuries can be supported through joint assessment with Adult Retrieval Victoria, in adults, or the Paediatric Infant Perinatal Retrieval Service (PIPER) for all children <16 years. Further advice can be gained from the relevant Major Trauma Service.

The Trauma Case Review Group acknowledges that urgent splenectomy is a life-saving measure for some trauma patients however traumatic spleen injury is not an absolute indication for splenectomy.

The decision for splenectomy should be made once a joint assessment of the clinical scenario with Adult Retrieval Victoria/PIPER has determined that the patient is too critically unwell for transfer. Early communication with the Major Trauma Service surgical team is an essential part of this decision making.

Any patient who undergoes CT imaging prior to transfer to a Major Trauma Service must have the images made available to the receiving hospital, preferably in advance of the patient’s arrival. In children, the decision to perform a CT for suspected abdominal trauma should be discussed prior whenever possible with the Paediatric Major Trauma Service to avoid unnecessary CT radiation in this age group.
Unable to respond
In any situation where timely retrieval response is not able to be provided due to crewing or weather, or other factors, this decision must be discussed with the referral agency, and every effort made to assist in resolving the problem or resource gap. Review of the status of weather or logistics within an agreed timeframe should occur, and further communication be undertaken if necessary. There are circumstances where such delays or impediments indicate that a preferred option (or only viable option) for a patient may be a ‘mercy dash’ with any available AV crew and/or referring doctor to move the patient to the nearest site capable of necessary resuscitation.

AV provides a work instruction to facilitate this which essentially requires close collaboration and planning between referrer, AV Clinician, AV crews, and ARV coordinator.

Uninsured Patients & Private Hospitals

ARV will screen all patients for private hospital insurance and where clinically appropriate offer insured patients who so agree, transfer to a private hospital. Uninsured patients will be transferred to public hospitals only. If appropriate critical care beds are unavailable, the defined transfer policy framework applies. ARV does not have an active role in non-critical care patient coordination in private hospitals unless the patient meets other specific criteria such as: Major Trauma Transfer Criteria.

Inpatients

In uncommon circumstances or uninsured admitted patients in private hospitals subsequently elect to become a public patient (change of status) and require critical care admission (ICU, CCU, HDU): An inpatient, who is being treated at a private hospital, can at any time during their treatment elect to become a public patient. When this election occurs in a private hospital by a patient requiring critical care services (that is, intensive care or coronary care), the hospital must contact Adult Retrieval Victoria (ARV) to arrange transfer to a public critical care service. While transfer is being organised, the private hospital is expected to provide urgent medical care. ARV will not be responsible for any medical costs accrued during this period.

If the patient elects to be a public patient then the private hospital is responsible for all charges for the first 24 hours of care after contacting ARV to request patient transfer. This 24-hour period allows ARV to find an appropriate public hospital critical care bed, and to facilitate transfer, where it is clinically appropriate to transfer the patient. If the patient remains in the private hospital after the first 24 hours, ARV/AV is responsible for payments of all costs for care provided to the patient in the private hospital.

ED patients

Occasionally, uninsured patients self-present to a private hospital ED. Where such patients require critical care, transfer may be facilitated to a public hospital via ARV at the earliest possible, clinically appropriate time. While transfer is being organised, the private hospital is expected to provide urgent medical care to a standard consistent with usual practice.

Any decision regarding timing, clinical appropriateness, or stability for transfer will be made by the ARV coordinator after discussion with treating physicians and after administrative escalation and consultation if required.

Where a patient is assessed as too unstable to transfer, the above arrangements for admitted patients will apply, with the 24 hour period commencing at the time of decision to admit.

Uncontrollable haemorrhage

In cases such as ruptured AAA or Ectopic Pregnancy, attention is drawn to the need to expedite transfer to an appropriate service (capable of intervention). Considerations include:

- Expeditious transfer to an appropriate facility, for surgical (or radiological) intervention is the highest priority. This may be accomplished with an ALS paramedic crew if MICA or Retrieval doctor are not immediately available. MICA or medical escort may add little in the way of additional interventions. Transfers should not be inappropriately delayed to facilitate higher crew mix.
- Transfer for an intervention takes priority over the presence of an ICU bed. Secondary transfer may become necessary to access a critical care bed.
An AV operation instruction: WIN/OPS/118 ARV: Critical Care Inter Hospital Transfers – ARV or AV skill set unavailable, outlines the process to facilitate movement. A copy is available on Navigator (via Search function) or at (http://navigator.ambulance.vic.gov.au/portal/page/portal/PAGE_GRP_MAS_PROCS/PAGE_OPS/PAGE_OWI/PORTLET_OWI/PORTLET_WI_CLINICIAN/ARV%20or%20AV%20Skill%20Set%20Unavailable.pdf) ARV coordinators should be aware of this instruction.

HATS are not a suitable platform due to the need for rapid response – time to patient, lights/siren response is almost certainly appropriate.

Resuscitation should target cerebral and coronary perfusion. Maintenance of “normal” blood pressures is not appropriate.

These patients would often be transferred with a limitation of treatment order. This should be discussed with the patient and family. This can be done by referring hospital staff.

**Urgency**

In general, ARV departure response times of 20-30 minutes will be aimed for in time critical cases and all standard acute cases within 60 minutes. Some cases are non-acute and are dispatched within 180 minutes, or occasionally scheduled for more delayed departure.

Urgency of each retrieval mission is formally assessed and graded and constitutes an important component of response logistics. Urgency describes the clinically optimum timeframe for retrieval activation (time from crew tasking/dispatch to doors closed / wheels rolling). Urgency may vary based on clinical condition and stability, and also based on the setting of the patient and local (referrer) capability. The table below provides examples of each of the urgency types, related to clinical setting. Within ARVIS, business rules support this process, and these rules are built into the system as visual alerts. These are outlined below.

Decision support guidelines which have been included in ARVIS to assist the Coordinator related to combined assessment of complexity, stability, preferred crew mix, urgency and the preferred principal platform.

The following guidelines apply:

- **Complexity recommendations** are based on the worst REMS (Rapid Emergency Medicine Score) score using the following guidelines: High > 12, Medium 8-12, Low < 8
  - REMS is a validated outcome score based on patient Age, MAP, HR, GCS, SPO2.
- **Stability recommendations** are based on the following guidelines. A patient is unstable if:
  - HR > 120, < 50
  - MAP > 110, < 60
  - GCS < 14
  - RR > 30, <10
  - SPO2 < 90
  - Temp > 39, < 35
  - If the current obs (at the time of referral) breach this rule, the patient is classified as unstable
  - If worst in last 4 hrs breach the rule and current obs normal, the patient is classified as previously unstable.
- **Preferred crew mix recommendations** are based on the following guidelines:
  - If complexity = high, Doctor lead crew recommended
  - If complexity = medium and stability = prev unstable or unstable a Doctor lead crew mix is recommended
- **Urgency**
  - **General clinical assessment of urgency** is based on the following considerations:
    - **Time critical (activation time <30 minutes):** The patient has a life, cognition or limb threatening clinical problem or is clinically unstable (above) and is in a setting where definitive or satisfactory interim care is unavailable.
    - **Acute (<60 minutes):** The patient has a life, cognition or limb threatening clinical problem but is clinically stable (above) and is in a setting where satisfactory interim care is available.
- Non acute (<180 minutes): The patient has a significant critical care problem but is clinically stable (above) and is in a setting where satisfactory interim care is available.
  - Urgency indicators will alert if stability is unstable and hospital type = sub regional or sub tertiary with no ICU and the selected value is not time critical
<table>
<thead>
<tr>
<th>Classification</th>
<th>Time from dispatch (crew tasking) to en route (wheels rolling / doors closed)</th>
<th>Case Description (examples)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Clinical Presentation</td>
</tr>
<tr>
<td>Time critical</td>
<td>Immediate (&lt;30 mins)</td>
<td>• Septic Shock</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ruptured AAA</td>
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<tr>
<td></td>
<td></td>
<td>• Acute intracranial injury/bleed with likely raised intracranial pressure</td>
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<tr>
<td></td>
<td></td>
<td>• Respiratory or cardiovascular failure with rapid deterioration</td>
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<tr>
<td></td>
<td></td>
<td>• Life or limb threatening trauma</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ECMO – unstable, needing to start ECMO quickly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• STEMI post thrombolysis with ongoing pain, ST segment elevation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Ischaemic stroke for clot retrieval intervention</td>
</tr>
<tr>
<td>Acute</td>
<td>&lt; 60 minutes</td>
<td>• Septic Shock with coagulopathy and needing haemofiltration</td>
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<tr>
<td></td>
<td></td>
<td>• Type A aortic dissection</td>
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<tr>
<td></td>
<td></td>
<td>• SAH – GCS 15</td>
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<tr>
<td></td>
<td></td>
<td>• Post cardiac arrest</td>
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<tr>
<td></td>
<td></td>
<td>• STEMI post thrombolysis, borderline hypotension / LVF</td>
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<tr>
<td></td>
<td></td>
<td>• SDH – no mass effect, GCS 14-15</td>
</tr>
<tr>
<td>Non-Acute</td>
<td>&lt;180 minutes</td>
<td>• Septic shock on inotropes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ECMO but reasonably stable</td>
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<tr>
<td></td>
<td></td>
<td>• STEMI post thrombolysis – painfree, segments resolved.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• ECMO – likely but stable enough to wait.</td>
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<tr>
<td></td>
<td></td>
<td>• Post cardiac arrest - stable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Type B aortic dissection</td>
</tr>
<tr>
<td>Scheduled</td>
<td>&gt;180 minutes</td>
<td>• Non STEMI, pain free</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• SDH – chronic, no mass effect.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Long standing complete heart block with adequate blood pressure</td>
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</tbody>
</table>
Videoconferencing (Telehealth) Capability

List of VC equipped hospitals

<table>
<thead>
<tr>
<th>Loddon-Mallee Region</th>
<th>Grampians Region</th>
</tr>
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<tbody>
<tr>
<td>Mildura</td>
<td>Ballarat</td>
</tr>
<tr>
<td>Swan Hill</td>
<td>Ararat</td>
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<tr>
<td>Echuca</td>
<td>Stawell</td>
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<tr>
<td>Bendigo</td>
<td>Horsham</td>
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<tr>
<td>Mildura</td>
<td>Bacchus Marsh</td>
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<tr>
<td>Swan Hill</td>
<td>Daylesford</td>
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<tr>
<td>Castlemaine</td>
<td>Hopetoun</td>
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<tr>
<td>Cohuna</td>
<td>Nhill</td>
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<td>Heathcote</td>
<td>Rapanyup</td>
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<tr>
<td>Inglewood</td>
<td>Edenhope</td>
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<td>Kerang</td>
<td>Beaufort</td>
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<td>Kyabram</td>
<td>St Arnaud</td>
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<td>Kyneton</td>
<td>Birchip</td>
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<td>Maryborough</td>
<td>Warracknabeal</td>
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<tr>
<td>Ouyen</td>
<td>Donald</td>
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<tr>
<td>Robinvale</td>
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<td>Rochester</td>
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</table>

Barwon SouthWest Region

<table>
<thead>
<tr>
<th>Barwon SouthWest Region</th>
<th>Metropolitan Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warrnambool ED</td>
<td>Alfred Hospital – ED/ICU fixed unit</td>
</tr>
<tr>
<td>Warrnambool ICU</td>
<td>(pending)</td>
</tr>
<tr>
<td>Portland</td>
<td>Austin Hospital - ED fixed unit</td>
</tr>
<tr>
<td>Colac</td>
<td>St Vincent's Hospital - ICU fixed unit</td>
</tr>
<tr>
<td>Apollo Bay</td>
<td>Royal Children's Hospital - ED fixed unit</td>
</tr>
<tr>
<td>Camperdown</td>
<td>(they may have another unit)</td>
</tr>
<tr>
<td>Geelong ICU</td>
<td></td>
</tr>
<tr>
<td>Hamilton ICU</td>
<td></td>
</tr>
<tr>
<td>Hamilton resus room</td>
<td></td>
</tr>
<tr>
<td>Lorne ED</td>
<td></td>
</tr>
</tbody>
</table>

Gippsland Region

<table>
<thead>
<tr>
<th>Gippsland Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wonthaggi (via BSW ARV multiparty number)</td>
</tr>
</tbody>
</table>

Hume Region

Principles for use of telehealth

1. The use of telehealth technologies to deliver health care, conduct research, or provide education does not alter the basic standards of professional conduct governing health care professions as described in *Good Medical Practice: A Code of Conduct for Doctors in Australia*\(^{13}\). Where specific professional guidelines are required to inform practice protocols, then the APHRA *Guidelines for technology based patient consultations* must be applied\(^{14}\).

2. Confidentiality of patient telehealth consultations, patient health records, and the integrity of information in the health care information system are essential.

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3. Health professionals (at each end of a telehealth consultation) must make their identity known and confirm the identity of each patient at each encounter. As much as possible, patients or next of kin directly involved in a telehealth encounter should be informed about the process.

4. Services provided via telehealth must adhere to the principles of best practice in accordance with each health care discipline's clinical standards.

5. Each health care discipline and health service must examine how its patterns of care delivery are affected by telehealth and is responsible for developing its own processes for assuring competence in the delivery of health care via telehealth technologies.

6. Documentation requirements for telehealth services must be agreed between the providers. Documentation of each client encounter should ensure recommendations and treatment, communication with other health care providers as appropriate, and adequate protection of client confidentiality.

7. Clinical guidelines in the area of telehealth should be based on empirical evidence, when available, and professional consensus among involved health care disciplines.

8. The integrity and therapeutic value of the relationship between client and health care practitioner should be maintained and not diminished by the use of telehealth technology.

9. Health care professionals and practices do not need additional licensing/accreditation to provide services via telehealth technologies. At the same time, telehealth technologies cannot be used as a vehicle for providing services that otherwise are not legally or professionally authorised.

10. The safety of clients and practitioners must be ensured. Safe hardware and software, combined with appropriate training and demonstrated user competence, are essential components of safe telehealth practice.

11. The relevant telehealth technical standards for jurisdictional authorities (state or commonwealth) must be applied.

Telehealth Units
ARV currently has two mechanisms for accessing telehealth. There is a large telehealth unit on the wall in the coordination center which is used for telehealth within the Loddon Mallee region and the metropolitan sites.

To Make A Call

- Press the ‘Directory’ button.
- Press the ▶ button to move the cursor currently flashing in the top left hand corner of the screen over to the directory list.
- Select Favorites and scroll down to the site you wish to call and press the green ‘Call’ button.
- Mute the mic if you don’t wish to be heard by the far site.
- The connection may take a couple of seconds to appear on Screen 2. If the far site does not appear and you are still seeing ARV, the cart you are dialing may not be switched on as yet. Once that unit is switched on it will display on Screen 2.
- If a far site is dialing into ARV the unit will answer the call automatically.
- Once you have finished with the call, press the ‘hang up’ button. Do this regardless of who initiated the call.
**Camera & Volume Control**

- To control the volume of the sound projecting into the ARV room, use the volume +/- buttons as indicated.
- To move the ARV camera, press the ‘near’ button (see diagram) then use the arrow keys to direct the camera.
- To move the camera at the far site, press the ‘far’ button (see diagram) then use the arrow keys to direct the camera.
- To zoom in and out with the camera, select near/far for the appropriate camera you wish to control, followed by the zoom +/- button (see diagram).
- If the far site cannot hear you, please check that your microphone is not on mute (indicated on Screen 1 by the same mute icon located on the remote).

**Initiating a Multi Point Video Session in ViTCCU**

The ViTCCU video conferencing system has been established using the concept of meeting rooms for each site. Consequently it is only possible to have a multi point video conferencing session (more than two attendees) using a single meeting room.

