OXFORD SPECIALIST HANDBOOKS

RETRIEVAL MEDICINE

Edited by

Charlotte Evans

Anne Creaton

Marcus Kennedy

Consulting Editor: Terry Martin

OXFORD MEDICAL PUBLICATIONS

Retrieval Medicine

Oxford Specialist Handbooks published and forthcoming

General Oxford Specialist Handbooks

A Resuscitation Room Guide
Addiction Medicine, 2e
Day Case Surgery
Perioperative Medicine, 2e
Pharmaceutical Medicine
Postoperative Complications, 2e
Renal Transplantation
Retrieval Medicine

Oxford Specialist Handbooks in Anaesthesia

Anaesthesia for Medical and Surgical Emergencies
Cardiac Anaesthesia
Neuroanaesthesia
Obstetric Anaesthesia
Ophthalmic Anaesthesia
Paediatric Anaesthesia
Regional Anaesthesia, Stimulation and Ultrasound Techniques
Thoracic Anaesthesia

Oxford Specialist Handbooks in Cardiology

Adult Congenital Heart Disease
Cardiac Catheterization and Coronary Intervention
Cardiac Electrophysiology and Catheter Ablation
Cardiovascular Computed Tomography
Cardiovascular Magnetic Resonance
Echocardiography, 2e
Fetal Cardiology
Heart Failure, 2e
Hypertension
Inherited Cardiac Disease
Nuclear Cardiology
Pacemakers and ICDs
Pulmonary Hypertension
Valvular Heart Disease

Oxford Specialist Handbooks in Critical Care

Advanced Respiratory Critical Care
Cardiothoracic Critical Care

Oxford Specialist Handbooks in End of Life Care

End of Life Care in Cardiology
End of Life Care in Dementia
End of Life Care in Nephrology
End of Life Care in Respiratory Disease
End of Life in the Intensive Care Unit

Oxford Specialist Handbooks in Infectious Disease

Infectious Disease Epidemiology

Oxford Specialist Handbooks in Neurology

Epilepsy
Parkinson's Disease and Other Movement Disorders, 2e
Stroke Medicine, 2e

Oxford Specialist Handbooks in Oncology

Practical Management of Complex Cancer Pain

Oxford Specialist Handbooks in Paediatrics

Paediatric Dermatology
Paediatric Endocrinology and Diabetes
Paediatric Gastroenterology, Hepatology, and Nutrition
Paediatric Haematology and Oncology
Paediatric Intensive Care
Paediatric Nephrology, 2e
Paediatric Neurology, 2e
Paediatric Palliative Medicine, 2e
Paediatric Radiology
Paediatric Respiratory Medicine
Paediatric Rheumatology

Oxford Specialist Handbooks in Pain Medicine

Spinal Interventions in Pain Management

Oxford Specialist Handbooks in Psychiatry

Child and Adolescent Psychiatry
Forensic Psychiatry
Medical Psychotherapy
Old Age Psychiatry

Oxford Specialist Handbooks in Radiology

Interventional Radiology
Musculoskeletal Imaging
Pulmonary Imaging
Thoracic Imaging

Oxford Specialist Handbooks in Surgery

Cardiothoracic Surgery, 2e
Colorectal Surgery
Gastric and Oesophageal Surgery
Hand Surgery
Hepatopancreatobiliary Surgery
Neurosurgery
Operative Surgery, 2e
Oral and Maxillofacial Surgery, 2e
Otolaryngology and Head and Neck Surgery
Paediatric Surgery
Plastic and Reconstructive Surgery
Surgical Oncology
Urological Surgery
Vascular Surgery, 2e

Oxford Specialist Handbook of Retrieval Medicine

Edited by

Dr Charlotte Evans

Consultant in Emergency & Retrieval Medicine,
Clinical Lead,
Adult Retrieval Victoria, Ambulance Victoria, Australia

Dr Anne Creaton

Assistant Professor of Emergency Medicine,
Fiji National University, Fiji

Dr Marcus Kennedy

Director, Adult Retrieval Victoria,
Ambulance Victoria, Australia

Consulting editor

Dr Terry Martin

Consultant in Anaesthesia & Intensive Care Medicine,
Medical Director, Capital Air Ambulance, Exeter, UK

OXFORD
UNIVERSITY PRESS

OXFORD
UNIVERSITY PRESS

Great Clarendon Street, Oxford, OX2 6DP,
United Kingdom

Oxford University Press is a department of the University of Oxford.
It furthers the University's objective of excellence in research, scholarship,
and education by publishing worldwide. Oxford is a registered trade mark of
Oxford University Press in the UK and in certain other countries

First Edition published in 2016

Impression: 1

Published in the United States of America by Oxford University Press
198 Madison Avenue, New York, NY 10016, United States of America

British Library Cataloguing in Publication Data

Data available

Library of Congress Control Number: 2016936809

ISBN 978–0–19–872216–8

Printed and bound in China by
C&C Offset Printing Co., Ltd.

Retrieval medicine—this complex network of medicine, logistics, systems, innovation and improvisation—woven together with the dedication and efforts of many.

We hope this book inspires another generation: passionate, skilled, and from a range of backgrounds. They will contribute to a specialty that is motivated to close gaps in the accessibility of critical health care across our states and countries.

We say thank you

To the staff in the remote facility caring for the critically ill child, or the patient who is challenging, or the clinical scenario that frightens us . . .

To those working in isolation, doing the best with what they have, looking to a retrieval service for help . . .

To the clinician struggling to secure an airway of a trapped patient . . . or to the team working to cut him free amidst the smell of burning metal and blood, the noise, the managed chaos . . .

To the highly skilled, well-resourced, retrieval team that brings the intensive care unit to the patient any hour, every day . . .

To those at the cutting edge, civilian and military—researching and implementing new interventions, crafting systems, technology, and communications, new ways to preserve life . . .

To the pioneers, the teachers, and the mentors who started this specialty as passionate volunteers . . .

To the fundraisers and the communities who have supported service development . . .