The process to initiate a multi-point video conferencing session is:
- Identify which meeting room will be used for the linking of each site eg. ARV.
- Set a time and date for the meeting and ensure that each site is aware of the correct meeting room to dial.
- At the agreed time and date the unit at the location of the meeting room (eg. Echuca) must be turned on and available for dialing.
- All other sites (eg. ARV and Alfred) are required to dial the meeting room of the agreed location (Echuca). Eg. From the Directory, select Echuca, enter the password when instructed, wait for each site to come online.
- When the conference is over, each dialing site will be required to hang-up.

Note: Each site dialing will be required to enter the Chairman password of #9# if using the ViTCCU system. Only one site will appear on the video screen at a time, and that is the site that is talking, or the last site that spoke.

**Jabber – BSW and Grampians**

The Barwon South West and Grampians regions utilise the Jabber client which is located on the three dedicated telehealth desktop units in the coordination centre. These computers should be signed in using the ARVtemp account (Username - ARVtemp, Password - Welcome 1) as the Jabber client is configured for this account.

Select the Jabber icon from the desktop.

Jabber will automatically sign in when you log into the computer using these credentials. The contact lists have been set up according to region. Select the site you would like to call from the list and use the phone icon to place the call.
To initiate a multi-party call (not involving the Alfred) a virtual meeting room has been set up and saved in the directory for you. You will need to advise all parties that the number they need to dial is 179263041. This is saved as ARV Multiparty in the directory. You will also be required to use this number when contacting Wonthaggi as a direct point to point connection cannot be established at this time.

Due to the nature of how the Alfred connects to SWARH, if you require a multi-party call involving The Alfred the number required is 203.49.131.121##553894. This has been saved in the directory as Alfred Multiparty.
Aeromedical Safety

Aircraft
Beechcraft Super King Air 200
Twin engine turbo prop aircraft
Maximum range: 1800 nautical miles
Pressurised cabin
Max Altitude: 35000ft
Engines: Pratt & Whitney 850 HP each
Cruising speed: 289 knots

Safety card
On walls in aircraft, one loose copy available on request
See Appendix 2 for safety card.

Emergency Exits and doors
Two doors for regular use, both located on left rear of aircraft. Cargo door for loading/unloading of stretcher. Passenger stair door is located within cargo door. The passenger stair is also one of the emergency exits.
The second emergency exit is at the front right side of the cabin over the wing.
In case of a water landing, ONLY use the emergency exit on the right side over the wing. DO NOT use the rear exit in case of a water landing, as the cabin will quickly fill with water.
Pre flight safety briefing

Before every flight the flight paramedics will do a safety briefing

**Seat belts**
Must be worn during the following times:
During takeoff.
During landing.
Flights below 1000ft.
Turbulent conditions.
As directed by the pilot.
By patients at all times.

Flight paramedics will give instruction in the correct fitment of seatbelt.
Prior to take off and landing an audible tone will sound to remind passengers to fasten seat belts.

**Emergency Oxygen during Cabin Depressurisation**
All pressurised aircraft are required to have an emergency oxygen system.
The King Air has a system that automatically deploys if there is a cabin depressurisation.
This occurs above 12500ft.
Yellow cup like oxygen masks (similar to commercial airlines) will drop from the midline of the roof. Should they deploy, fit your own mask immediately. Pull on the mask to activate oxygen.
Put your own mask on first, and then assist others.
Fogging and wind rush might occur in the cabin.
The pilot will dive steeply and rapidly.
Seat belts must be worn.

**Fire extinguishers**
Two 1kg fire extinguishers:
One under co-pilots seat in the cock pit (right hand seat).
One in rear of cabin on the left of the cargo door adjacent to the rear left hand seat.
Each contains approximately 25-30 seconds of extinguishing agent.
Instructions:
Remove locking clips.
Pull the safety pin.
Hold unit upright, aim at the base of the fire.
Squeeze the trigger while doing a side to side swinging motion.

**Survival equipment**
Located under rearward facing seat at the front of the cabin
Content:
Four litres of water
Emergency rations
Cordage
Hatchet and Leatherman tool
**Waterproof matches**  **Thermal blankets**
**Waterproof torch**  **Illuminating light stick**
**Insect repellent**  **Sea dye**
**Mirror**  **Compass**
**Sun hats (3)**  **First aid booklet**

**Emergency Locator Transmitter (ELT)**
In the event of a forced landing in an emergency situation the ELT automatically activate. This activation is via a 7G force impact.
Should it not activate automatically, there is a manual switch located on the right side of the cockpit console between the pilot seats. A plastic cover protects a red switch and light. (Pictures above)
In the event of an impact a red light will be flashing. If not the ELT should be manually activated.

**Emergency Landing**
Wait for paramedic to call BRACE BRACE BRACE.
There will probably be more than one impact.
Wait for the aircraft to come to a complete stop.
Be prepared to evacuate the aircraft to a safe distance.
The paramedic is responsible for the evacuation; however he may not be capable.

**Life jackets**
Stowed under your seat.
Life jackets must be worn:
In an emergency situation on over water flights
In a low level flight over water (under 2000ft)
At the pilot’s discretion.
Spare life jackets are kept in the rear cabin cabinets.
A portable life raft will be loaded onto the aircraft if a flight over a great distance of water is planned (e.g. to Tasmania).
The life raft contains a portable ELT that requires manual activation.
After activation of the life raft ELT, attach it to the raft with its own tether line and allow it to freely float in the water.
The life raft carries basic survival equipment and water. It is advisable to retrieve the aircraft survival kit.

**Airside Safety**
The airside is the movement area of an aerodrome, adjacent terrain and buildings or portions thereof, to which access is restricted. **Commonsense and vigilance are required at all times when airside.**

**Airside rules**
High visibility vest are required to be worn at all times when airside (Pilots and passengers are exempt if they are moving directly to or from the aircraft for operation purposes).
Aircraft always have right of way over vehicles, equipment or pedestrians.
Never park or stand within 3 metres of any aircraft unless you are directly involved with that aircraft.
No person is permitted within 30 metres of a helicopter or a helicopter landing site unless essential to the helicopter operation.
No smoking, alcohol or any banned substances are permitted to be consumed airside.
Never stand within 15 metres of a refueling aircraft.
Mobile phones are not permitted within 15 metres of a fuel hydrant point or aircraft that is being refueled.
Never approach a jet or propeller driven aircraft with its engine/s running.
Never approach a helicopter with its engine/s running (unless escorted or entering or departing the aircraft following specific procedures discussed in safety around helicopters).
Beware of the direct effects of jet blast and propeller wash and their effects on debris.
Foreign Object Debris (FOD) causes Foreign Object Damage – If you see debris – pick it up. Beware of what you put down and where (light weight bags/equipment) – it may blow into the path of an aircraft.

Be aware of vehicles moving around the airside – fuel trucks, maintenance and emergency vehicles. Only authorised vehicles with an operating anti collision light or vehicles being escorted by an authorised escort are permitted airside.

Airside emergencies – depending upon the nature of the emergency, emergency services should be notified if necessary and the airport duty operations manager must be notified in all instances. In the event of a ‘full’ emergency the airport will be closed and all unnecessary persons are to clear airside.

**Strategies for controlling risks/hazards**

Wearing appropriate clothing and footwear e.g. flame retardant flight suits and undergarments and sturdy flat soled footwear. (No high heels – they are likely to get caught in the Douglas tracking in the floor)

Using ear plugs on the tarmac and good quality headsets within the aircraft.

Securing all items within the aircraft.

Wearing seatbelts/harnesses at all times.

Listening to in-flight briefings and following directions of the flight crew.

Be well rested prior to duty and keep hydrated during flights.

Most importantly: maintain an awareness of your surroundings, use ‘common sense’ and if in doubt – ask somebody who knows!

**Fixed wing aircraft (FW) danger areas**

Propeller driven:

- Propellers: large and spin at high speeds which make them difficult to see.
- Exhausts: Piping hot emissions and exhaust remain hot for a period of time after shut down.

Jet driven:

- Engine intakes – sucks in an enormous amount of air when engine is running.
- Engine outlet: jet efflux is extremely hot gas.

**Approach to a fixed wing aircraft**

It is normal practice to be in the cabin of the FW with the doors closed prior to engine start. The pilot will advise when clear to open doors following engine shut down and when propellers have stopped turning.

Approach and depart FW from the side remaining well clear of the engines.

Remember: a propeller might still turn with the engine shut down.

**Approach to a ROTARY wing aircraft**

Approach to the helicopter should be limited to pilot authorised movement.

All approaches should be within direct vision of the pilot and acknowledged by them.

Areas to the rear of the helicopter are ‘no go’ zones.

**Cabin safety**

Command:

The Pilot in Command (PIC) is in sole command of the aircraft and its operation. No one may load, equip or enter the aircraft without the knowledge and permission from the PIC.

The PIC will give commands regarding procedures to be undertaken when in the aircraft.
Seatbelts: must be securely fastened prior to take off and remained fastened until after landing (unless restrained by an approved harness).

Exits: Identify your primary and secondary exits, their operation and reference point to locate them. Remember this will be different for each seating position in the aircraft.

Communication: there should be no communication over the intercom during times the pilot is communicating with air traffic control such as when receiving clearances or instructions and during take off and landing unless essential to aircraft safety. If necessary to communicate with other medical crew during these times – request to be isolated from the cockpit.

Controls: No person shall operate or interfere with any aircraft control, instrument or aviation radio unless specifically requested to by the PIC.

Equipment stowage: No item should be loaded into the aircraft without the knowledge and permission of the PIC.

Safety equipment: Safety equipment such as life vests/jackets should be worn when provided by the crew. Even though the flight may not be anticipated to go over water, an unexpected diversion may occur necessitating.

Observation:
It is important that all persons onboard the aircraft keep a good look out during all phases of flight for anything that may pose a hazard to the aircraft and report the hazard to the PIC e.g. other aircraft, power lines, people, animals.

When reporting a hazard give an indication of its position using the clock method, i.e. 12 o’clock is the nose of the aircraft, 6 o’clock the tail, 3 o’clock directly right, etc.; an estimation of the distance and if relevant the level.

Briefings: prior to take off a briefing shall be given in accordance with Civil Aviation order (CAO 20:11):

- Smoking, including the prohibition of smoking in toilets
- Use and adjustment of seatbelts
- Location of emergency exits
- Use of oxygen where applicable
- Use of flotation devices where applicable
- Stowage of hand luggage
- Presence of on board special equipment where applicable

Emergency Procedures
In the event of an in-flight emergency:

- Ensure you are secure
- Ensure the cabin is secure
- Familiarise yourself with your emergency exits
- Follow the instructions of the PIC.

Post landing:
- Exit the aircraft following safe departure procedures
- Assist other WHERE SAFE TO DO SO, and provide first aid

If in a remote area: Establish shelter, gather all emergency/survival equipment, ration water/food, have signalling equipment prepared, ensure you know how to use it and use it at an appropriate time.

If in the water: ONCE OUT OF THE AIRCRAFT inflate your life jacket, deploy the life raft if carried on board, turn on ELT, prepare signalling equipment, dry out raft and prepare rations.

Bottom line
The key to aviation safety is COMMON SENSE. Follow the directions of those whose primary business is aviation and remain aware of your surroundings.
Rotary Platform (AW 139)

This document may also be found at the following link:

<<ARV Intranet link to be inserted>>
Retrieval Medicine

This section of the ARV manual is dedicated to specific clinical issues and in particular to relevant aspects of their management in the retrieval setting.

It is not intended that this section be a ‘cloned textbook’, rather that it investigate common retrieval clinical scenarios, define the particular challenges and risks of the most complex transfer challenges, and present methods of awareness, risk mitigation and clinical optimization.

This section assumes clinical knowledge at or close to specialist / consultant level and aims to take the advanced clinician to the next level in retrieval medicine.
Airflight Medicine – the basics

The Effects of Altitude on Gas Volume

Boyles Law
"When the temperature remains unchanged, the volume of a given mass of gas varies inversely to its pressure."
In flight terms, as your aircraft ascends, increasing in altitude, the barometric pressure diminishes. Any gas within an enclosed space will expand. Alternatively, as the aircraft descends and barometric pressure increases, the gas will contract.

The Effects Of Altitude On Oxygen Availability

Dalton’s Law: Pt = P1 + P2 + P3 + … Pn
Dalton's law states "the overall pressure of a gas mixture is the sum of the individual or partial pressures of all the gases in the mixture."

In flight terms, oxygen is "thinner" in the upper atmosphere. Why? At sea level the barometric pressure is 760 mm Hg, and the atmosphere is composed of 20.95% O2. As altitude increases, the barometric pressure decreases, and the molecules in the atmosphere move farther apart. While oxygen still comprises 20.95% of the atmosphere, there are less oxygen particles per cubic millimeter to be utilized.

Clinically, an increase in altitude diminishes the oxygen available to the body and can result in hypoxia. For instance, at 12,000 feet the barometric pressure decreases to 483 mm Hg. The composition of the atmosphere remains the same, and so the percentage of oxygen remains at 20.95 percent. However, the partial pressure of oxygen will decrease to 101.19 mm Hg.

The Effects Of Pressure Changes On Gas Bubble Formation

Henry’s Law
Henry’s law states "...the quantity of gas dissolved in 1 cm3 of a liquid is proportional to the partial pressure of the gas in contact with the liquid".

In clinical terms, an example of gas solubility in a liquid is decompression sickness (a.k.a. "the bends"). As a diver ascends, the pressure is decreased on the nitrogen gas dissolved in the blood. Ascending too quickly or flying within 24 hours of a dive can result in nitrogen bubble formation in the blood, which can cause dire clinical consequences. Treatment includes 100 percent oxygen and rapid descent treatment in a hyperbaric chamber and may be necessary if the symptoms do not resolve.

Altitude restriction in air transport is a consideration in only a few rare cases. When transporting a patient with decompression sickness, altitude should be restricted to less than 1000 feet above ground level. An untreated pneumothorax is an absolute contraindication to air transport. Prior to take-off, treatment with a chest tube or temporizing one-way valve system is required. Decreased flying altitude results in increased turbulence, longer flying times, and increased fuel consumption over a decreased aircraft range, consequences which must be considered when a patient requires low altitude flight.

Stresses Of Flight

In addition to hypoxia, barometric pressure changes, and thermal variations, the stresses of flight include noise, vibration, humidity/dehydration, gravitational forces, third spacing, and fatigue.

Noise
Permanent or temporary hearing loss may occur for patient or provider. The longer the exposure, and the more intense the noise, the greater the potential damage. Consequences include headaches, fatigue, nausea, vertigo, stress, and reduction in task performance effectiveness. Noise may interfere in provider communications with the patient and other crew members, and impedes the ability to auscultate the lungs, heart or blood pressure. Hearing protection should be worn by patient and crew, and includes earplugs, headsets, and helmets.

Vibration
Vibration results from the aircraft motor/rotors and can be due to turbulent weather. Vibration may result in an increase in metabolic rate, fatigue, shortness of breath, motion sickness, and an inability to
properly thermo-regulate. Low frequency vibration of the eye may cause visual decrements. Vibration in general is less well tolerated in the supine position due to x-axis vibrations. Neonates are most susceptible to direct injury from vibration and noise. Care must be taken with fractures, as the vibration may increase discomfort at the fracture site or from an inadequately padded and secured splint. Special consideration must be given to patients with electronic monitoring as in-flight vibration may interfere with invasive and non-invasive monitoring, and may cause dysfunction of activity-sensing pacemakers. Protection from vibration is essentially limited to isolating the individual and equipment from the aircraft by use of adequate padding.

**Humidity/dehydration**

Patients and crew flying at high altitude for prolonged flights will be exposed to very low humidity and may develop dehydration. Patients in a hot environment or with pre-existing dehydration may have an exacerbation of their condition, and attention should be paid to oral and IV fluid intake and urine output when appropriate. Additionally, respiratory secretions may become thick, resulting in less efficient gas exchange and contributing to hypoxia. Dehydration may be prevented through humidified oxygen and adequate fluid intake.

**Gravitational Forces**

Gravitational forces are most evident on ascent and descent, or when the aircraft changes speed or direction. Patient positioning during maneuvers may affect blood pooling and intracranial pressure. For example, in a cardiac patient it may be advantageous to position them with their head toward the rear of the aircraft during ascent, so that the G-forces help to pool blood in the upper part of the body. Conversely, in patients with intracranial injury or volume overload, a position with the feet toward the rear of the aircraft during ascent may pool fluids in the lower extremities and avoid a transient and potentially detrimental increase in intracranial pressure.

**Third Spacing**

Third Spacing is the loss of fluid from the intravascular space to the extravascular space in the tissues. This phenomenon is due to the effect of pressure changes and cellular increases in permeability resulting in fluid transitions. The effects of third spacing include edema, dehydration, tachycardia and hypotension. These affects may be complicated by other stresses of flight, including thermal variations, vibration, and gravitational force effects.

**Fatigue**

Fatigue is generally felt to be a culmination of all of the stresses of flight. Tactics should be taken by the aircrew to minimize the effects of flight and personal stresses to maximize effective performance, alertness and safety.

**Pressurized Environments**

In order to minimize the effects of barometric pressure changes and subsequent hypoxia, a controlled flow of compressed air can maintain a constant pressure in a fixed-wing aircraft. Typically the cabin pressure can simulate an 8,000–10,000 foot altitude while flying at an actual altitude of greater than 40,000 feet. Malfunction of the aircraft’s pressurization system or structural damage sustained by the aircraft may result in rapid decompression. The crew must understand this emergency, and be ready to respond. A loss of pressure through a large defect results in a rush of air towards the defect. Any person or equipment not adequately restrained may be blown about the cabin or through the defect due to the development of cyclonic winds. Decompression sickness, hypothermia, hypoxia and expansion of GI tract gases resulting in decreased respiratory movements and vaso-vagal syncope can result from this loss in cabin pressure. Hypoxia is the most important immediate consequence of rapid decompression. Supplemental oxygen must first be supplied to the pilot, the crew, and then the patient or passengers. Recall that gas in medical systems will rapidly expand, and any catheters, chest tubes, NG tubes, or drains should be unclamped. Losing cabin pressure may also result in decompression sickness. This, however, is rarely a problem under 25,000 feet unless the patient has been exposed to compressed gas (i.e. scuba diving) within 24 hours of the event. The nitrogen gas bubbles can result in a decrease or blockage of blood flow to any organ system, and causes a wide variety of symptoms depending on the system affected. Treatment includes application of 100 percent oxygen and rapid descent in altitude. Unresolved symptoms will require treatment in a hyperbaric chamber.
**Confined Spaces**

A final mention should be made of the challenges of the confined space in which the crew must work. The tight quarters necessitates efficient use of space, compact equipment and conservative storage of supplies. Equipment inventory should be replaced after each transport. Advanced planning regarding patient access is also required.

*Guidelines for Air Medical Crew Education, AAMS, Kendall/Hunt, Iowa USA, 2004.*
ECMO Retrieval

Retrieval Team
The standard ECMO Retrieval Team consists of 5 members:

- **2 Alfred Team members** (Usually 2 intensivists but may be Dr(s)+/-RN) - Clinical leadership of the team will be provided by the senior intensivist. The Alfred intensivist is responsible for perfusion management of the ECMO circuit.
- **ARV Retrieval Physician** - The general role of the retrieval physician is to provide an expert clinical interface with equipment and the practicalities of the retrieval process. ARV registrars may be tasked for ECMO cases after 3 months service, if they have reached an appropriate standard of capability at both clinical and mission leadership levels.
- **Paramedic or HATS RN** – The paramedic is the clinician who is the expert interface between AV environment, equipment and processes.
- **Pilot or single HATS/CPAV attendant** - During air missions, the pilot is responsible for the overall safety and management of logistics. In flight the pilot is in control of all resources, and is responsible for all decisions in relation to the aircraft, flight path, safe altitude etc. The CPAV attendant is responsible for operation of the stretcher, lifting devices, and stabilisation of stretcher and equipment within the vehicle (including power and gas supplies).

Equipment
Other than the ECMO specific equipment, all retrieval equipment is provided by ARV. This means the RP is the clinician familiar with infusion devices, drug pack, monitor and ventilator. The RP is the hands on clinician who is relied upon to operate this equipment. The RP is responsible for ensuring that there is good communication about settings and drug dosing. The RP should ensure and communicate that there are adequate supplies of infusions, oxygen and drugs for the *entire, often lengthy* retrieval. At a minimum, sufficient sedation, muscle relaxants and vasoactive infusions for the expected mission duration must be made-up for rural ECMO missions. Ensure enough (at least three and perhaps more) infusion pumps are taken for the job. Generally there is time and space for the retrieval physician to sort out equipment, drugs, and rationalise infusions during the ECMO cannulation process to reduce scene time.

Cannulation
Most ECMO retrievals will be percutaneous, bilateral, peripheral, Seldinger technique femoral cannulations although central (in theatre) or internal jugular options exist. The cannula positions are often checked by ultrasound if available. A heparin bolus may be requested towards the end of the cannulation process.

**Veno-venous (VV) ECMO** (for respiratory failure)

- One cannula tip is situated in the IVC – this is the access cannula, which draws dark venous blood to the ECMO oxygenator.
- The other cannula tip is inserted to situate in or near the right atrium - this is the return cannula for bright oxygenated blood.
- If these cannula tips are too close together, already oxygenated blood can be drawn back into the circuit.

**Veno-arterial (VA) ECMO** (usually for cardiac failure)

- The venous access cannula is usually at the right atrium.
- The arterial cannula is situated in a large (often femoral) artery for returning oxygenated blood and also to supplement cardiac output. This cannula maybe in another large artery if placed during cardiac surgery.

ECMO Circuit
The ECMO circuit has 3 main components:
- The ECMO console, which provides the drive cable to the pump head and indicates circuit flow rate. This is usually placed between the patient’s legs when pushing the patient stretcher and tied down on the CPAV shelf or on the floor of fixed wing aircraft.
- Has a centrifugal pump in the circuit which is driven by the ECMO console (or manually in an emergency by a pump handle). This pump is clamped onto the patient stretcher.
- An oxygenator in the circuit. This is also clamped onto the patient stretcher.

**Clinical Considerations**

**Sedation**
All patients should be adequately sedated and paralysed with muscle relaxant prior to cannulation and for the remainder of the retrieval.

**Ventilation**
Once the ECMO circuit is operating and oxygenation has improved, the aim of ventilation is to prevent further ventilator related lung injury. The Alfred intensivists will help guide settings. One common approach for retrievals is to select a safe pressure control setting eg: inspiratory pressure of 30 and a safe PEEP of 15. Tidal Volumes may be very small in patients with stiff lungs eg 150mls.

CO₂ ECMO is more effective at removing CO₂ than oxygenating blood. The oxygenator is connected to an oxygen source with normal oxygen tubing such as the green tubing used with a Hudson mask. This oxygen supply rate determines the amount of CO₂ removed by the oxygenator, analogous to minute ventilation to the lungs. Lung minute ventilation will also contribute to the arterial CO₂ but to a lesser extent. The end tidal CO₂ becomes a poor predictor of arterial pCO₂, making it mandatory to carry I-Stat cartridges.

**Oxygenation**
FiO₂ may still need to be 1.0 to aid oxygenation during the retrieval. To avoid oxygen toxicity, the medium term aim is to be below a FiO₂ 0.7. Low FiO₂ may result in reverse O₂ diffusion from the ECMO blood to alveolar gas.

It is worth noting that increasing O₂ supply flow to the ECMO oxygenator does not increase ECMO oxygenation of the blood. It is by increasing ECMO circuit blood flow, particularly in VV ECMO, that patient oxygenation is increased.

Many patients have permissive hypercapnia prior to ECMO institution. The rapid fall of CO₂ when the circuit is switched on (as well as decreased right atrium pressures with VA ECMO) can cause hypotension.

**Intravascular Volume State**
During VV ECMO there is a trade off between
1) Keeping vessels full – particularly the IVC – so that the ECMO cannulas can draw blood at an appropriate rate, and,
2) Worsening oedema of the lungs with high filling pressures.

In the acute/retrieval setting the effective operation of the ECMO cannula usually takes precedence and there may be a request for vascular filling, often with 4% Albumin (if available). The forces of acceleration/deceleration/ turbulence/rough roads on the IVC around the venous cannula in VV ECMO and can drastically reduce flow rates, decreasing oxygenation. Adequate filling above usual CVP parameters may help reduce these effects.

**Patient Movement**
Patient movements and transfers should be minimized and will occur in well-lit, protected environments. All transfers (e.g. from bed to trolley etc) require a team of at least 5 people. The RP should direct this team and be responsible for managing the ETT, standing at the patient’s head. The Alfred intensivist will be responsible for managing the circuit and lines. Effective communication between all team members if extremely important to minimise the risk of catastrophic accidental line removal.

To bring a Victorian AAV aeroplane into a hangar usually requires an accredited engineer and needs to be pre-planned.
**ECMO Transfers**

ECMO retrieval in Victoria is an advanced collaborative system involving ARV (AV) and The Alfred Hospital, working within a formal memorandum of understanding. ARV is the principal organisation in regard to retrieval in Victoria and is responsible for coordination and delivery of critical care advice, outreach support and retrieval. ARV provides support for many patients with severe (critical) cardiorespiratory failure, a small proportion of whom may be considered for ECMO. The processes for ECMO retrieval are broadly described in the attached flowchart.

**Key concepts include:**
Optimal communication between all parties involved in retrieval work is essential. To this end, ARV uses teleconferencing and videoconferencing technologies extensively. (All calls to and from ARV are recorded for quality purposes)

Where patients are referred to ARV regarding potential ECMO transfer/commencement, or where they meet general ECMO inclusion criteria, the ARV coordinator will initiate a teleconference involving the Alfred Hospital ICU consultant.

Where the Alfred hospital receives direct referral of patients for ECMO transfer, the ICU consultant will contact ARV to ensure commencement of a teleconference involving the ARV coordinator from the outset.

All ECMO retrieval staff will be fully credentialed.

Decisions will be made jointly and collaboratively. Issues that cannot be resolved will be escalated to the ARV and Alfred ICU directors (or delegate)

Prior to any ECMO mission, the ARV coordinator will convene a “Summary Teleconference”. This will be attended by all involved clinical and logistics parties or the case must not proceed. In this teleconference, the plan including contingencies will be discussed and agreed.

**During ECMO transfers:**
The ARV coordinator is the clinical ‘control point’ for all retrievals. They are responsible for defining time criticality of a retrieval case, and for overall coordination of crewing, logistics and resource.

All case communication will occur through the ARV RASO / coordination office.

All transport coordination will be provided by ARV utilising AV transport platforms. Urgency of outbound legs will be discussed with the ARV coordinator who will coordinate platform responses via AAV, ERTCOM or NETCOM.

Standard crewing will be: Paramedic, ARV retrieval physician, Alfred Team (Intensivist(s), +/- ICU RN)

Clinical leadership will be provided by the senior intensivist

Operational leadership and environmental guidance will be provided by the ARV retrieval physician

Patient movements and transfers will be minimized, and will occur in well-lit, protected environments (e.g. a hangar rather than open tarmac).

During air missions, the pilot is responsible for the overall safety and management of logistics. In flight the pilot is in control of all resources, and is responsible for all decisions in relation to the aircraft, flight path, safe altitude etc.
Acute Respiratory Failure: Patient Selection for veno-venous ECMO

Conditions where ECMO use is commonly associated with favourable clinical outcomes
- ARDS with primary lung injury (from infection, aspiration or direct trauma)
- Primary graft dysfunction following lung transplantation (within 7 days)
- Pulmonary vasculitis (Goodpasture's, ANCA-associated, other Autoimmune)

Conditions where ECMO is often considered, but outcome is variable
- ARDS from secondary lung injury (from non-pulmonary sepsis, burns or pancreatitis)
- Lung transplant recipients 7-30 days post transplant
- Age >70

Consideration of ECMO support in these conditions depends on individual patient circumstances and should include discussion with experienced ECMO Clinical Service Staff

Clinical triggers supporting the initiation of VV ECMO
- Inability to maintain SaO2 > 88 or pH > 7.20 with safe mechanical ventilation
  - Plateau pressure < 35cmH2O and
  - Total Volume <60ml/Kg predicted body weight
- Despite (if considered safe and available)
  - Echo assessment
  - Adequate (inotropic) cardiac support
  - Trial of high PRPE (18-20)
  - Recruitment manoeuvers
  - Prone positioning
  - Nitric Oxide or alternative pulmonary vasodilators
- Evidence of progressive barotrauma as a result of mechanical ventilation (pneumothorax or pneumomediastinum)

Logistic triggers supporting the initiation of VV ECMO
- The need for inter-hospital transport of the patient with progressive severe respiratory failure

Acute Respiratory Failure: Patient Selection for veno-venous ECMO

Chronic Health Exclusion Criteria
- Age: > 75 years
- Active malignancy
- Severe brain injury
- Immunosuppressed
  - Previous Bone marrow transplant
  - Previous heart, lung, renal transplant (>30 days)
  - HIV/ AIDS defining illness despite antiretroviral therapy
- Presence of additional severe, symptomatic chronic organ failure
  - Cirrhosis (jaundice, ascites, encephalopathy)
  - End-stage renal failure (dialysis)
  - Cardiomyopathy (VAD or inotropes)
  - Chronic lung disease* (see Chronic Respiratory Failure/Bridge to Transplant Patient selection)

Presenting Illness Exclusion Criteria
- Septic shock (where ≥3 or more of the following features are present before ECMO)
  - Lactate > 10
  - Noradrenaline > 1.5ug/Kg/min
  - Severe myocardial depression
  - Advanced microcirculatory failure with severe mottling or established purpuria
- Acute/subacute pulmonary fibrosis is the likely cause of acute respiratory failure
  - Previous known/treated SLE, extra-articular Rheumatoid Arthritis, Scleroderma, Dermatomyositis, Sarcoidosis,
  - Clinical or pathological investigations suggestive of irreversible process (e.g. biopsy lung injury)
- Obliterative Bronchiolitis is the likely cause of respiratory failure
  - Minimal or nodular CXR changes with profound fixed airway limitation
Chronic Respiratory Failure Bridge to Transplant*:
Patient Selection for ECMO (VV or VA)
*Includes chronic PAH patients

Patient Eligibility for ECMO
- AIR1 (Lung Transplant) unit approval for transplant (PRIOR to ECMO)
AND
- Lung Transplant Surgery Consultant approval for transplant (PRIOR to ECMO)

Note: provision of ECMO for patients with chronic lung disease must be preceded with multidisciplinary approval of patient eligibility. This will require at least 12-24 hours.