To the friends and families of the dedicated individuals that have worked long hours to grow this area of clinical expertise . . .

And in particular we thank those who have helped us the most . . .

To my parents who instilled my commitment to medicine and helping; to Lorna my wife, my love, my best friend and companion for life; and to Alice and Lucy who are my joy and celebration.

Marcus Kennedy

To Elizabeth my mother and mentor; to Brian my father and role model; to Rebecca my sister and teacher; to Johnathan my brother and friend; and to Sandy my husband and beloved.

To all the Evans's and Mainwaring's this book is for you with all of my love and deepest gratitude.

Charlotte Evans

To my mother who showed me anything is possible, my father for understanding; to Tony and Bettina who radiate love and joy; and to Yvonne my dearest friend. To the doctors and nurses of Fiji who have been a constant source of inspiration.

Anne Creaton

Preface

Retrieval medicine has existed in various guises for many decades, however, in recent years it has become more systematized as an area of specialist clinical practice and an area of clinical medicine which requires its own body of literature, educational systems, qualifications, and recognition.

The days are gone where retrieval consisted of critical care transfer by junior staff, with ad hoc equipment and monitoring, and non-specialized transport platforms, all enveloped by a clinical governance void!

In contradistinction, around the world we now have specialist training systems that are established or developing, formal qualifications, and defined standards and accreditation in many settings. University courses and qualifications in aeromedical, prehospital, and retrieval medicine have emerged, and research activity is progressing positively. In addition, governance systems, regulation, accreditation, data sharing, and benchmarking are also appearing worldwide.

However, this progress is not uniform, and retrieval medicine is practiced in a vast range of models around the world.

We have approached this textbook from the perspective that there is international commonality at the core of this discipline, and that systems of patient care and clinical retrieval medicine are similar in many countries. We have consulted widely with international colleagues and adopted generic approaches where possible, and feel confident that the contents of this work will be of value and relevance to all retrieval practitioners—from those working in high-volume, critical care retrieval services, to those who are 'occasional retrievalists' or need to maintain low-volume patient transfer capability.

It is our aim to add to the knowledge that drives standards of patient care and the quality of clinical outcomes. Each of us has seen the difference between non-systematized patient transfer, and the transfer of patients via professional retrieval services who deploy well trained, educated, and supported staff. We hope that this work will contribute further to these systems, the quality of retrieval care, and the health of our communities.

Marcus Kennedy

Contents

Contributors

Mr Ian Badham OAM
Founding Director, Careflight, Australia

Dr Belinda Carne
Emergency Physician, Retrieval Physician, GP, Senior Lecturer; Faculty of Health, Deakin University Barwon Health, Melbourne, Australia

Dr Jane Cocks
Clinical Director, MedSTAR Kids, SAAS MedSTAR, Emergency Medical Retrieval Service, South Australian Ambulance, Australia

Dr Graeme Duke
Staff Specialist, Intensive Care, Box Hill Hospital, Melbourne, Australia

Dr Mark Elcock PSM
Associate Professor, College of Public Health, Medical and Veterinary Sciences. James Cook University, Queensland, Australia
Senior Director, Retrieval Services and Counter Disaster Unit, Queensland Department of Health, Australia

Dr Daniel Ellis
Associate Professor, School of Public Health and Tropical Medicine, James Cook University, Queensland, Australia
Clinical Director, SAAS MedSTAR, Emergency Medical Retrieval Service, South Australian Ambulance, Australia

Dr Tim Gray
Director of Medical Education
Adult Retrieval Victoria, Ambulance Victoria, Australia

Dr Stephen Hearns
Lead Consultant Emergency Medical Retrieval Service,
Honorary Senior Lecturer, University of Glasgow, Scotland

Dr Amy Keir
SAAS MedSTAR Emergency Retrieval Service Consultant Neonatologist, Women's and Children's Health Network Clinical Senior Lecturer, School of Medicine, University of Adelaide, Australia

Dr Minh Le Cong
Royal Flying Doctor Service, Queensland Section, Australia

Dr Allan MacKillop
Chief Medical Officer, CareFlight (Qld) Limited, Australia

Dr Stefan Mazur
Associate Professor, School of Public Health and Tropical Medicine, James Cook University, Queensland, Australia
PreHospital and Retrieval Physician, SAAS MedSTAR, Emergency Medical Retrieval Service, South Australian Ambulance, Australia

Dr Felix Oberender
Paediatric Intensive Care Specialist, Intensive Care Unit, Royal Children's Hospital, Melbourne, Australia

Lieutenant Colonel Michael C. Reade
Professor of Military Medicine and Surgery,
Joint Health Command, Australian Defence Force
Intensive Care Physician, Burns, Trauma, and Critical Care Research Centre, University of Queensland, Australia

Dr Jacqui Smith
Medical Director (Perinatal), Paediatric Infant Perinatal Emergency Retrieval, (PIPER) Victoria, Australia

Dr Jack Spencer
Emergency Physician, Alfred Hospital, Melbourne, Australia

Dr Gary Tall
Emergency and Retrieval Physician, New South Wales Ambulance, Australia

Symbols and abbreviations

►	important
►►	don't dawdle
⚠	warning
	controversial topic
	cross reference
	weblink
↓	decreased
↑	increased
→	to/leading to
A-a	alveolar-arterial
AAMS	The Association of Air Medical Services
ABCDE	Airway, Breathing, Circulation, Disability, Exposure
ABG	arterial blood gases
ACS	acute coronary syndrome
ACT	activated clotting time
ACV	assist control ventilation
AEOO	aeromedical evacuation operations officer
AF	atrial fibrillation
ALS	advanced life support
ALSO	Advanced Life Support in Obstetrics
AME	aeromedical evacuation
AMPA	Air Medical Physician Association
APACHE	acute physiology and chronic health evaluation
APLS	advanced paediatric life support
APTT	activated partial thromboplastin time
ARDS	acute respiratory distress syndrome
ARV	Adult Retrieval Victoria
AS	aortic stenosis
ASA	Aeromedical Society of Australasia
ASD	atrial septal defect
ASS	acute splenic sequestration
ATLS	Advanced Trauma Life Support
AVM	arteriovenous malformation
AVPU	alert, voice responsive, pain responsive, unresponsive
AXR	abdominal X-ray
bd	bis in die; twice daily