Note: patients with end-stage lung disease referred for ICU support in extremis or shock, should not receive ECMO as a bridge to recovery or decision

Absolute contraindications to ECMO
- Cardiac Arrest
- Multiple system organ failure
- Immobility
- Inadequate vascular access*

*Patients with long term SVC access catheters must have a venogram prior to ECMO cannulation to exclude significant SVC stenosis

The Alfred Intensive Care Unit, Melbourne, Australia

Patient Selection for veno-arterial ECMO
Cardiogenic Shock:

Conditions where ECMO use for cardiogenic shock is commonly associated with favourable clinical outcomes
- Acute fulminant myocarditis
- Cardiomyopathy (first presentation)
- Chronic cardiomyopathy (suitable for VAD)
- Primary Graft Failure post heart transplant
- AMI
  - without multiple organ failure or sepsis
  - with early revascularisation (PCI)
- Drug overdose
- Pulmonary Embolism
- Pre/post lung transplant with severe pulmonary artery hypertension

Conditions where ECMO is often considered, but outcome is variable and often poor
- AMI
  - with multiple organ failure or sepsis
  - late revascularisation, need for CABG or distal disease
- Sepsis with profound myocardial depression
- Post cardiomy (ischaemic or valvular surgery)

Consideration of ECMO support in these conditions depends on individual patient circumstances and should include discussion with experienced ECMO Clinical Service Staff

The Alfred Intensive Care Unit, Melbourne, Australia
Patient Selection for veno-arterial ECMO

Cardiogenic Shock:

**Chronic Health Exclusion Criteria**
- Age: > 70 years
- Active malignancy
- Severe brain injury
- Immunosuppressed
  - Previous bone marrow transplant
  - Previous heart, lung, renal transplant (>30 days)
  - HIV/AIDS defining illness despite antiretroviral therapy
- Presence of additional severe, symptomatic chronic organ failure
  - Cirrhosis (jaundice, ascites, encephalopathy)
  - End-stage renal failure (dialysis)
  - Chronic pulmonary artery hypertension*
(*see Chronic Respiratory Failure/Bridge to Transplant Patient selection)

**Presenting Illness Exclusion Criteria**
- Advanced shock (where 3 or more of the following features are present before ECMO)
  - Lactate > 15 or pH < 6.9
  - Anuria > 4 hours (prior to ECMO)
  - AST or ALT > 2000, or, INR >4.5
  - Advanced microcirculatory failure with severe mottling or established purpura
- Shock primarily due to mitral or aortic valvular insufficiency
- Aortic dissection

---

Patient Selection for veno-arterial ECMO

Following Cardiac Arrest (> 10 minutes):

**Chronic Health Exclusion Criteria**
- Age: > 70 years
- Multiple past coronary revascularisations
- Any known severe, symptomatic chronic organ failure
  - Cirrhosis (jaundice, ascites, encephalopathy)
  - End-stage renal failure (dialysis)
  - Peripheral vascular disease (surgery)
  - Cardiomyopathy (VAD or inotropes)
  - Chronic lung disease*
  - Chronic Pulmonary artery hypertension*
(*see Chronic Respiratory Failure/Bridge to Transplant Patient selection)

**Presenting Illness Exclusion Criteria**
- External centre needing cannulation
- Unwitnessed
- Known or suspected aortic dissection
Patient Selection for ECMO
Request for VA ECMO transfer following
ECMO initiation at another site

Exclusion Criteria
Patients SHOULD NOT be retrieved to The Alfred ICU from other centres following emergency VA ECMO if any of the following are present

- Central (sternal) cannulation
- Leg ischaemia
- Left ventricular distension and pulmonary haemorrhage
- Evidence of neurological deficit (ECMO following cardiac arrest)
  > All patients more than 24 hours post ECMO should have a CT brain and clinical assessment
- Ongoing bleeding
- Unstable blood pressure or vasopressor requirements
- Unstable circuit blood flow (<3L/min)
ECMO CPAV setup

Complex Patient Ambulance Vehicle (CPAV):
Mercedes Sprinter, longer, wider and higher than normal road car.

Hydraulic platform at the rear: can lift 500kg.

Note: there is no stretcher bridge available in CPAV. The equipment must be moved.

ECMO Console is strapped to side shelf in rear of car.

Syringe drivers attached to bar on CPAV stretcher

Propaq monitor clipped (and secured) onto the bar to the left of where the ARV Retrieval Physician is seated

Oxylog 3000 + attached (and secured) to top of the CPAV stretcher in front of ARV Retrieval Physician
ARV kits stored in locker at the front of CPAV vehicle.

Note: Access to the kit bags is not possible in transit; please ensure any equipment required during transfer does not remain in the kit bags.

Extra space for ARV kit bags is at the rear of CPAV vehicle behind the stretcher.
ECMO HATS setup

High Acuity Transport Service (HATS)
Mercedes Sprinter

Note: Lifting mechanism at rear for heavy equipment (e.g. IABP)

Patient and equipment loaded on stretcher
Note: Console secured to stretcher bridge and Oxylog 3000 + and Propaq monitor on side of the stretcher and secured.

ECMO Console secured to stretcher bridge with syringe drivers attached to front of bridge.
ARV kits stored in locker at the front of HATS vehicle.

Note: access to contents of kits difficult during transit. All equipment must be secured or tied down in mobile platforms.
ECMO Fixed Wing Setup

Rear Cabin of Air Ambulance Fixed Wing Aircraft where stretcher is secured to floor.

Patient loading mechanism. Process done only by accredited staff, please listen carefully and follow directions during loading.

Note: ECMO console is secured to stretcher bridge and Oxylog 3000 + and Propaq monitor are on stretcher.

Loaded patient stretcher in rear cabin of fixed wing aircraft.

Note: confined space. All required equipment and drugs etc. should be planned prior to departure as moving around cabin is very difficult.
REFERRING HOSPITAL
Patient with respiratory and / or cardiac failure unresponsive to conventional therapy? For ECMO

ALFRED HOSPITAL
Patient referred to Alfred Hospital for ECMO

TERTIARY HOSPITAL
Patient under consideration for ECMO transfer

CONTACT ARV
1390 368651

Teleconference ARV, Coordinator, Alfred Hospital ICU Consultant and Referring Hospital from commencement of case

ARV Clinical
Coordination & Case Assessment

Optimise filling, isotropic support, and management of sepsis related or other CVS modulators.

Has cardiovascular support been optimised

Has ventilation been optimised

Optimise ventilation mode, posture, intravascular fluid status, metabolic status.

Is the patient stable for transfer

Yes

No

Transfer to appropriate destination (consider Alfred Hospital if deterioration and subsequent ECMO likely)

Consider ECMO Retrieval

Consider further clinical advice

Consider Limitation of Treatment Decisions

Alfred ICU Consultant activates team and confirms capacity at AH ICU

Does the patient have contraindications for ECMO

Does the patient have contraindications for ECMO

NO

YES

Absolute Contraindications

Ongoing Case Management

ECMO Retrieval

Criteria may include:
- Hypoxia: \( \text{SpO}_2 < 80\% \) or \( \text{PaO}_2 < 60\text{mmHg} \) on \( \text{FiO}_2 > 0.85 \); PEEP \( >12 \) and PIP \( >30 \)
- Hypotension: MAP \( <70\text{mmHg} \) on "high inotropic support" e.g. noradrenaline \( >30\mu\text{g/min} \) OR multiple inotropes
- Unstable Rhythm
- With perfusion inadequacy
- Postural fragility
- CVS instability OR hypoxia precipitated by movement (rolling, lifting, tilting) even if stable in static position
Clinical Staff Checklist for ECMO transfers

3 POINTS OF FORMAL CHECK EXIST IN THE ECMO MISSION FOR THE RESPONDING CREW

1. Pre mission departure (ARV Essendon facility or other crew rendezvous point)
   - Case documentation is complete and all crew have full briefing
   - Full standard ARV Kit
   - i-STAT + cartridges
   - Additional syringe drivers
   - Full Alfred ECMO Kit
   - Check with all clinical crew re special needs
   - Staff comfort / food / clothing / bathroom

2. Pre loading (pre departure from referring hospital)
   - Monitoring in place and secured
     - art line, ECG, SaO₂, ETCO₂, Temp
     - Battery charged
   - Ventilator circuit secured.
     - Ventilator functioning,
   - ECMO circuit secured to patient with adhesive fixings,
     - trolley for ECMO equipment at patients feet.
   - Ample infusions for duration of transfer pre prepared.
   - Adequate portable oxygen for transfer to platform – 1 cylinder for Oxylog, additional cylinder for ECMO oxygenator.
   - Patient is paralysed
   - Verbalise (walkthrough) loading and transfer processes
   - Adequate staff for safe transfer of patient and equipment.
   - Confirm with platform crew adequate O₂ for duration of transfer. (ECMO consumption is relatively low, usually 6-8litres / min, but cannot be interrupted.

3. During platform loading / return transfer preparation
   - Place Ventilator / ECMO on platform O₂ supply
   - ECMO pump placed on inverter power (90mins battery power)
   - Place any other equipment on charge if possible
   - All equipment safely secured
   - All staff seated securely
   - Communications reviewed – radio, cell-phone
   - Transfer urgency agreed (steady/secure – avoid emergency driving / speed)
Equipment: ARV Standard Kit

ARV has a comprehensive equipment management process and manual

Link to be inserted when guideline posted
## Equipment Kit and Checklist

### RETRIEVAL EQUIPMENT CHECK LIST

#### RED BAG

<table>
<thead>
<tr>
<th>Main compartment</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Femoral arterial line - ARROW</td>
<td>2</td>
</tr>
<tr>
<td>CVC kit - ARROW</td>
<td>2</td>
</tr>
<tr>
<td>Rapid infusion catheter (RIC) exchange kit - ARROW</td>
<td>2</td>
</tr>
<tr>
<td>Radial arterial line - ARROW</td>
<td>2</td>
</tr>
<tr>
<td>Pressure transducers</td>
<td>2</td>
</tr>
<tr>
<td>IV gauze set with hand PUMP</td>
<td>1</td>
</tr>
<tr>
<td>NSaine 500ml</td>
<td>2</td>
</tr>
<tr>
<td>Urn serum (250ml)</td>
<td>1</td>
</tr>
<tr>
<td>15% dextrose 100ml</td>
<td>1</td>
</tr>
<tr>
<td>Mannitol 20% 500 ml</td>
<td>1</td>
</tr>
<tr>
<td>Together in a zip-lock bag;</td>
<td></td>
</tr>
<tr>
<td>OXY</td>
<td>1</td>
</tr>
<tr>
<td>2 PEEP valve</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Basic airway kit

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magill forces Modified bouleldr for CMAC</td>
<td>1</td>
</tr>
<tr>
<td>Lubricant</td>
<td>2</td>
</tr>
<tr>
<td>ETT sizes 6, 7, 8</td>
<td>1 ea</td>
</tr>
<tr>
<td>Yellow waste bag</td>
<td>1</td>
</tr>
<tr>
<td>Gluecid size 3 (green)</td>
<td>1</td>
</tr>
<tr>
<td>Gluecid size 4 (yellow)</td>
<td>1</td>
</tr>
<tr>
<td>Gluecid size 5 (red)</td>
<td>1</td>
</tr>
<tr>
<td>Nasopharyngeal airway 4, 5 &amp; 7.5</td>
<td>1 ea</td>
</tr>
<tr>
<td>Trol syringe</td>
<td>1</td>
</tr>
<tr>
<td>Trolley</td>
<td>2</td>
</tr>
<tr>
<td>CMAC Pocket Monitor (light source/cameramon)</td>
<td>1</td>
</tr>
<tr>
<td>CMAC 3 Blade</td>
<td>1</td>
</tr>
<tr>
<td>CMAC 4 Blade</td>
<td>1</td>
</tr>
<tr>
<td>CMAC D Blade</td>
<td>1</td>
</tr>
<tr>
<td>CMAC spare light source</td>
<td>1</td>
</tr>
<tr>
<td>ETT introducer - Adult</td>
<td>1</td>
</tr>
<tr>
<td>Tracheal tape</td>
<td>1</td>
</tr>
<tr>
<td>Easy Cap II CO2 detector</td>
<td>1</td>
</tr>
<tr>
<td>2ml syringe - catheter tip</td>
<td>1</td>
</tr>
<tr>
<td>Nasal tube 16g</td>
<td>1</td>
</tr>
<tr>
<td>NG drain bag</td>
<td>1</td>
</tr>
<tr>
<td>Suction catheters 12F</td>
<td>2</td>
</tr>
<tr>
<td>Bucal</td>
<td>2</td>
</tr>
<tr>
<td>Laryngoscope</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Difficult Airway Kit

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>LMA size 3, 4 &amp; 5</td>
<td>1 ea</td>
</tr>
<tr>
<td>ETT size 7</td>
<td>1</td>
</tr>
<tr>
<td>Curved forceps</td>
<td>1</td>
</tr>
<tr>
<td>Disposable surgical blade</td>
<td>1</td>
</tr>
<tr>
<td>Lubricant</td>
<td>1</td>
</tr>
<tr>
<td>Overal endoro rhino-thorotony kit</td>
<td>1</td>
</tr>
<tr>
<td>Cook needle cricotomy kit</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Outside Pocket 1

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trol syringe</td>
<td>2</td>
</tr>
<tr>
<td>Min volume extension tubing</td>
<td>3</td>
</tr>
<tr>
<td>Short arrow radial lines</td>
<td>3</td>
</tr>
<tr>
<td>Drug delivery sets (ORANGE)</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Outside Pocket 2

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trauma shears</td>
<td>1</td>
</tr>
<tr>
<td>Waste bag for dirty equip</td>
<td>2</td>
</tr>
<tr>
<td>Mini cressot reule</td>
<td>1</td>
</tr>
<tr>
<td>Molar retention disc</td>
<td>2</td>
</tr>
<tr>
<td>BLS monitor</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Outside Pocket 3

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure bag</td>
<td>2</td>
</tr>
</tbody>
</table>

#### Outside Pocket 4

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>BP cuff - high, regular, small</td>
<td>1 ea</td>
</tr>
<tr>
<td>2 lumen BP cuff connector</td>
<td>1</td>
</tr>
</tbody>
</table>

#### BLUE BAG

<table>
<thead>
<tr>
<th>Main compartment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Braun syringe pumps</td>
<td>3</td>
</tr>
<tr>
<td>Braun 3-way power cord splitter</td>
<td>1</td>
</tr>
<tr>
<td>Syringe driver pole clamp</td>
<td>1</td>
</tr>
<tr>
<td>Oxygen Mask, Pressure bags (white)</td>
<td>1</td>
</tr>
<tr>
<td>Power pack for Oxylog Ventilator</td>
<td>1</td>
</tr>
<tr>
<td>Power pack for ZOLL monitor</td>
<td>1</td>
</tr>
<tr>
<td>Power lead for syringe pumps</td>
<td>1</td>
</tr>
<tr>
<td>Suction orange power cables</td>
<td>1</td>
</tr>
<tr>
<td>Suction warming blanket</td>
<td>1</td>
</tr>
<tr>
<td>Suction tubing (in underside of compartment lid)</td>
<td>1</td>
</tr>
<tr>
<td>Safety glasses</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Top outer pocket

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency intubation kit - COOK</td>
<td>1</td>
</tr>
<tr>
<td>Emergency pneumothorax kit - ARROW</td>
<td>1</td>
</tr>
<tr>
<td>Chest drainage kit bag</td>
<td>2</td>
</tr>
<tr>
<td>Disposable Oxylog 2000 ventilation circuit</td>
<td>1</td>
</tr>
<tr>
<td>Invasive pressure Monitoring MULTI cable adapter</td>
<td>1</td>
</tr>
</tbody>
</table>

#### End pocket 1 (Left side)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial filters</td>
<td>2</td>
</tr>
<tr>
<td>Luercone stick</td>
<td>2</td>
</tr>
</tbody>
</table>

#### End pocket 2 (Right side)

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Qty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some invasive pressure monitoring cables (square &amp; oval)</td>
<td>1 ea</td>
</tr>
</tbody>
</table>

### ZOLL X SERIES MONITOR

ZOLL X Series Monitor cables includes adult BP cuff:
- non-invasive BP cable
- O2 sets cable & probe - non-disposable
- 3 lead ECG cable
- Temperature cable
- Temperature probe
- SpO2 cable
- Multi-function (Defib & Pacing) pads
- Defib cable
- ECG cable (bag of 2)
- O2 set probe - disposable
- O2 - VEIOO chest pads
- ZOLL X series monitor - Quick Reference guide
Infection Control & Prevention

The following information is an extract from the comprehensive AV policy – Infection Control Manual.
This extract was accessed 28/08/2014 and may not be the latest version. Please refer to the web link below for the up to date complete document. The extract covers:

- Standard Precautions (Hand Hygiene, PPE)
- Special Precautions (Tyvek overalls)
- Table of communicable diseases and specific recommendations


Standard Precautions

Hand Hygiene

All staff must ensure strict mechanical hand washing following any contact with a body substance or physical contact with patients as follows:

- At commencement of duty occlude cuts, abrasions and other lesions on the skin with a waterproof dressing
- Fingernails should be kept short, clean and free from varnish
- Artificial fingernails must not be worn as research shows that they may have an increased bacterial (particularly gram-negative organisms) and fungal colonisation despite performing an adequate hand scrub
- Remove all jewelry prior to washing hands
- Liquid soap and water should be used for routine hand washing between patients.
- Hands should be wet prior to applying liquid soap
- Thorough hand drying should be performed preferably using disposable paper towels
- Gel hand sanitising liquid should be used as an in field hand cleaning agent between contact with different patients or different procedures on the samepatient.

Wear gloves to protect larger skin lesions, and wear gloves at all times when handling body substances. Wash and dry hands and other skin surfaces immediately after direct patient care, the removal of gloves and after any contamination with body substances

Hands should be washed after:

- Direct contact with body secretion(s)
- Handling objects/materials soiled with body substances
- Removing gloves, protective glasses and masks
- Contact with wounds
- Emptying drainage bags/suction containers
- Fitting or touching a mask

Personal Protective Equipment (PPE)

Staff must wear Personal Protective Equipment to maintain a protective barrier against blood and/or body fluids, including:

Disposable Gloves

Disposable Gloves must be:

- Worn when touching blood and/ or body fluids, secretions, excretions, and contaminated items
- Worn when performing any invasive procedure.
- Worn when changing tasks and procedures on the same patient to prevent cross contamination
- Changed as soon as they become torn or punctured.
Discarded before answering telephone or transmission devices, recording patient notes or driving a vehicle.

**Protective Eyewear**
Protective Eyewear must be worn during procedures where spraying/splashing of blood or body fluids may occur, i.e. during:
- Endotracheal intubation of patients (ETT)
- Insertion of naso-pharyngeal (NPA), oro-pharyngeal (OPA) or laryngeal mask airways (LMA).
- All airway examinations.
- All airway suctioning, including via ETT, NPA, OPA, LMA
- Insertion of intravenous lines, drain tubes.
- Emptying drainage bags/suction containers
- Impending birth
- Caring for patients with a cough
- Invasive procedures
- Cleaning of equipment

**Protective Mask**
A Protective Mask – P2/N95 must be worn whenever there is a risk of spraying/ splashing blood or body fluid. This includes:
- Endotracheal intubation of patients (ETT), Insertion of Naso-pharyngeal (NPA),
- Oro-pharyngeal (OPA) and Laryngeal mask airways (LMA).
- Caring for patients with a productive or non productive cough.
- Caring for patients with a suspected or known airborne spread disease. In such circumstances staff are to wear vented P2/N95 rated masks and patients (where practicable) are to be fitted with non vented masks.
- Administering medication via a nebuliser.
- Suctioning
- Caring for patients with an undiagnosed fever.
- Invasive procedures

**Additional Precautions**
Additional Precautions are used for patients known or suspected to be infected or colonised with infectious agents that are epidemiologically important or easily spread, and may not be contained with Standard Precautions alone. Additional Precautions items include: Standard Precautions (as above) PPE plus Tyvek disposable overalls and overshoes.
Additional Precautions are to be implemented if patients are suspected of, or diagnosed with infections transmitted by way of the following:

**Contact Transmission**
Transmission of infection from direct and indirect contact with an infected person or contaminated object, e.g.
- Severe Acute Respiratory Syndrome (SARS)
- Open or discharging purulent wounds (e.g. multi-resistant organisms)
- Faecal contamination from carriers of Vancomycin Resistant Enterococci (VRE)
- Patients with exfoliative dermatitis

**Droplet Transmission**
Droplets are generated during sneezing, coughing or talking. Transmission occurs when droplets that contain infective agents contact the conjunctivae, nasal mucosa, mouth or the environment, e.g.
- Influenza, Rubella, Pertussis
- Severe Acute Respiratory Syndrome (SARS)
Airborne Transmission
Airborne transmission are the transmission by dissemination in the air of either droplet nuclei (which are much smaller particles than droplets) or dust particle containing the infective agent. The microorganisms carried in this way can be widely dispersed in air currents and can remain viable for varying periods before being inhaled or deposited, e.g.
- Mycobacterium Tuberculosis (Open pulmonary TB), Chicken Pox, Measles.

Instructions
Additional Precautions
In addition to the Precautions noted above, particular infectious agents and the mode of transmission; the following Additional Precautions are applied and should be adapted to the environment:
- Transport separately from other patients if required.
- For suspected airborne transmission wear a P2/N95 vented mask and if possible request the patient to wear a non vented mask.

Handling of Sharp Objects
Staff must take care when handling all blood/body fluid contaminated sharp objects to prevent needle stick or associated injuries. Needles are never to be re-capped, bent or disconnected from syringes but disposed intact into sharps containers provided.
Sharps must not be passed between employees or other persons.

Protective Overall (i.e. Tyvek)
Tyvek disposable overalls are to be worn to protect staff and uniform from contamination. With blood and body substances. This includes caring for patients with communicable infectious disease/s, e.g. Severe Acute Respiratory Syndrome (SARS).

Body Fluid Exposure
- Wash the affected surface well with soap and water or if in field with Gel hand sanitising liquid
- If eye or mucous surfaces contamination, rinse well with water or normal saline.
- Notify the ARV Coordinator who will notify the AV Duty Manager (DM) as soon as possible. The DM will contact the AV Duty Medical Officer (1800 240 395) who will contact the ARV practitioner and recommend further investigation or treatment as required.
- The DM will liaise directly with the injured employee regarding treatment as advised by the DMO.
- The ARV coordinator will liaise with clinical staff at the receiving hospital to commence urgent investigation of relevant patient serology.
- Notify the ARV Admin on Call in hours.
POST HAZARDOUS EXPOSURE PROCESS
CHEMICAL - BIOLOGICAL - RADIOLOGICAL

FIRST AID
Administer first aid.

NOTIFY DM IMMEDIATELY
Duty Manager (DM) takes you out of service and immediately contacts Medical Services Provider* on 1800 240 395.

TRANSPORT PATIENT
- Transport patient if required to hospital and await contact from MSP.
- Decontaminate where necessary and able.

MSP PHONE TRIAGE
- MSP will contact you directly within 30 mins and advise you what to do.
- MSP will advise if testing/treatment is required.
- MSP will contact Emergency Department (ED)/Dr to plan management if required.

IS TESTING REQUIRED?

YES - Present to Triage/GP

TREATMENT PROCEDURE
- MSP contacts ED/Dr and discusses management of your exposure (e.g., tests, serology, vaccinations, treatment and follow-up required).
- Treatment is undertaken at hospital or GP if advised by MSP.
- MSP provides fact sheets and support to-paramedics.
- You can contact MSP on 1800 240 395 (quote case number provided) if you have any concerns.
- Test results will be sent to MSP. MSP will contact you and provide further advice within two business days to discuss.

RETURNING TO SERVICE
- MSP with treating Dr will advise if you are clear to return to service.

NOTIFY DM IMMEDIATELY
Paramedic advises DM of availability to return to service.

NO

SUPPORT PROCESS
- MSP provides fact sheets and support to paramedics.
- You can contact MSP on 1800 240 395 (quote case number provided) if you have any concerns.

RETURNING TO SERVICE
- Clear to return to service.

HII
Paramedic or TM completes Hazard Incident Injury (HII) online ASAP.

*Medical Services Provider (MSP)
Intra-aortic Balloon Pump

This document outlines the basics of IABP technology and its use in the retrieval environment.

All IABP retrievals will be done with a perfusionist (technician) and retrievalist. The perfusionist brings the machine and manages the pump and circuit leaving the retrievalist to manage the patient. A good working relationship between retrievalist and perfusionist should be established early in the mission. Many of the perfusionists are used to travelling with fairly junior cardiology registrars who have little familiarity with the transport environment.

What is an IABP?
The IABP is a long balloon over a catheter which is placed in the aorta, ideally just distal to the left subclavian artery and proximal to the renal arteries. It is usually inserted femorally although can be inserted from a brachial approach. A percutaneous Seldinger technique is used, generally with fluoroscopic guidance in an angio suite although blind insertion with X ray for confirmation of position is possible. The catheter has two lumens, one to measure aortic pressure and one to inflate and deflate the balloon. The balloon is filled with helium gas from a small tank on the pump and inflation-deflation is timed with the cardiac cycle. Helium is used because of its flow characteristics allowing very rapid and precise inflation and deflation.

How is it timed?
The balloon inflates in diastole, just prior to the dicrotic notch. The second peak after the dicrotic notch, is the result of closure of the aortic valve and muscular and elastic recoil of the aorta against the closed. The balloon deflates at the onset of systole. As it happens the point “just prior to the dicrotic notch” corresponds to the mid-T wave and the beginning of systole to the peak of the R wave. Timing, therefore, can be achieved by computer recognition of ECG features (ECG peaks, ECG shapes or patterns, atrial pacing spikes or ventricular pacing spikes), by fluctuations in aortic pressure measured at the catheter tip or by an intrinsic, machine-generated rhythm in case of cardiac arrest). The machines used by Perfusion Services Australia have an Autopilot mode that automatically selects the best timing mode for the conditions.

How does it help?
By inflating in diastole with a competent aortic valve the balloon displaces blood from the aorta increasing forward flow during diastole when it would normally diminish and increasing coronary perfusion by increasing diastolic pressure without any increase in intra-cardiac pressure (although empirical evidence of the latter effect is less convincing). By deflating just before the aortic valve opens again it decreases left ventricular afterload by presenting the left ventricle with a relatively empty aorta to pump into. This means the left ventricular wall tension is lower as are left ventricular and left atrial end diastolic pressures which means a reduction in preload. Stroke volume and cardiac output increase and myocardial oxygen consumption decreases.
The pump can be used on every cardiac cycle or on a fraction of them. It must inflate on at least 1 in 8 cycles to prevent thrombosis. Increasing the frequency of cycling will increase the degree of help provided to the cardiac output. During weaning the cycling ratio is decreased gradually.

What will the blood pressure do?
So, you thought blood pressure was two numbers with a oblique line in between them (and another in brackets if you are an intensivist)? Not once you have two pulsation pumps (heart and IABP) working in series.
In figure 1 the IABP is set to cycle 1:2, that is to say, the balloon inflates on every second cardiac cycle. The first wave is a normal heartbeat without the IABP activating. There is a systolic pressure (now called unassisted systole), a dichrotic notch and diastolic pressure (now called an unassisted aortic end diastolic pressure). The IABP inflates after the next systole so the next systolic pressure is another unassisted one. Diastole, however, is very different this time. Note that the Augmented diastolic pressure is quite high, higher than systolic pressure and that it is followed by an Assisted aortic end diastolic pressure which is lower than the unassisted one (because of the effect of sudden evacuation of the aortic contents). Following that there is another “normal” beat only this one is not normal because the ventricle is benefiting from the decreased afterload that results from the lower assisted aortic end diastolic pressure. This is, therefore an assisted systolic pressure.

So, with the IABP cycling 1:2 we have an unassisted systolic pressure, an augmented diastolic pressure, an assisted end diastolic pressure, an assisted systolic pressure, an unassisted diastolic pressure and then an unassisted systolic pressure again.

Thankfully the machine will report the mean arterial pressure making the task of keeping a sensible obs chart somewhat easier.

Note though that the assisted pressures should be lower than the unassisted ones or will be in patients who were relatively normotensive at the outset. In patients with hypotension an increase in MAP will result as the increase in pressure during diastolic augmentation is greater than the decrease in pressure during assisted systole and diastole.

**When is it used?**

- Cardiogenic shock
  - Ischaemic contractile failure - majority of cases, obvious benefits from decreased preload and afterload and augmented pumping.
  - Acute MR or ventricular septal rupture - leads to significant decrease in backflow (MR) or left to right shunt (VSR).

- Intractable angina
  - Weaker indication, probably helps

- High risk CABG peri-procedure
  - Decreases time on bypass and post-op IABP time

- High risk cardiac cath
  - Weakest indication but may be beneficial should procedure related ischaemia occur (e.g. in tight left main stenoses)

**Contraindications**

- Aortic regurgitation
IABP relies on a competent aortic valve. In AR the IABP will cause increased regurgitation and increased intracardiac pressures and wall tension, the reverse of what it aims to do.

- Aortic dissection
  - Risk of placement in a false lumen and aortic rupture
- Aortic aneurysm (large)
  - Risk of rupture
- Severe peripheral vascular disease preventing insertion
- Uncontrolled septicaemia
- Uncontrolled bleeding diathesis

What could possibly go wrong?

- Vascular
  - Bleeding
  - Thrombosis
  - Embolisation
  - Limb ischaemia
  - Infection
  - Aortic branch vessel occlusion (particularly spinal arteries)

- Mechanical
  - Balloon rupture
  - Inadequate inflation
  - Inadequate augmentation
  - Catheter displacement or damage due to patient movement

- Haematological
  - Thrombocytopenia and anaemia are common due to mechanical destruction
  - Complications of heparinisation may occur

- Underlying disease may progress in spite of IABP.

Deaths from IABP are rare and mainly related to aortic dissection or rupture.

What do you need to check?

- Ensure you are clear about:
  - The indication for insertion of the pump
  - The response to treatment
  - The rate of cycling, why this rate has been chosen and whether it has changed since insertion.
    - Minimum rate to avoid thrombosis is 1:8
    - If cardiac output is inadequate rate can be increased as far as 1:1.
- Check with the perfusionist that the technology used at the referral site, their technology to be used in transit and that which is likely to be used at the destination site are going to be compatible. In general the machines used by PSA for transport are able to be adapted to lines made for other machines.
- Insertion site for haematoma, bleeding, adequacy of dressings and inflammation
- Position
  - Ensure you have seen radiological confirmation of the position. A CXR should demonstrate a radio-opaque catheter tip at the top of the ascending aorta.
  - If it has been inserted fluoroscopically ask for a copy of the still images to take with the patient or get a CXR taken before departure as evidence of correct position
- Heparin infusion rate and APTT if done already.
- Patient comfort
  - Patients need to lie flat and not move the affected limb for the duration of the time the IABP is in. This necessitates good analgesia and often sedation, especially when the patient is on a transport stretcher. In the aeromedical transport environment this may require intubation in some cases. This should be born in mind when coordinating IABP transfers from CCU to CCU.
- Timing (see Figure 2 below)
  - This is primarily the realm of the perfusionist however these are the things that are considered. The key to assessing timing is assessment of the aortic pressure waveform which is displayed on the machine monitor.
  - Basically, the balloon can inflate too early (B) or too late (C) and can deflate too early (D) or too late (E) ((A) is normal).