BGL	blood glucose level
BiPAP	bi-level positive airway pressure
BMI	body mass index
BNP	B-type natriuretic peptide
BP	blood pressure
bpm	beats per minute
BSA	body surface area
BVM	bag valve mask
CAH	congenital adrenal hyperplasia
CAMTS	Commission on Accreditation of Medical Transport Systems
CBP	complete blood picture
CBRN	chemical, biological, radiological, and nuclear
CCATT	critical care air transport team
CCRN	critical care registered nurse
CCU	coronary care unit
CDH	congenital diaphragmatic hernia
CHB	complete heart block
CHD	congenital heart disease
CME	continuing medical education
CMV	controlled mandatory ventilation
CoA	coarctation of the aorta
COPD	chronic obstructive pulmonary disease
CPAP	continuous positive airway pressure
CPD	continuous professional development
CPG	clinical practice guidelines
CPR	cardiopulmonary resuscitation
CRM	crisis resource management
CRP	C-reactive protein
CRT	capillary refill test
CSF	cerebrospinal fluid
CT	computed tomography
CTA	computed tomography aortography
CTG	cardiotocograph
CTPA	CT pulmonary angiogram
CVC	central venous catheter
CVP	central venous pressure
CVS	cardiovascular system
CXR	chest X-ray
DAT	direct antiglobulin test

DCS	decompression sickness
DDx	differential diagnosis
DKA	diabetic ketoacidosis
DPG	diphosphoglycerate
DVT	deep venous thrombosis
ECG	electrocardiogram
ECMO	extracorporeal membrane oxygenation
EDH	extradural haemorrhage
EEG	electroencephalogram
E-FAST	extended focused assessment by sonography in trauma
EHAC	European HEMS & Air Ambulance Committee
EMRS	Emergency Medical Retrieval Service
EMS	emergency medical services
EMST	early management of severe trauma
ENT	ear, nose, and throat
ERCP	endoscopic retrograde cholangiopancreatography
ET	exchange transfusion
ETA	expected time of arrival
$EtCO_2$	end-tidal CO_2
ETT	endotracheal tube
EUPHOREA	European Prehospital Research Alliance
EURAMI	European Aero-Medical Institute
EWS	early warning scores
FBE	full blood examination
FES	fat embolization syndrome
FFP	fresh frozen plasma
FiO_2	fraction of inspired oxygen
FNA	Flight Nurses Australia
FOAMed	free open-access meducation
FRC	functional residual capacity
ft	feet
FW	fixed wing
GBS	group B streptococci
GCS	Glasgow coma scale
GIT	gastrointestinal
GP	general practitioner
GRACE	Global Registry of Acute Coronary Events
GTN	glyceryl trinitrate
HAZMAT	hazardous materials
hCG	human chorionic gonadotropin

HDU	high dependency unit
HEMS	Helicopter Emergency Medical Service
HEPA	high-efficiency particulate air
HFT	high flow therapy
HIE	hypoxic ischaemic encephalopathy
HITS	heparin-induced thrombocytopenia
HLHS	hypoplastic left-sided heart syndrome
HUET	helicopter underwater escape training
IABP	intra-aortic balloon pump
ICC	intercostal catheter
ICH	intracerebral haemorrhage
ICP	intracranial pressure
ICU	intensive care unit
IEM	inborn errors of metabolism
IFR	instrument flight rules
IHD	ischaemic heart disease
IM	intramuscular
INR	international normalized ratio
IO	intraosseous
iT	inspiratory time
IUGR	intrauterine growth retardation
IV	intravenous
IVC	inferior vena cava
IVIG	intravenous immunoglobulin therapy
JVP	jugular venous pressure
KPI	key performance indicator
LBBB	left bundle branch block
LMA	laryngeal mask airway
LP	lumbar puncture
LV	left ventricular
LVAD	left ventricular assist device
LVF	left ventricular failure
MAP	mean arterial pressure
MAS	meconium aspiration syndrome
MCAT	military critical care AME team
MET	medical emergency team
MI	myocardial infarction
MIMMS	Major Incident Medical Management and Support
MOET	major obstetric emergencies and trauma
MR	mitral regurgitation

MRI	magnetic resonance imaging
MS	mitral stenosis
MSL	meconium-stained liquor
MV	minute volume
NAI	non-accidental injury
NEB	nebulized
NEC	necrotizing enterocolitis
NETS	Newborn Emergency Transport Service
NG	nasogastric
NICE	National Institute for Health and Care Excellence
NICU	neonatal intensive care unit
NIV	non-invasive ventilation
NODESAT	nasal oxygen during efforts to secure a tube
NSTEMI	non-ST-elevated myocardial infarction
NTD	neural tube defects
NVG	night vision goggles
OA	oesophageal atresia
OHP	hydroxyprogesterone
OMF	originating medical facility
PA	pulmonary atresia
PAPR	powered air-purifying respirator
PCC	prothrombin complex concentrates
PCI	percutaneous coronary intervention
PCV	pressure controlled ventilation
PDA	persistent ductus arteriosus
PE	pulmonary embolus
PEA	pulseless electrical activity
PECC	patient evacuation coordination cell
PEEP	positive end-expiratory pressure
PETS	Paediatric Emergency Transport Service
PIP	peak inspiratory pressure
PO	by mouth; oral route (per os)
PPE	personal protective equipment
PPHN	persistent pulmonary hypertension
PPV	positive pressure ventilation
PR	per rectum
ProCESS	protocol-based care for early septic shock
PS	pulmonary stenosis
PSV	pressure support ventilation
PT	prothrombin time