Figure 2. Timing issues with IABP

- Early inflation (B) (before aortic valve closure) causes increased afterload and myocardial oxygen consumption with the ventricle contracting against an inflated balloon.
- Late inflation (C) occurs when the aorta pressure has already dropped off so there is less potential for diastolic augmentation.
- Early deflation (D) shortens the period of diastolic augmentation and may result in backflow from coronaries and carotids.
- Late deflation (E) has the same consequences as early inflation.
What about the hardware?
PSA use Arrow machines distributed in Australia by Mayo Healthcare. The two machines are Autocat 2 Wave and ACAT 1.

The Autocat Wave 2 is pictured above. The display and control unit on top comes off the unit and can sit on the lap of the perfusionist with a wired connection to the pump unit which needs to be stowed securely. In Victoria NPT HATS or CPAV should be used for IABP retrievals. NSW ambulance services have a vehicle in each region that is purpose built to carry an IABP patient with a lifter and docking area for the pump at the rear of the vehicle.
Massive Exsanguination Pack

Occasionally blood products are required for interhospital retrieval cases. These are usually sourced locally by the referral hospital. When this is not possible it may be necessary for ARV to source and transport blood products to the patient. An arrangement is in place with the Royal Melbourne Hospital Blood Bank to arrange for urgent supplies of blood and blood products.

**Packs Available**

1. ARV transfusion pack (ARVTP), also known as a MEP pack (massive exsanguinations pack), ratio (1:1:1) contains:
   - 4 units of RCC (Group O red cells, RhD negative/Kell negative),
   - 300-600ml of plasma (Group AB, 150ml = 1 unit)
   - 1 pool (4 units) of platelets

2. Warfarin reversal pack (WRP) contains:
   - Prothrombinex
     - Life threatening haemorrhage
     - 50 IU/kg (maximum 4000 IU dispensed in warfarin reversal pack)
     - Clinically significant haemorrhage
     - 30-50 IU/kg
   - Vitamin K to be sourced locally – 5-10mg IV
   - FFP to be sourced locally (150-300ml)

**Process**

**Coordination staff:**

1) ARV coordinator identifies need for either ARVTP or WRP
2) Contact RMH Blood Bank Scientist on duty to arrange blood products
   - 03 93427275 or
   - 03 93427276.
3) ARV coordinator to provide case details:
   - Patient name,
   - Gender,
   - Age and DOB,
   - Diagnosis, and
   - Planned destination.
4) Laboratory preparation time is 20 minutes after system activation.
5) ARV coordinator to arrange urgent transport of the pack via either
   - ARV vehicle,
   - Police vehicle, or
   - Other appropriate method.
6) The ARVTP or WRP is to be picked up from the RMH Emergency Department, Shift Coordinator at the ED control desk.
7) Blood products are to be delivered to the ARV Coordination office and picked up by retrieval staff from there.
Retrieval staff

1) Collect the Blood pack from coordination office.
2) **DO NOT OPEN** the pack unless blood products are required.
3) Standard documentation **TO BE COMPLETED** is included with the pack.
4) Ensure the pack is appropriately restrained in transit.
5) If blood products are transfused, the following instructions apply:
   - Pre–transfusion - take a blood sample from the patient using a 7.5ml EDTA blood collection tube, label THE TUBE and place IT in a pathology specimen bag - *(this is to remain with the patient and be, given to medical staff at the receiving hospital)*. This clarifies the patient’s original blood type.
   - Standard documentation must be completed for **EACH** unit of blood transfused. Please see the attached example.
   - Enter the used blood product serial number into the PCR and into VACIS.
   - Where possible retain the empty blood products bag for return to the RMH blood bank *(place in a biohazard bag and put in the blood pack)*
   - A copy of the patient PCR and the standard documentation is to be emailed to the RMH blood bank upon completion of the case – email to Michael.Haeusler@mh.org.au

6) The blood pack *including any unused product* is to be returned to the ARV Coordination office for transport back to the Royal Melbourne Hospital Blood Bank via taxi **ASAP**.
7) The ARV RASO is to advise the RMH Blood Bank of the ETA on either:
   - 03 93427275 or
   - 03 93427276.

**Transport Bags For Blood Products**

**ARV Transfusion Box**
The blood products will be issued within a red transport bag.

- Large RED bag is for 4oC storage.
- Small RED bag attached to the top of the large RED bag is for platelet storage at 20-24oC (room temperature).
Within the large red bag is a blue foam esky and within this is a blue cooling block. The gel/cooling packs and eskies are referred to as the ‘Blood in Motion’ (BIM) system. The BIM maintains the temperature at 2-10 degrees Celsius. The blue cooling block contains 4 units RBC and 2 thawed FFP units.

Within the smaller red bag is a green cooling block (BIM) with the temperature indicator strip, which maintains the platelets at 20-24 degrees Celsius.
O Neg K Neg RCC’s.
All red cell units are Life Guard® temperature tagged. This is a proprietary tag which discolours once the unit exceeds 10 degrees Celsius.

Life Guard® Temperature Indicators

- Indicator Disk – Not activated
  - Light Colour
- Indicator Disk – Activated
  - Dark Blue
- Indicator Disk – Critical Temperature Exceeded
  - Bright Red
**Thawed FFP – Extended Life Plasma**

Thawed FFP Bags
Vol. 300ml
Expiry 1-5 days post thawing

**Pooled Platelets**

Pooled Platelets
Vol. 300ml
5 day expiry from date of collection
MH Shared Pathology Service
NATA/RCPA Accredited Laboratories

HAEMATOLOGY DEPARTMENT
TRANSFUSION LABORATORY
Phone: RMH 93427275
WH 8345 6292
SH 8345 1485

MEP, ISSUE
HOSP: Aav  WARD: Exto
DOB: Unknown
Unknown

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</tbody>
</table>
| Antibody Screen | ?

*TO BE COMPLETED BY PERSONS ADMINISTERING BLOOD*

<table>
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<tr>
<th>Prod</th>
<th>Bag Number</th>
<th>Blood Group</th>
<th>Product</th>
<th><em>Start Date</em></th>
<th><em>Start Time</em></th>
<th><em>Unit Checked By</em></th>
<th><em>Unit Commenced By</em></th>
<th>React</th>
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<td>RCCLFF 5539464</td>
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<td>ONBG</td>
<td>29/05/2013</td>
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<td>RCCLFF 5218338</td>
<td>ONBG</td>
<td>31/05/2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*COMMENCE TRANSFUSION WITHIN THIRTY (30) MINUTES.

*IF DELAYED RETURN THE PRODUCT IMMEDIATELY TO THE TRANSFUSION LABORATORY OR CONTROLLED STORAGE.*

TRANSFUSE BEFORE CROSSMATCH EXPIRY:

24:00 hrs
on 16/06/2013

Comments:

Unit to The Alfred via AAV.

Patient Name: BOTTERILL, Kathleen
DOB: 20/05/1931
VACIS #: 10327
Alfred UR:

Signed:

Date: 13 May 2013

Please turnover for Transfusion checking procedure.

Products for Transfusion

Please file permanently in Patient’s Medical Record.

PRINTED: 13 May 2013 14:32
Massive Transfusion Guideline
Morbidly Obese Critical Care Patient Retrieval

Definitions
Body mass index, BMI = weight/height² in kg/m²
Overweight: BMI > 30
“Morbid obesity”: BMI > 40

Physiologic consequences
Metabolic rate is proportional to body weight
• increased O2 demand
• increased CO₂ production and alveolar ventilation
Restrictive lung disease
• decreased chest wall compliance
• diaphragm forced cephaladly
• decreased lung volumes accentuated by supine position
• functional residual capacity (FRC) may fall below closing capacity leading to
  o alveolar collapse with ventilation/perfusion mismatch
  o often relatively hypoxemic
  o occasionally hypercapnic (obesity-hypoventilation or Pickwickian syndrome)
• Obstructive sleep apnoea syndrome (OSAS)
• snoring, apnea pauses during sleep, associated with
  o hypertension
  o hypoxia
  o dysrhythmias
  o myocardial infarction
  o pulmonary oedema
  o stroke
  o difficult airway management
  o more vulnerable to airway obstruction after opioids or sedatives

Cardiovascular
• increased workload
• hypertension
• left ventricular hypertrophy (LVH)
• increased pulmonary blood flow and hypoxic pulmonary vasoconstriction leads to
  o pulmonary hypertension and
  o cor pulmonale

Gastrointestinal
• gastroesophageal reflux
• poor gastric emptying
• hyperacidic gastric fluid
• fatty infiltration of the liver
• elevated liver function tests

Assessment
• cardiopulmonary function
  o chest X-ray
  o ECG
  o arterial blood gases
  o pulmonary function tests
• blood pressure with appropriate size cuff (at least 75% of arm circumference)
• assess need for central venous or arterial access
• airway
  o limited TM joint mobility
• limited atlanto-occipital mobility
• narrow upper airway
• small space between mandible and sternal fat pads

In 100 morbidly obese patients, neither obesity nor body mass index predicted problems with tracheal intubation. However, a high Mallampati score (≥3) and large neck circumference may increase the potential for difficult laryngoscopy and intubation (Brodsky, et al, Anesth Analg 2002;94:732-736)
• awake fiberoptic intubation good choice if difficult direct laryngoscopy expected
• relatively high FIO2 may be needed

Mechanical ventilation
Pressure-controlled ventilation (PCV) may be a better alternative to Volume Controlled Ventilation (VCV) in ICU patients with morbid obesity. The two differences between VCV and PCV are the flow pattern and the chosen target: PCV uses a decelerating flow, which reaches the highest possible value at the beginning of inspiration, while having a preset pressure limitation but no minimum Vt. Flow diminishes throughout inspiration according to the pressure target, and the resulting Vt depends on the pressure limitation and on the chest compliance. These characteristics of PCV (faster tidal volume delivery, different gas distribution, and high and decelerating inspiratory flow) tend to compensate for any potential reduction in ventilation caused by pressure limitation. Furthermore, the limitation of pressure levels has a positive effect on the patient's haemodynamics and might even reduce the risk of barotrauma. (Cadi et al, British Journal of Anaesthesia 2008 100(5):709-716)

Morbidly obese patients sometimes require higher than normal range of airway pressures (40–50 cm H₂O) to achieve and maintain adequate oxygenation. These pressures, which can be generated by regular ventilators, are required to oppose the excess weight, which is centrally localized in the abdominal area. Pressure-controlled ventilation with vigilant monitoring of tidal volumes may help prevent barotrauma. Pressures of up to 50 cm H₂O have been used without adverse pulmonary sequelae. The Oxylog 3000 can deliver up to 2l tidal volumes, with peak pressures to 55 cmH₂O. The adult 3-L Ambu bag is adequate for obese patients because their lung volumes are not larger than that of nonobese patients. Morbidly obese patients can be adequately hand-ventilated with the standard (3-L) ventilation bag. One can adjust the pressure relief ("pop off") valve so that larger than usual inflation pressures (up to 50 cm H₂O) can be used to inflate the lungs. The danger of barotrauma is minimized by the fact that most of the excess pressure is directed towards opposing the additional abdominal girth during lung inflation.

The maximum 400 joules of energy in regular defibrillators is sufficient for the morbidly obese. Although higher transthoracic impedance from chest wall fat may occasionally make defibrillation difficult, the chest wall is usually not much thicker in most obese patients.

Pharmacology/Weight-Based Dosing
Highly lipophilic substances such as barbiturates and benzodiazepines, show significant increases in volume of distribution (VD) for obese individuals relative to normal-weight individuals. Less-lipophilic compounds have little or no change in VD with obesity. Certain exceptions to this rule include digoxin, procainamide, and remifentanil, which are highly lipophilic drugs but which have no systematic relationship between their degree of lipophilicity and their distribution in obese individuals. Consequently, their absolute VD remains relatively consistent between obese and normal-weight individuals, and their doses should be calculated on the basis of ideal body weight.

Drugs with weak or moderate lipophilicity can be dosed on the basis of ideal body weight (IBW) or, more accurately, lean body mass (LBM). These values are not identical, because 20%–40% of an obese patient’s increase in total body weight can be attributed to an increase in LBM. Adding 20% to the estimated IBW dose of hydrophilic medications is sufficient to include the extra lean mass. Nondepolarizing muscle relaxants can be dosed in this manner. The majority of anesthetic drugs are strongly lipophilic. Increased VD is expected for lipophilic substances, but this is not consistently demonstrated in pharmacological studies because of factors such as end-organ clearance or protein binding.

Weight-Based Dosing of Common IV Anaesthetics
<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosing</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propofol</td>
<td>IBW</td>
<td>Maintenance: TBW. Systemic clearance and $V_d$ at steady-state correlates well with TBW (92). High affinity for excess fat and other well perfused organs. High hepatic extraction and conjugation relates to TBW.</td>
</tr>
<tr>
<td>Thiopentone</td>
<td>TBW</td>
<td>Increased $V_d$. Increased blood volume, cardiac output, and muscle mass (91). Increased absolute dose. Prolonged duration of action (93).</td>
</tr>
<tr>
<td>Midazolam</td>
<td>TBW</td>
<td>Central $V_d$ increases in line with body weight. Increased absolute dose. Prolonged sedation because larger initial doses are needed to achieve adequate serum concentrations (93, 94).</td>
</tr>
<tr>
<td>Succinylcholine</td>
<td>TBW</td>
<td>Plasma cholinesterase activity increases in proportion to body weight. Increased absolute dose (93).</td>
</tr>
<tr>
<td>Vecuronium</td>
<td>IBW</td>
<td>Recovery may be delayed if given according to TBW because of increased $V_d$ and impaired hepatic clearance (93, 95).</td>
</tr>
<tr>
<td>Rocuronium</td>
<td>IBW</td>
<td>Faster onset and longer duration of action. Pharmacokinetics and pharmacodynamics are not altered in obese subjects (96, 97).</td>
</tr>
<tr>
<td>Atracurium</td>
<td>TBW</td>
<td>Absolute clearance, $V_d$, and elimination half-life do not change. Unchanged dose per unit body weight without prolongation of recovery because of organ-independent elimination (98, 99).</td>
</tr>
<tr>
<td>Cisatracurium</td>
<td>TBW</td>
<td></td>
</tr>
<tr>
<td>Fentanyl</td>
<td>TBW</td>
<td>Increased $V_d$ and elimination half-time, which correlates positively with</td>
</tr>
</tbody>
</table>

**IBW** = Ideal body weight; **TBW** = Total body weight; **$V_d$** = volume of distribution.

The morbidly obese are vulnerable to both pressure areas and thromboembolic complications. Appropriate precautions should be taken.

**Transport Platform Options**

Morbidly obese patients need to be considered both in terms of their weight as well as their physical dimensions, particularly width. A patient who is oversized for a stretcher may fall off, develop pressure wounds, or make ongoing management impossible. If there is too much “overhang” from the patient’s arms over the side rails, then this can also be a problem when stretchers fit tightly against a wall such as in all AAV helicopters and HATS vehicles.

In general, a patient approaching 160kg will not fit on a standard ambulance stretcher because of width rather than weight and should be considered for CPAV or NPT bariatric vehicles. A patient between 120 and 160kg should be carefully considered regarding platform selection. AAV fixed wing is limited to 120kg.

Example: A 70-year-old 130kg, 160cm (5 ft 3 in) tall female only just fits on a standard ambulance stretcher in HEMS 4 (with difficulty and after some equipment rearrangement). This is due to both stretcher handling difficulty/pressure care/won’t fall off, but more because the patient’s arms and body overhanging the stretcher edge won’t fit against the engine wall and therefore the stretcher can’t be rolled in. A 180cm (6 ft) person of the same weight is likely to fit with relative ease.
# Ventilator Setting Guide (Drager Oxylog 3000 Plus)

## Guide for Initial Settings for Pressure Controlled Ventilation for Draeger Oxylog 3000 Plus

Assumes patient is apnoeic from sedation & nursed at 30° to minimise aspiration.

### Recommended for all Uncuffed Tubes

<table>
<thead>
<tr>
<th>Mode</th>
<th>Lung Protective Strategy (all other patients)</th>
<th>Obstructive Strategy (bronchiolitis/asthma)</th>
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<tbody>
<tr>
<td>VT</td>
<td>PC SIMV+</td>
<td>PC SIMV+</td>
</tr>
<tr>
<td>RR</td>
<td>See chart; then titrate to normal pCO₂/pH</td>
<td>(1/3 normal RR); see chart then examine Expiratory Flow Curves if breath stacking, RR by further 20% - permissive hypercapnea (pH &gt; 7.1)</td>
</tr>
<tr>
<td>Pmax(alarm)</td>
<td>≥40 (if alarms, follow instructions below)</td>
<td>≥40 (if alarms, follow instructions below)</td>
</tr>
<tr>
<td>FiO₂</td>
<td>Titrate using FiO₂/PEEP scale &gt; SpO₂ of 88-95%</td>
<td>Minimal FiO₂ for SpO₂ 88-95%</td>
</tr>
<tr>
<td>PEEP</td>
<td>PEEP 5-8</td>
<td>5 (default)</td>
</tr>
<tr>
<td>Ppeak</td>
<td>Start at 20 then titrate to VT (6ml/kg IBW)- see chart</td>
<td>Start at 20 then titrate to VT (6ml/kg IBW)- see chart</td>
</tr>
<tr>
<td>I/E</td>
<td>1:1:5 (default)</td>
<td>≥1:4</td>
</tr>
<tr>
<td>Slope</td>
<td>√ (default)</td>
<td>√ (i.e. fast inspiratory flow rate)</td>
</tr>
<tr>
<td>Other</td>
<td>&quot;If high PEEP results in BP, give fluids &amp; inotropes keeping SBP as per chart&quot;</td>
<td>&quot;If high PEEP results in BP, give fluids &amp; inotropes keeping SBP as per chart&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;If Pmax alarms, check for patient agitation/tube obstruction. If not the cause, perform INSPIRATORY HOLD MANOEUVRE - if Pplat &gt; 30 mL on VT by 1mL/kg steps (1mL/kg)&quot;</td>
<td>&quot;If Pmax alarms, check for patient agitation/tube obstruction. If not the cause, perform INSPIRATORY HOLD MANOEUVRE - if Pplat &gt; 30 mL on VT by 1mL/kg steps (1mL/kg)&quot;</td>
</tr>
</tbody>
</table>

Further modifications depend on hourly ABGs and haemodynamics.

### Ventilator Setting Table

<table>
<thead>
<tr>
<th>Age/IBW</th>
<th>RR (obstructive RR)</th>
<th>VT (6mL/kg)</th>
<th>Systolic BP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term/3.5kg</td>
<td>40-60 (13-20)</td>
<td>20mL</td>
<td>≥ 50</td>
</tr>
<tr>
<td>3 months/6kg</td>
<td>30-50 (10-16)</td>
<td>36mL</td>
<td>≥ 50</td>
</tr>
<tr>
<td>6 months/8kg</td>
<td>30-50 (10-16)</td>
<td>48mL</td>
<td>≥ 60</td>
</tr>
<tr>
<td>1 year/10kg</td>
<td>30-40 (10-13)</td>
<td>60mL</td>
<td>≥ 65</td>
</tr>
<tr>
<td>2 years/13kg</td>
<td>20-30 (7-9)</td>
<td>78mL</td>
<td>≥ 65</td>
</tr>
<tr>
<td>4 years/15kg</td>
<td>20 (7)</td>
<td>90mL</td>
<td>≥ 70</td>
</tr>
<tr>
<td>6 years/20kg</td>
<td>16 (6)</td>
<td>120mL</td>
<td>≥ 75</td>
</tr>
<tr>
<td>8 years/25kg</td>
<td>16 (6)</td>
<td>150mL</td>
<td>≥ 80</td>
</tr>
<tr>
<td>10 years/30kg</td>
<td>16 (6)</td>
<td>180mL</td>
<td>≥ 85</td>
</tr>
<tr>
<td>12 years/40kg</td>
<td>16 (6)</td>
<td>240mL</td>
<td>≥ 90</td>
</tr>
<tr>
<td>14 years/50kg</td>
<td>16 (6)</td>
<td>300mL</td>
<td>≥ 90</td>
</tr>
<tr>
<td>17 years+/70kg</td>
<td>16 (6)</td>
<td>420mL</td>
<td>≥ 90</td>
</tr>
</tbody>
</table>

Other patients (i.e. modifications from LUNG PROTECTIVE STRATEGY)
- **HEAD INJURY**: too much PEEP can decrease BP and thus decrease cerebral perfusion pressure. PEEP=5 (default) is OK.
- **METABOLIC ACIDOSIS**: RR ≥ patient achieved, ETCO₂ ≤ patient achieved. Lighten sedation to allow patient to add additional breaths as required - add pressure support (Asupp=10, Trigger=2) to these breaths as patient tired.

If patient is crashing:
- Take the ventilator out of the equation-bag the patient to feel how they are to ventilate
- Check the tube - displaced/dislodged/obstructed
- Check the patient - pneumothorax - bedside US/CXR and needle/finger thoracostomy
- Check the ventilator

---

148
GUIDE FOR INITIAL SETTINGS FOR VOLUME CONTROLLED VENTILATION FOR DRAEGER OXYLOG 3000 PLUS

Assumes patient is apnoeic from sedation & nursed at 30° to minimise aspiration.

<table>
<thead>
<tr>
<th>LUNG PROTECTIVE STRATEGY (all other patients &gt;1yo if cuffed tube)</th>
<th>OBSTRUCTIVE STRATEGY (asthma/COPD if cuffed tube &gt;1yo)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mode</strong></td>
<td>SIMV (default)</td>
</tr>
<tr>
<td><strong>VT</strong></td>
<td>6ml/kg ideal body weight; see chart</td>
</tr>
<tr>
<td><strong>RR</strong></td>
<td>16-18 breaths/min then titrate to normal pCO2/pH</td>
</tr>
<tr>
<td><strong>Pmax(Alarm)</strong></td>
<td>≥40 (ff alarms, follow instructions below)</td>
</tr>
<tr>
<td><strong>FiO2</strong></td>
<td>titrate using FiO2/PEEP scale for SpO2 of 88-95%</td>
</tr>
<tr>
<td><strong>PEEP</strong></td>
<td>PEEP 5</td>
</tr>
<tr>
<td><strong>I:E</strong></td>
<td>1:1.5 (default)</td>
</tr>
<tr>
<td><strong>AutoFlow: ON</strong></td>
<td>Slope: 0 (default)</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>if high PEEP results in HP, give fluids &amp; inotropes keeping MAP&gt;65 (for paediatric values, check chart)</td>
</tr>
</tbody>
</table>

Further modifications depends on hourly ABGs and haemodynamics.

Other patients (i.e. modifications from LUNG PROTECTIVE STRATEGY):
- **HEAD INJURY**: too much PEEP can ↓BP and thus ↓cerebral perfusion pressure. PEEP=5 (default) is OK. 30° head up. Aim for low-normal CO2.
- **METABOLIC ACIDOSIS**: RR > patient achieved, ETCO2 < patient achieved. Lighten sedation to allow patient to add additional breaths as required - add pressure support (Delta=10, Trigger=2) to these breaths as patient tired.
- **HYPERTENSIVE APO**: start PEEP=10 and rapidly titrate up while rapidly titrating IV GTN for SBP≤140.
- **CARDIogenic SHOCK**: avoid high-level PEEP as can ↓BP.
- **PREGNANCY**: left lateral position. TV: 8ml/kg ideal body weight, RR 18-20 bpm aim for low-normal pCO2 & normal pH.

If patient is crashing:
- **Take the ventilator out of the equation-bag the patient to feel how they are to ventilate**
- **Check the tube**: displaced/ dislodged/ obstructed
- **Check the patient**: pneumothorax - bedside US/CXR and needle/finger thoracostomy
- **Check the ventilator**
## Infusions

<table>
<thead>
<tr>
<th>ARV Infusions Table</th>
<th>Preparation</th>
<th>Concentration</th>
<th>Loading / Bolus</th>
<th>Infusion</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adrenaline Infusion (1mcg/1ml)</td>
<td>3mg dilute to 50ml with NS</td>
<td>60mcg/ml</td>
<td>N/A</td>
<td>Titrate to effect. Usually 1-20ml/hr</td>
<td>1ml/hr=1mcg/min</td>
</tr>
<tr>
<td>Adrenaline Increments (10mcg/ml)</td>
<td>Dilute 1ml of 1:10,000 adrenaline with 9mls of N.Saline</td>
<td>10mcg/ml</td>
<td>N/A</td>
<td>N/A</td>
<td>It is preferable that an infusion be set up and bolused during retrieval.</td>
</tr>
<tr>
<td>Amiodarone (150mg/3ml) (Bolus and Infusion)</td>
<td>300mg dilute to 50ml with 5%DW</td>
<td>6mg/ml</td>
<td>5mg/kg - usual adult dose 300mg over 30-60min</td>
<td>15mg/kg/24hrs - usual adult dose 900mg/24hr = 6.25ml/hr</td>
<td>Slow push in cardiac arrest.</td>
</tr>
<tr>
<td>Dobutamine</td>
<td>300mg dilute to 50ml with NS</td>
<td>6mg/ml</td>
<td>N/A</td>
<td>Titrate to effect usually 2-20mcg/kg/min (1.4ml/hr-14ml/hr in a 70kg patient)</td>
<td>1ml/hr = 100mcg/min</td>
</tr>
<tr>
<td>Dopamine</td>
<td>300mg dilute to 50ml with NS</td>
<td>6mg/ml</td>
<td>N/A</td>
<td>Titrate to effect usually 2-20mcg/kg/min (1.4ml/hr-14ml/hr in a 70kg patient)</td>
<td>1ml/hr = 100mcg/min</td>
</tr>
<tr>
<td>Fentanyl (100mcg/1ml)</td>
<td>500mcg dilute to 50ml with NS</td>
<td>10mcg/ml</td>
<td>1-5mcg/kg = 0.1-0.5ml/kg</td>
<td>1-10mcg/kg/hr Usual adult rate 5-20ml/hr</td>
<td></td>
</tr>
<tr>
<td>Fentanyl &amp; Midazolam</td>
<td>Fentanyl 1000mcg and Midazolam 50mg make up to 50ml with NS</td>
<td>Fentanyl 20mcg/ml &amp; Midazolam 1mg/ml</td>
<td>N/A</td>
<td>Usual rate 5-10ml/hr</td>
<td></td>
</tr>
<tr>
<td>Fentanyl &amp; Ketamine Increments</td>
<td>Fentanyl 200mcg and Ketamine 200mg dilute to 20ml with NS</td>
<td>10mcg Fentanyl &amp; 10mg Ketamine / ml</td>
<td>N/A</td>
<td>Used by some pre-hospital specialists in the Military. One syringe can deliver analgesia/ sedation/ modified RSI adjunct depending on dose.</td>
<td>Ratio of Fentanyl to Ketamine is altered by some practitioners.</td>
</tr>
<tr>
<td>ARV Infusions Table</td>
<td>Preparation</td>
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<td>Comments</td>
</tr>
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<td>---------------</td>
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<td>-----------------------------------</td>
<td>----------------------------------------------</td>
</tr>
<tr>
<td>Glyceryl Trinitrate (GTN) (50mg/10ml)</td>
<td>50mg dilute to 50ml with NS</td>
<td>1mg/ml</td>
<td></td>
<td>10-200mcg/min. Start 3ml/hr. (50 mcg/min) up to 12ml/hr (200 mcg/min)</td>
<td>Titrating to pain and BP</td>
</tr>
<tr>
<td>Hydralazine (20mg dry)</td>
<td>100mg dilute to 50ml with NS</td>
<td>2mg/ml</td>
<td>5-10mg = 2.5-5ml as a “Pushes” (= 150ml/hr) followed by infusion</td>
<td>50-300mcg/min = 1.5-9ml/hr</td>
<td>Bolus 5mg = 2.5ml over 1 min. May need over 20mg initially in severe hypertension. Controversial</td>
</tr>
<tr>
<td>Hypertonic Saline (Hypovolaemic shock with head Trauma)</td>
<td>Neat</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isoprenaline</td>
<td>3mg dilute to 50ml with NS</td>
<td>60mcg/ml</td>
<td></td>
<td>Titrating to effect. Usually 5-20mcg/min</td>
<td>1ml/hr=1mcg/min</td>
</tr>
<tr>
<td>Ketamine (200mg/2ml)</td>
<td>200mg dilute to 50ml with NS</td>
<td>4mg/ml</td>
<td>1-2mg/kg = 0.25-0.5ml/kg</td>
<td></td>
<td>Titrating to sedation and vital signs</td>
</tr>
<tr>
<td>Ketamine Increments</td>
<td>200mg dilute to 20 ml with NS</td>
<td>10mg/ml</td>
<td>N/A</td>
<td></td>
<td>1-2 ml bolus for painful procedures (Femoral splint, stretcher transfer)</td>
</tr>
<tr>
<td>Levosimendin</td>
<td>12.5mg dilute to 50ml with 5%DW</td>
<td>0.25mg/ml or 250mcg/ml</td>
<td>6-12 mcg/kg over 10 mins (e.g. 70kg 420-840 mcg or a rate of 10-20mls per hour for 10 minutes only) (Recommend completing bolus before departure)</td>
<td>0.05-0.1mcg/kg/min (e.g. 60mcg/0.7-1.4mls/hr, 70kg=0.8-1.6mls/hr, 80kg=0.9-1.8mls/hr) “Levo” is given for 24 hours only but may be repeated after a 48hr interval. This is usually set up as a 500ml infusion and the rate is not changed over the 24 hours.</td>
<td>100mg routinely carried. Ensure that ampoule is suitable for IV use.</td>
</tr>
<tr>
<td>Lignocaine (Spinal Decompression Illness / AGE) Hyperbaric Unit</td>
<td>200mg dilute to 50ml with 5%DW</td>
<td>4mg/ml</td>
<td>1mg/kg over 2 mins. Usual adult dose 100mg</td>
<td>4mg/min=60ml/hr for 1hr; then 3mg/min = 45ml/hr for 2hrs; then 2mg/min = 30ml/hr up to 24hrs total.</td>
<td></td>
</tr>
<tr>
<td>ARV Infusions Table</td>
<td>Preparation</td>
<td>Concentration</td>
<td>Loading / Bolus</td>
<td>Infusion</td>
<td>Comments</td>
</tr>
<tr>
<td>---------------------</td>
<td>-------------</td>
<td>---------------</td>
<td>-----------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Magnesium Sulphate (2.5g=10mmol/ 5ml) (Pre-eclampsia)</td>
<td>5g=20mmol dilute to 50ml with NS</td>
<td>0.1g=0.4mmol/ml</td>
<td>4g=16mmol=40ml over 20min</td>
<td>1-2g=4-8mmol = 10-20ml/hr</td>
<td>For seizure give further 2gm = 8mmol = 20ml over 5 min</td>
</tr>
<tr>
<td>Magnesium Sulphate (2.5g=10mmol/ 5ml)(Asthma)</td>
<td>5g=20mmol dilute to 50ml with NS</td>
<td>0.1g=0.4mmol/ml</td>
<td>2g=8mmol=20ml over 20min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesium Sulphate (2.5g=10mmol/ 5ml)(Torsades)</td>
<td>5g=20mmol dilute to 50ml with NS</td>
<td>0.1g=0.4mmol/ml</td>
<td>2g=8mmol=20ml over 10-15 min</td>
<td>0.5-0.75g/hr=2-3mmol/hr=5-7.5ml/hr</td>
<td></td>
</tr>
<tr>
<td>Mannitol (20%)</td>
<td></td>
<td></td>
<td></td>
<td>0.5-1gr/kg over 30 minutes</td>
<td></td>
</tr>
<tr>
<td>Metaraminol Infusion (10mg/1ml)</td>
<td>10mg dilute to 50ml with NS</td>
<td>200mcg/ml</td>
<td>0.2-0.5mg = 1-2.5ml boluses</td>
<td>Suggest start 2mg/hr=10ml/hr</td>
<td>Titrate to effect</td>
</tr>
<tr>
<td>Metaraminol Increments (10mg/1ml)</td>
<td>10mg dilute to 20ml with NS</td>
<td>0.5mg/ml</td>
<td></td>
<td></td>
<td>Short term option. Beware reflex Bradycardia.</td>
</tr>
<tr>
<td>Midazolam (5mg/1ml and 50mg/10ml)</td>
<td>50mg dilute to 50ml with NS</td>
<td>1mg/ml</td>
<td>0.05-0.1mg/kg = 0.05-0.1ml/kg</td>
<td>0.5-10mg/hr = 0.5-10ml/hr</td>
<td></td>
</tr>
<tr>
<td>Milrinone</td>
<td>10mg dilute to 50 ml with NS</td>
<td>0.2mg/ml</td>
<td>0.05mg per Kg over 10 minutes</td>
<td>1.6-3.2 mg/hour = 8-16 ml/hour</td>
<td></td>
</tr>
<tr>
<td>Morphine (10mg/ml)</td>
<td>50mg dilute to 50ml with NS</td>
<td>1mg/ml</td>
<td>2.5-15mg in 2.5mg = 2.5ml boluses</td>
<td>2-10mg/hr = 2-10ml/hr</td>
<td></td>
</tr>
<tr>
<td>Morphine and Midazolam</td>
<td>Morphine 50mg and Midazolam 50mg dilute to 50ml NS</td>
<td>1mg Morphine and 1mg Midazolam /ml</td>
<td>1-2ml boluses</td>
<td>Usual rate 5-10ml/hr</td>
<td>Titrate to sedation.</td>
</tr>
<tr>
<td>Naloxone (400mcg/1ml)</td>
<td>400mcg dilute to 50ml with NS</td>
<td>8mcg/ml</td>
<td>400mcg-2mg. Rpt if needed</td>
<td></td>
<td>Give half the effective bolus dose over 1hr. Titrate to effect.</td>
</tr>
<tr>
<td>ARV Infusions Table</td>
<td>Preparation</td>
<td>Concentration</td>
<td>Loading / Bolus</td>
<td>Infusion</td>
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</tr>
<tr>
<td>---------------------------------------------</td>
<td>------------------------------------------</td>
<td>---------------</td>
<td>------------------------------------------</td>
<td>----------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>NImodipine</td>
<td>10mg dilute to 50ml with NS</td>
<td>200mcg/ml</td>
<td>5ml/hr (15mcg/kg/hr) first 2/24</td>
<td>10ml/hr (30mcg/kg/hr) maintenance</td>
<td>Titrating to BP. If drops 7ml/hr for 2hrs then back to 10ml/hr. Run centrally with co-infusion solution (eg. NS) at 40ml/hr.</td>
</tr>
<tr>
<td>Noradrenaline (2mg/2ml)</td>
<td>3mg dilute to 50ml with NS</td>
<td>60mcg/ml</td>
<td></td>
<td></td>
<td>Titrating to effect. Usual range 2-20ml/hr</td>
</tr>
<tr>
<td>Octreotide (Oesophageal Varices)</td>
<td>500 mcg dilute to 50ml with 5%DW</td>
<td>10 mcg/ml</td>
<td>50-100 mcg</td>
<td>25-50mcg/hr for 48 hrs = 2.5 - 5 ml/hr</td>
<td></td>
</tr>
<tr>
<td>Phenytoin (250mg/5ml)</td>
<td>1g in 20ml neat</td>
<td>50mg/ml</td>
<td>15-20mg/kg = 0.3-0.4ml/kg over at least 20min. Usual adult dose 1g. Max rate 50mg/min = 1ml/min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potassium Chloride (10mmol/10ml)</td>
<td>2-4 mmol dilute to 50ml with NS</td>
<td>40-80 micromol/ml</td>
<td></td>
<td>250-500ml/hr. Max 20mmol/hr</td>
<td>Continuous cardiac monitoring. May irritate peripheral veins. Not routinely carried.</td>
</tr>
<tr>
<td>Propofol (200mg/20ml)</td>
<td>200mg in 20ml neat</td>
<td>10mg/ml</td>
<td>Bolus 10-50mg = 1-5ml slowly</td>
<td>1-3mg/kg/hr. Usual adult range 6-20ml/hr</td>
<td></td>
</tr>
<tr>
<td>Salbutamol (5mg/5ml)(Asthma)</td>
<td>6mg dilute to 50ml with NS</td>
<td>120mcg/ml</td>
<td>200-300mcg = 1.7-2.5ml over 2-5min</td>
<td>2 mcg/min = 1 ml/hr</td>
<td></td>
</tr>
<tr>
<td>Salbutamol (5mg/5ml)(Preterm Labour)</td>
<td>6mg dilute to 50ml with NS</td>
<td>120mcg/ml</td>
<td></td>
<td>2 mcg/min = 1 ml/hr</td>
<td></td>
</tr>
<tr>
<td>Sodium Nitroprusside (50mg dry)</td>
<td>50mg dilute to 50ml with NS</td>
<td>1mg/ml</td>
<td></td>
<td></td>
<td>Titrating to BP target</td>
</tr>
<tr>
<td>ARV Infusions Table</td>
<td>Preparation</td>
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<td>Infusion</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-------------</td>
<td>---------------</td>
<td>-----------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Syntocinon (10 Units/1ml) PPH</td>
<td></td>
<td></td>
<td>5 units by slow IV injection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiopentone (500mg dry)</td>
<td>500mg dilute to 20ml with water</td>
<td>25mg/ml</td>
<td>2-5mg/kg Usual adult dose 120-350mg = 5-14ml</td>
<td>Usual range 1-5mg/kg/hr = 0.04-0.2ml/kg/hr</td>
<td></td>
</tr>
<tr>
<td>Vasopressin (20 units/1ml) (Shock resistant to Noradrenaline)</td>
<td>20 units dilute to 50ml with NS</td>
<td>0.4units/ml</td>
<td>N/A</td>
<td>Usual dose 0.01-0.04 Units per minute (0.6-2.4 units/hr) = 1.5-6ml/hr. (Range 1-12 ml/hr)</td>
<td>Central Line Only</td>
</tr>
<tr>
<td>Vasopressin (20 units/1ml) (Oesophageal Varices)</td>
<td>20 units dilute to 50ml with NS</td>
<td>0.4units/ml</td>
<td>N/A</td>
<td>Start at 0.4 units per minute up to 1.0 units per minute</td>
<td>Central Line Only, Octreotide preferred. Note: Very high doses required (thus side effects)</td>
</tr>
</tbody>
</table>
## AV Platform Capability and Fitout