RA	road ambulance
RASS	Richmond agitation–sedation scale
RCA	right coronary artery
RCC	red cell concentrate
RDS	respiratory distress syndrome
REBOA	resuscitative endovascular balloon occlusion of the aorta
REMS	rapid emergency medicine score
RFDS	Royal Flying Doctor Service
RMB	right main bronchus
ROSC	return of spontaneous circulation
RSI	rapid sequence intubation
RV	right ventricular
RW	rotary wing
SA	situational awareness
SAMU	Service d'Aide Médicale d'Urgence
SAR	search and rescue
SARS	severe adult respiratory distress syndrome
SCA	sickle cell anaemia
SCA	subcutaneous
SDH	subdural haemorrhage
SIADH	syndrome of inappropriate antidiuretic hormone secretion
SIMV	synchronized intermittent mandatory ventilation
SIRS	systemic inflammatory response syndrome
SoCP	scope of clinical practice
SOFA	sequential organ failure assessment
SOP	standard operating procedure
SpO_2	peripheral capillary oxygen saturation
STaR	safe transfer and retrieval
STEMI	ST-elevation myocardial infarction
SVT	supraventricular tachycardia
TAPVD	total anomalous pulmonary venous drainage
TBI	traumatic brain injury
TCPL	time cycled pressure limited
tds	ter die sumendum; three times a day
TGA	transposition of the great arteries
TIC	traumatic induced coagulopathy
TIMI	Thrombolysis In Myocardial Infarction
TOE	transoesophageal echocardiography
TOF	tracheoesophageal fistula
ToF	tetralogy of Fallot

TPN	total parenteral nutrition
TRM	team resource management
TTE	transthoracic echocardiography
TTN	transient tachypnoea of the newborn
TUC	time to useful consciousness
U&E	urea and electrolytes
UAC	umbilical artery catheter
USAR	urban search and rescue
UTC	coordinated universal time
UVC	umbilical vein catheter
V/Q	ventilation/perfusion
VCV	volume controlled ventilation
Vei	volume of gas at end of inspiration
VF	ventricular fibrillation
VFR	visual flight rules
VLCFA	very long-chain fatty acids
VSD	ventricular septal defect
Vt	tidal volume
VT	ventricular tachycardia
Vte	exhaled tidal volume
WBC	white blood cells

Chapter 1

Retrieval systems

Introduction to retrieval systems

Definition

The definition of retrieval varies by jurisdiction; however, it includes the inter-hospital transfer of critically ill patients using specialized clinical staff, transport platforms, and equipment. In many regions this definition extends to the prehospital environment when medical staff crewing is deployed, and in this setting it is termed primary retrieval. In various systems, staff may include doctors, nurses, advanced life support (ALS) paramedics, or intensive care paramedics (or equivalents) in a range of combinations or crew-mixes.

Principles

Retrieval generally involves the transfer of patients with critical illnesses or life-threatening injuries; 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 specialized 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.

Coordination

Retrieval is a coordinated process that provides specialized assessment and management prior to, and during the transfer of critically ill patients from situations where resources or services are inadequate, to a destination where definitive care can be provided.

Movement 'up the chain of care'

It aims to deliver the same or a 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.

Need for retrieval systems

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 recognized that there is often an urban/rural divide in regard to the accessibility of health care generally and to specialized critical care in particular.

Key clinical 'gap' areas exist at urban and rural and regional levels in regard to trauma, neurosurgery, cardiac, and neonatal and paediatric critical care. Advances in medicine and technology are inevitably (and at least initially) concentrated in major metropolitan centres, thus increasing the need for critical patient transport to major trauma centres and paediatric tertiary and quaternary care hospitals (e.g. for coronary percutaneous procedures and interventional radiology such as angio-embolization). Given that such divides exist, and that critical care transfer is inevitable, retrieval medicine aims to ensure the best quality of care in transfer. In the past, a somewhat ad hoc approach to irregular critical care transfers was the norm.

System standards

There are no universally accepted system designs or standards, and consequently services vary in their use of transport platforms and crew types (nurse, paramedic, doctor). Varying degrees of regulation exist in different parts of the world, and within countries marked heterogeneity is also seen.

Staff may be employed by a health department or ambulance service; or by a contract with a private provider; or a retrieval service may utilize hospital personnel. A state (or national) service may incorporate several retrieval service providers with central coordination; alternatively, 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 systematization and corporate and clinical governance aimed at a reduction in variation, greater accountability, and increased reliability at the system level.

Generic retrieval processes

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, algorithms, policies, guidelines, and standard operating procedures.

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 to have clear guidelines (both system and local) to encourage early referral and good decision-making.

Statewide/regional 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 specialized training and knowledge. Case coordination fundamentally answers: What are the needs of the referrer and their patient? Are the needs for clinical advice, for organization of transport and crew, or for assistance in obtaining an appropriate destination for a critically ill 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 organizations, 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 on case progress, estimated response times, and patient status changes. During the response and transfer phase the coordination centre maintains communication with response teams, providing logistic support and mission oversight.

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 the need for pressurization, the need for space for a specialized 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 the need to minimize the out-of-hospital time for the patient are considered.

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 the 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, 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 geography, road 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.

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 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 that in a retrieval setting, 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 inter-hospital 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 judgemental 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 a system overview of the capability and capacity of health services to receive victims. Retrieval staff must therefore be trained to expert status in this discipline.

Skill sets

Retrieval medicine and primary response aeromedical settings provide the most challenging of all clinical environments, and therefore choice of staff skill sets and professional team makeup is fundamental to optimizing 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 skill set of critical care trained nursing staff. Paramedic staff contribute 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 staff paired in various combinations and without a medical crewmember are appropriate for lower risk critical care transfers, or for non-critical care retrieval.

The skill set needs to match the requirements of the patient in the basic dimensions of clinical complexity and physiological stability, with 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 specialized clinical staff to the patient may be appropriate and should be considered, for example transporting an appropriately qualified surgeon to perform an infield amputation on a patient that is trapped.

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: a complete range of airway management equipment including a difficult airway kit; a 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 (medical professional crewing a retrieval mission) will also require access to antivenoms, thrombolytics, blood and blood products, and other specialized agents at times—systems must be in place to ensure timely access to uncommonly used pharmacological agents.

Models of service

Centralized systems

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

Decentralized models

In larger geographical zones, decentralized retrieval service models commonly exist. A central base may house core administrative and governance resources whilst peripheral bases focus more on service delivery and direct operations. Case coordination is usually central in such systems. Typically, peripheral arms see lower case volumes, though this is not always the case.

Various arrangements for staffing may exist such as central training models, staff secondments or rotations, and recruitment of peripheral medical staff from local hospitals.

A key challenge of hub-and-spoke models is the coordination of governance—although often operating remotely from management structures, it is imperative that clinical and corporate governance standards receive the same attention and achieve the same outcomes. Use of web conferencing or videoconference links is useful in driving closer inclusion of remote teams in educational and management activities.

Environmental drivers

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 services (such as the Helicopter Emergency Medical Service (HEMS), London); and systems driven by the tyranny of distance such as the Australian outback retrieval services.

Retrieval systems vary by State or region, and internationally.

Health system models as drivers

The existence of retrieval services is mandated by the necessity to move patients with particular healthcare needs from locations where those needs cannot be met, to a more suitable healthcare facility. The lack of appropriate health care in a particular location is not necessarily due to errors in planning or lack of funding. Often the issue relates to demographics (i.e. there are not enough people with a particular condition to justify the infrastructure and staffing to treat it). Modern medicine continues to subspecialize at a rapid pace and this compounds the problem. Medico-legally, it is now harder to defend doctors performing low numbers of risky medical interventions when an accessible and alternative centre performs many

more of the same procedures. Retrieval services serve as the 'link' between those centres. In many geographical locations, the route of referral from one centre to another follows a fixed pattern. These patterns are best illustrated with examples:

All patients with confirmed myocardial infarction are sent from Hospital A to Hospital Z, because Hospital Z has a fully staffed cardiac angiography suite. In this simple example, Hospital Z is the 'hub' and Hospital A is connected to it via a 'spoke'. This arrangement is reasonable even in isolation, but it becomes more recognizable when all the hospitals in the region send all their myocardial infarction patients to Hospital Z. Now there are multiple 'spokes' to the one 'hub' and the traditional 'wheel' of the hub-and-spoke model can be conceptualized. For critical care, this approach must factor in the underlying pathology and the recognized treatment timeframes. In other words, the 'wheel' cannot be so big and the spokes so long that transfer to the hub hospital ceases to be effective or useful. So for myocardial infarction patients, the recommended 'door to balloon' time is say 90 minutes. A 30-minute helicopter flight from the hub hospital is likely to be the maximum effective radius for primary percutaneous intervention. (30 minutes out; 30 minutes assessment, stabilization, and packaging; and 30 minutes return.) This means a 30-minute flight time from the hub forms the 'rim' of the wheel in the hub-and-spoke model. All smaller (or less specialized) healthcare facilities within that 30-minute flight time would be suitable locations for additional spokes in the wheel.

Often, smaller hub-and-spoke models form part of larger similar models leading to several potential transfers up through larger and larger hubs until definitive care is reached. Well-organized retrieval services with effective clinical coordination can ensure that smaller hubs are bypassed if need be, and patients can be delivered direct to definitive care (Fig. 1.1).

Due to modern transport platforms and infrastructure, this model has no tangible geographical limit. Depending on the medical condition, the hub-and-spoke model can be local, national, or international. For example, the hub for paediatric cardiac transplant might be in a capital city of a country with all the other cities connected via spokes. The hub for a particular super-specialized procedure may be the only centre in the world and therefore all other countries are connected to that hub by spokes. Retrieval services are frequently required in these situations, and the concept of timing for retrieval is also evolving. The old adage of 'too sick for transfer' is often redundant, and when the hub hospital is providing definitive care, the patient's only real chance is prompt retrieval. In fact, it is fair to say that the hub-and-spoke model has become successful only because of the increasing availability of competent, consistent, highly functional retrieval services.

Environmental drivers

In addition to demographics, the environment will affect the model of retrieval. Distance is usually the key factor and services will select different transport platforms to ensure the 'spokes' are kept within an acceptable range. Geographical obstacles will also contribute to the model, with water being the most common. Many island communities have little or no choice with healthcare provision and are dependent on accurate assessment and timely retrieval.

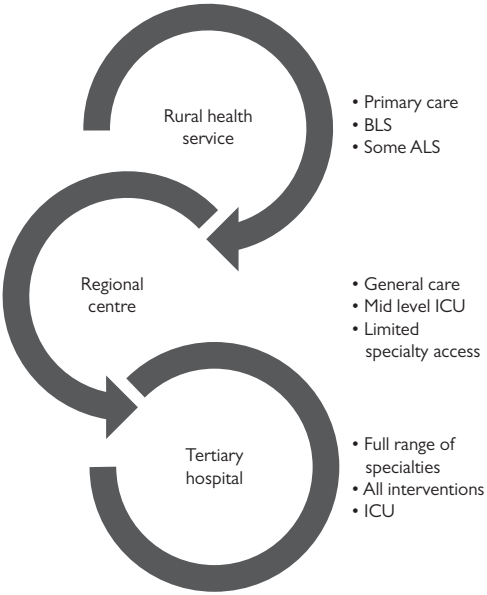

Fig. 1.1 Integrated health systems.
ALS: advanced life support; BLS: basic life support; ICU: intensive care unit.

Funding models

There is an enormous range of funding systems for retrieval services. Historically, many retrieval services, particularly rotary wing based services, were funded through community-based and benevolent funding. Corporate sponsorship has provided a component of such funds in many services and has both positive and negative implications.

It is clear, however, over time that there is a fundamental and ongoing need for securely-funded retrieval services. The impacts they achieve through improved patient care and the benefits they provide to health systems through their coordination, educational, and other roles are now widely recognized and valued. Consequently, most retrieval services now sit within other larger state health organizations and receive government funding.