<table>
<thead>
<tr>
<th>PLATFORM</th>
<th>APPROX RANGE</th>
<th>CREW</th>
<th>CAPACITY (stretchers)</th>
<th>WEIGHT MAX</th>
<th>OXYGEN CAPACITY</th>
<th>ELECTRICAL EQUIPMENT</th>
<th>RESTRICTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEMS 1</td>
<td>150 km out</td>
<td>Pilot, Crewman, MICA Officer</td>
<td>1</td>
<td>Approx. 140kg</td>
<td>3270L Fixed 600L Portable</td>
<td>240 AC 12/24 DC</td>
<td>Invasive Propaq Monitor NIBP, ECG, SpO2 Invasive Pressure, ETCO2 Zoll Defibrillator 3 Infusion pumps ACLS Equipment/Drugs LTV1200 Ventilator</td>
</tr>
<tr>
<td></td>
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<td>At times dependant on load or weather conditions eg. cross winds, storms, lightning, fog and heat, may be unable to land at certain destinations eg. RMH, RCH (new) Helipad Landing restrictions placed on certain rotary platforms, may be unable to land at certain destinations eg. RMH, RCH (new) Helipad. These include most replacement platforms for servicing of HEMS. Whilst distances may be prohibitive, don't totally dismiss Rotary as an option as they still may be the available best option. platform of choice eg refuel options, helipad to helipad.</td>
</tr>
<tr>
<td>HEMS 2</td>
<td>150 km out</td>
<td>Pilot, Crewman, MICA Officer</td>
<td>1 optimal, 2 possible</td>
<td>Approx. 140kg</td>
<td>3270L Fixed 600L Portable</td>
<td>240 AC 12/24 DC</td>
<td>Invasive Propaq Monitor NIBP, ECG, SpO2 Zoll Defibrillator 4 Infusion pumps ACLS Equipment/Drugs LTV1200 Ventilator</td>
</tr>
<tr>
<td>HEMS 3</td>
<td>150 km out</td>
<td>Pilot, Crewman, MICA Officer</td>
<td>1 optimal, 2 possible</td>
<td>Approx. 140kg</td>
<td>3270L Fixed 600L Portable</td>
<td>240 AC 12/24 DC</td>
<td>Invasive Propaq Monitor NIBP, ECG, SpO2 Zoll Defibrillator 4 Infusion pumps ACLS Equipment/Drugs LTV1200 Ventilator</td>
</tr>
</tbody>
</table>

Discuss with Flight Coordinator.
<table>
<thead>
<tr>
<th>PLATFORM</th>
<th>APPROX RANGE</th>
<th>CREW</th>
<th>CAPACITY (stretchers)</th>
<th>WEIGHT MAX</th>
<th>OXYGEN CAPACITY</th>
<th>ELECTRICS</th>
<th>EQUIPMENT</th>
<th>RESTRICTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEMS 4</td>
<td>150 km out</td>
<td>Pilot, Crewman, MICA Officer</td>
<td>1 optimal, 2 possible</td>
<td>230kg (theoretical, generally limit at ~160kg depending on width etc)</td>
<td>3280L Fixed (2xD’s) 600L Portable</td>
<td>240 AC 12/24 DC</td>
<td>Invasive Propaq Monitor NIBP, ECG, SpO2 Zoll Defibrillator 4 Infusion pumps ACLS Equipment/Drugs LTV1200 Ventilator</td>
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</tr>
<tr>
<td>HEMS 5</td>
<td>150 km out</td>
<td>Pilot, Crewman, MICA Officer</td>
<td>1 optimal, 2 possible</td>
<td>230kg (theoretical, generally limit at ~160kg depending on width etc)</td>
<td>3280L Fixed (2xD’s) 600L Portable</td>
<td>240 AC 12/24 DC</td>
<td>Invasive Propaq Monitor NIBP, ECG, SpO2 Zoll Defibrillator 4 Infusion pumps ACLS Equipment/Drugs LTV1200 Ventilator</td>
<td></td>
</tr>
<tr>
<td>FIXED WING</td>
<td>2hrs out</td>
<td>1 Pilot 1 Paramedic or MICA</td>
<td>1 optimal, 2 possible</td>
<td>120kg lift capacity</td>
<td>3280L Fixed (2xD’s) 600L Portable</td>
<td>240 AC 12/24 DC</td>
<td>Invasive Propaq Monitor NIBP, ECG, SpO2 Zoll Defibrillator 4 Infusion pumps ACLS Equipment/Drugs LTV1200 Ventilator</td>
<td>At times dependant on weather conditions eg. cross winds, storms, lightening, fog and heat, may be unable to land at certain destinations. Patient weight may be limiting factor.</td>
</tr>
<tr>
<td>STANDARD ROAD</td>
<td>N/A</td>
<td>2 Paramedics 4 seat capacity total</td>
<td>1</td>
<td>160kg 'Old' trolleys 230kg 'New' 50E trolleys</td>
<td>3280L Fixed (2xD’s) 980L Backup (2xC’s) 980L Portable (2xC’s)</td>
<td>240 AC 12 DC only on some</td>
<td>Non Invasive Phillips MRX NIBP, ECG, SpO2, Defib. Basic Airway, LMA's</td>
<td></td>
</tr>
<tr>
<td>PLATFORM</td>
<td>APPROX RANGE</td>
<td>CREW</td>
<td>CAPACITY (stretchers)</td>
<td>WEIGHT MAX</td>
<td>OXYGEN CAPACITY</td>
<td>ELECTRICS</td>
<td>EQUIPMENT</td>
<td>RESTRICTIONS</td>
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<tr>
<td>MICA ROAD</td>
<td>N/A</td>
<td>As above.</td>
<td>As above</td>
<td>As above</td>
<td>As above</td>
<td>As above</td>
<td>Non Invasive Phillips MRX NIBP, ECG, SpO2, Defib. ETCO2, 12 lead ECG ACLS Equipment/Drugs 2 Infusion pumps</td>
<td>Light and sirens only in special clinical settings. Authorised by AV Clinician.</td>
</tr>
<tr>
<td>CPAV</td>
<td>N/A</td>
<td>Non Emergency Crew x2</td>
<td>1</td>
<td>318kg</td>
<td>6560L Fixed (2xD's) 980L Portable (2xC's)</td>
<td>240 AC 12 DC</td>
<td>Non Invasive Phillips MRX NIBP, ECG, SpO2, Defib. Basic Airway, LMA's</td>
<td>Light and sirens only in special clinical settings. Authorised by AV Clinician.</td>
</tr>
<tr>
<td>HATS</td>
<td>N/A</td>
<td>Non Emergency Crew x1 Critical Care Nurse x1</td>
<td>1</td>
<td>230kg 'New' 50E trolleys</td>
<td>3280L Fixed (2xD's) 1640L Backup (1xD) 980L Backup (2xC) 490L Portable (1xC)</td>
<td>240 AC x 6</td>
<td>Non Invasive Zoll M Series NIBP, ECG, SpO2, Defib. External Pacing ACLS Airway Equipment</td>
<td>Light and sirens only in special clinical settings. Authorised by AV Clinician. 07-2400 Weekdays. 10-2200 Weekends. No Public Holidays.</td>
</tr>
</tbody>
</table>

**OXYGEN USAGE VENTILATORS**

<table>
<thead>
<tr>
<th>LTV</th>
<th>MV x FIO2 / Min</th>
<th>Can run on ambient air</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxyllog 2000</td>
<td>1L + 50% MV on Airmix / Min</td>
<td>1L + 100% MV on 100% / Min</td>
</tr>
<tr>
<td>Oxyllog 3000</td>
<td>0.5L + MV x %FIO2 / Min</td>
<td></td>
</tr>
</tbody>
</table>
### Outline of MICA and Flight Paramedic Skillsets

| FlightPM X | Oro & Nasopharyngeal, LMA, BYM, Section X | Cricothyroidotomy X | Post ETT, Sedation / Analgesia (Fentanyl, Methone, Midaz) X | Propofol, Ketamine X | NMB: Suxamethonium, Pancuronium X | Rocuronium (Vecuronium, Atracurium) X | Mechanical Ventilation (incl NIV) X | IV access, ECG, SpO2, Temp, non invasive BP monitoring X | 12 lead ECG X | ETCO2 X | Intravenous infusion X | Radial Art line insertion X | Invasive pressure monitoring, iStat X | 12G chest drain X | Management of ICC / USWD X | Blood Transfusion on authorisation X | Cardiac Pacing X | Infusions and Drugs: See CPGs for detailed information X | Road MICA X X X X X | Flight MICA X X X X X X X X X X X X X X X Ext | X |
Helicopter base location

- Bendigo
- Essendon
- Latrobe Valley
- Warrnambool