Current paradigms include:

- A government funding stream is 'complete', that is the retrieval service has no other access to revenue and is essentially block grant funded. Such systems do not rely on charge outs to users, and are therefore free from financial disincentives to use retrieval services; however, they may also appear unconstrained to the user and therefore be accessed excessively.
- Government funding streams are partial, requiring copayment from customer health services. With copayments set at appropriate levels these systems are more balanced. Where retrieval services are integrated with ambulance services, this model is common, with transport costs (ambulance platform) charged at usual rates, and retrieval coordination, and staffing costs covered by government grants.
- Contribution from compensation or insurance sources—these complement other core systems by charging out costs where a patient-care episode may be 'compensable' by road users insurance, workers insurance schemes, or private health insurance schemes.
- Contribution from corporate sponsors and benevolent funders—such systems may augment or even dominantly fund retrieval services in some areas. These insecure funding streams, however, are common in less established sectors. Although potentially attractive from a government perspective, these systems are inherently insecure, aligned to drivers that are not purely health-provision related; such relationships may potentially lead to ethical challenges or conflicts.

Constrained systems

A common feature of most retrieval systems is fiscal constraint. It is a fact that few, if any, services are fully funded on an output or activity basis either through direct customer billing or through government funding, therefore decisions will always be required in regard to what 'cannot be done'.

Retrieval systems generally exist to close a health inequity divide, which is at least distance-based and may also be resource-based. Therefore, where constraint exists, explicit and strategic policy positions are required to focus resources to the needy in a cost effective manner (see 'Cost benefit vs cost effectiveness'). Need is most often driven by the lack of availability of local specialized clinical services—not every town can have a neurosurgeon,

interventional cardiologist, or intensive care unit. For most retrieval services, this type of need drives the business focus and defines the key service relationships, and has a rural weighting.

Retrieval services may have less need to support metropolitan health services due to the increased availability of transport resources and crew options in urban regions. Ideally these constraints should be managed by system design, to allow retrieval services to provide the highest level of care to all critical care patients in need of inter-hospital transfer.

Cost benefit vs cost effectiveness

In clinical systems, cost effectiveness often becomes confused with appropriateness (clinical, ethical, or social). Appropriateness is a cornerstone of quality management in clinical practice and is usually seen in a categorical way—an intervention is either appropriate or not at a clinical, ethical, or social policy level.

Cost effectiveness considers the expenditure against efficient completion of a required process.

Cost benefit analysis, however, acknowledges the reality of constrained systems and seeks to define the greatest benefit per cost across the system and often at points that are distant from the immediate intervention (downstream or flow-on benefits).

Given the inherent system focus of retrieval medicine, it makes sense that this benefit is pitched at the system level, so retrieval services will need to determine (with their communities and governors) how to ensure balance and objective evaluation of benefit. Should a service offer retrieval for beating-heart donor patients, which may mean a resource is not available to attend another patient? Should a service provide extracorporeal membrane oxygenation (ECMO) retrieval for patients who have had return of spontaneous circulation (ROSC) after prolonged cardiopulmonary resuscitation (CPR) or direct resource to night-time retrieval support for low-resourced health services? Such matters require mature consideration at a governance and policy level.

In terms of cost benefit analysis of retrieval practice per se, there are few if any studies that have the design or statistical power to address the question. Some work in trauma systems has demonstrated significant outcome impacts of retrieval systems in major trauma patients. Other studies demonstrate lack of excess mortality in the ICU-transferred retrieval population, demonstrating that retrieval systems may mitigate against the hostile environment and challenges of transfer in critical patients, and ensuring at least equivalent outcomes in this disadvantaged patient group.

In the absence of definitive evidence, evidence-based management would therefore revert to consideration of cohort studies as above, demographic studies, and expert consensus opinion—all of which support the cost benefit of retrieval systems.

Establishing or redesigning retrieval services

The establishment of a new retrieval service is not a common occurrence, however, it does occur from time to time. In comparison the redesign of retrieval systems is quite common. This can be due to a perceived need to substantially expand services, or a desire to address currently unmet need. Some retrieval services have slowly evolved from small local services or benevolent supported services and need to take that step into large organization and substantial system function. Some organizations are small scale and become merged with regional services or state services as part of a system overhaul.

In each of these circumstances, the process of design and implementation is quite similar and commences with a period of analysis, followed by design, then development of the new service, and finally implementation.

It is important to be clear from the outset about where the responsibility for such work lies and under whose jurisdiction the work comes; the scope of the work must be clearly stated.

Analysis

- **Establish scope:** Generally the sponsors of a redesign or service establishment project will be clear on the required scope and communicate this clearly. Often such a brief follows a period of limited review or the establishment of a degree of awareness about a service gap or significant problem. Scope must be explicit, limited, and contextualized.
- **Review of existing systems:** The starting point is review of existing systems or methods of patient transfer/retrieval. A comprehensive profile of activity levels, performance metrics, quality metrics, and an inventory of existing processes and structures is required.
- **Review of evidence:** Data is collated and analysed for trends, gaps, problems, and strengths. Financial performance is reviewed. Patient transfer patterns are reviewed.
- **Benchmarking:** Through collaboration with adjacent or similar jurisdictions, general patterns of retrieval activity can be established within the context of the health system operating across a region or state. Unless there are marked geographical differences, or distribution of health access is different, valid benchmarking of systems is possible and useful.
- **Identify stakeholders and consult:** The principal stakeholders for a retrieval service will always be the referral base, however, given the range of interfaces that all retrieval systems involve, a very broad stakeholder base should be expected. These players need to be actively involved in discussions and generation of system goals and service aspirations.
- **Consultation and communication strategy:** For the same reasons as required when identifying stakeholders, a communication and consultation strategy needs to be formally developed and followed. Investment of time and effort at this stage enriches the process, builds allies and enthusiasm, and lays the foundation for good relationships

in the future. These relationships and a shared vision, especially in regard to the service focus of the organization, ensure positive and constructive interactions during the difficult implementation and consolidation stages.

- **Define the unmet need:** Before moving into formal design work, currently unmet need must be clearly understood and documented. Where possible, competing needs should be prioritized to allow careful allocation of what will inevitably be a limited resource.

Design

- **Define the vision and mission of a new service:** A service needs to understand its goals and aspirations in terms of vision (based on values of the organization, humanistic, focused on future shape, and constant) and its mission (the way forward, actions-to-goals, dynamic, stakeholder-linked).
- **Draft service plan:** What is the range of services that can be delivered. At an early stage this may be aspirational and include options that may not be implemented. What evidence exists to support various clinical service options, and what are the driving needs of the community to be serviced.
- **Consider operational models:** To deliver the services considered in an early clinical service plan, what operational models need to be considered? What support structures, case management systems, clinical response options, and platform capabilities need to be established or modified?
- **Consider business models—free standing or embedded:** Should the retrieval service be a freestanding or independent entity or should it be embedded within a larger organization such as an ambulance service or hospital? This will largely depend on the size of the service at its potential for growth. Although attractive to embed within another organization to reduce infrastructure and support costs, it is important that such organizations understand the workforce, business, and process needs of retrieval—otherwise this advantage may be lost in inefficiency, rework, employee relations errors, contract mismanagement, etc. Any organization will always do its core work best.
- **Cost model options:** Once potential business and operational models are defined, a cost modelling exercise is required to define the most efficient option. Such options should always consider 5-year projected growth implications. For example 'fee-for-service' staffing models will grow in cost linearly with activity, whilst a salaried-staff, shift-based model allows relatively capped growth for activity expansion up to a plateau point. Similar considerations exist for capital, running, and support costs for retrieval platforms.
- **Complete service plan and communicate:** After completion of the planning options and models, a service plan can be decided upon and communicated to stakeholders.

Development

- **Document the governance framework:** The governance framework needs to be documented to the level that provides a framework for development of operational systems. It needs to be clear to a Board

(or equivalent management structure) and clear to potential external accreditors. This document defines the systems design, checks, and balances of the organization—it is the document against which an organization should be measured.

- **Document operational policy and procedure:** This document provides staff with the how and why of everyday operations. It defines the expectations and mechanisms of coordination, response, clinical care, and the activities that ensure the quality of these components such as audit, case review, and so on.
- **Develop implementation plan:** Standard project implementation development tools and processes are put in place to ensure appropriate oversight, resourcing, communication, stakeholder engagement, and contract management is applied to the implementation phase.
- **Project manage implementation:** The project of change or service implementation is activated and then monitored through its life by agreed reporting tools and interaction with a steering committee or project control group.
- **Role of the retrieval service director/leader:** The leader of a retrieval service is required to perform many disparate roles, and therefore needs to be an astute and perceptive leader, capable in governance processes, expert in clinical and logistic requirements, effective in managing relationships, broadly focused to ensure appreciation of stakeholder needs, sensitive to the needs of staff working in stressful environments, and politically savvy.

Implementation

- **Implementation steps:** In broad terms the implementation steps in the establishment of a new or significantly redesigned service will follow the implementation plan. Recruitment of appropriate staff to manage the implementation is vital, and at the outset establishing clear understanding, goals, milestones, and project-tracking systems are important. A project control group or committee is required and must contain leaders or 'influencers' from key infrastructure and support groups, and other key stakeholders.
- **Identify implementation milestones:** Implementation milestones are the markers that the developmental steps required are being taken. There is a need to focus on the short, medium, and long-term phases of a retrieval service's immediate development. Examples of such milestones are:
- Immediate
  - Ensure access to appropriate retrieval transport platforms;
  - Improving system governance;
  - Improving telecommunications;
  - Increasing management capacity; and
  - Improving critical care bed management.
- Within 12 months
  - Investigating improvement to regional services (e.g. hours and location);
  - Improving data capture and analysis;
  - Improving clinical governance arrangements;

  - Undertaking a statewide/regional education campaign;
  - Improving early activation arrangements.
- Within 3 years
  - Strengthening/expanding regional components of the retrieval service;
  - Expanding the service to more actively provide critical care advice and coordination statewide/regionally;
  - Improving telecommunication linkages; and
  - Introducing dedicated retrieval platforms (either air or road).

Medical director milestones

To achieve these milestones, a service director, or manager will be required to implement structured change over defined time periods. Short-term goals for a new director or a manager in a new retrieval service are:

- Develop new clinical governance framework.
- Establish clinical key performance indicators (KPIs) and contribute to establishment of core system metrics.
- Establish relationships with each regional service (corporate and clinical) and establish the change agenda.
- Initiate with the system peak governance body (state or regional government health department) a process of consultation to develop and improve systems for optimized bed access and destination determination for retrieval patients.
- Completion of a gap analysis and risk assessment.
- Identify and manage risk (including resistance). A risk register and issues management process should be implemented as for any significant project. As is usual, risk must be viewed from the perspective of both significance of impact and likelihood, and appropriate mitigation strategies developed.
- Review and adjustment. As a component of project evaluation, formative evaluation should take place during an implementation or change. Formative evaluation is any evaluation that takes place before or during a project's implementation with the aim of improving the project's design and performance. This is of particular value where complex systems that intersect with multiple stakeholders are concerned. Retrieval systems interface with many components of the health system, so design and build strategies are challenging and complicated. Mid-change or formative evaluation will inform this process and increase the likelihood of success.
- Consolidation of a major development project like this in a clinical sphere of activity depends on striking the correct balance (and maintaining that balance) between corporate and clinical governance and efficiency. Getting this balance right ensures that all stakeholders, from patients to the corporate chief executive officer (CEO), and from referral staff to receiving hospitals are satisfied, and that staff work within a supportive and fulfilling environment. At an appropriate time, perhaps with project evaluation, a careful 'maintenance strategy' is required to ensure that this balance is deliberately assessed on a periodic basis. It is easy and common for service and clinical pressures to run away with the attention of a system, and similarly it is quite possible for corporate or political agendas to become an overriding focus and to each distract from the value and importance of the other.

International systems

Many models of retrieval operate throughout the world. Types of services range from prehospital primary retrieval to international repatriation. Staffing models and medical skills provided are varied. Examples include Europe, Australasia, UK, North America, South Africa, and Hong Kong.

Europe

SAMU (Service d'Aide Médicale d'Urgence) operate retrieval services in **France**. Doctors based in ambulance control provide advice to paramedics as well as optimizing dispatch of specialist resources and direct transfer to definitive care. Doctor, nurse, and paramedic teams perform primary and secondary retrievals from specially equipped, mobile intensive care units or land ambulances and rotary aircraft.

A number of retrieval services operate from hospitals in **Sweden**. The Airborne Intensive Care service runs out of Uppsala University Hospital. This is a physician and nurse delivered service providing adult, paediatric, and neonatal inter-hospital transfer as well as prehospital critical care. Road, rotary, and fixed wing assets are utilized for around 800 missions per year. The service is also capable of ECMO retrieval. Specialist nurses are involved in neonatal missions.

The **Norwegian** government maintains an extensive aeromedical and search and rescue service. Twelve helicopters and nine planes are in operation. Crews include senior doctors. As in Sweden, all doctors are anaesthetists, or intensivists. The same teams undertake primary and secondary retrieval including neonatal missions.

REGA is the **Swiss** air rescue service. It is a private, not-for-profit organization paid for by donations by private individuals. Uniquely, members of the public can request helicopter assistance directly. All aircraft are crewed by a doctor and paramedic team. For technical rescue missions the crew includes a specialist rescue technician. REGA operate around 20 rotary and fixed wing platforms.

Germany aims to have a medical helicopter at any location in the country within 15 minutes. Approximately 100 air ambulances are operated by three services including ADAC (German automobile association), DRF (German Air Rescue), and the Ministry of the Interior.

Australasia

The not-for profit Royal Flying Doctor service (RFDS) in **Australia** has been in operation for around 90 years and is known internationally. The service has 21 bases and operates 61 fixed wing aircraft. The service provides both contracted services to state organizations and independent services.

RFDS, and most of the retrieval services under state auspices, provide aeromedical transfer, telehealth, and outreach support to remote communities in a country where travel distances are huge.

Critical care primary and secondary retrieval are provided by state government services. These services include Adult Retrieval Victoria (ARV) www.ambulance.vic.gov.au/Main-home/Arv.html; MedSTAR in South Australia; Queensland Retrieval Service; NSW Medical Retrieval Unit (and Greater Sydney Area HEMS); and the Tasmanian Retrieval Service. Each

service has fixed wing, rotary wing, and road response elements and integrates with the local ambulance system. Specialized paediatric and neonatal critical care retrieval is undertaken by PETS (Paediatric Emergency Transport Service) and NETS (Newborn Emergency Transport Service) teams in each state. The integration of these services with adult services varies from state to state with a clear long-term trend towards integrated, flexible systems.

Crew configuration may be a critical care doctor, and a critical care or flight (ALS) paramedic or nurse depending on case needs. Some services incorporate special access and rescue paramedics.

Systems for retrieval coordination are particularly well developed in Australia. These generally involve senior retrieval specialist doctors working on-shift in dedicated coordination and clinical advice duties.

A number of services operate rescue and air ambulance helicopters in **New Zealand**. These are predominantly dual paramedic crewed not-for-profit organizations. The Westpak Auckland service operates a doctor and paramedic model for prehospital care, secondary retrieval, and search and rescue.

United Kingdom

In the **United Kingdom** approximately 36 air ambulances are in operation. The great majority are charitably funded services providing daylight helicopter primary retrieval. Crew skill mix varies. Approximately half of services provide a dual paramedic medical team with the remainder comprising a doctor and paramedic. The busiest service is London's Air Ambulance, www.londonsairambulance.co.uk who are highly regarded as leaders in terms of critical care delivery, governance, and research. A number of paediatric and neonatal services operate throughout the UK providing predominantly land-based secondary retrieval. Retrieval services exist in various counties, including Kent, Surrey, Sussex, and Cambridgeshire (MAGPAS).

In Scotland the Emergency Medical Retrieval Service www.emrs.scot.nhs.uk is a government-funded service which provides paediatric and adult primary and secondary retrieval in Scotland.

Northern Ireland operates land-based retrieval teams for adults (NI critical care ambulance transfer service), children, and neonates (child or neonate needing emergency critical care transport). There is no air ambulance service in Northern Ireland. Secondary air transfers to mainland UK from Northern Ireland are carried out by a commercial provider.

North America

Aeromedical retrieval activity is considerable in the **United States**. The Association of Air Medical Services describes 1000 air ambulances in operation that undertake over half a million missions per year. Half of the missions flown are inter-facility transfers with the rest primary scene missions and transfer related to organ retrieval.

US retrieval services are a mix of private companies and not-for-profit organizations.

A number of organizations provide fixed and rotary wing retrieval in **Canada**. Most are funded by the government.

The majority of services operating in North America are crewed by nurses and paramedics rather than physicians.

South Africa

The South African Red Cross Air Mercy Service is a not-for-profit organization which operates five helicopters and two fixed wing aircraft in cooperation with the Department of Health. The service is staffed by medical volunteers. These aircraft undertake primary missions and secondary transfers, as well as mountain and surf rescue operations. Inter-hospital critical care transfers are frequently carried out by intensive care level paramedics. Retrieval in South Africa is supplemented by two private air ambulance providers: Netcare 911 and ER24.

Hong Kong

The aeromedical retrieval and search and rescue service in Hong Kong is operated by the Government Flying Service. Six helicopters and two planes are operated. The aircraft also complete law enforcement and fire-fighting roles. The service is government funded. The standard crew is trained to emergency medical technician level. On certain days of the week doctors and nurses join the team on a voluntary basis. All crew are winch trained. Each year, 1400 secondary retrievals and 400 search and rescue missions are flown.

Chapter 2

Governance

Clinical governance

The importance of clinical governance

Clinical governance is the system by which the governing body, managers, and clinicians share responsibility and are held accountable for patient care, minimizing the risks to the consumer, and for continuously monitoring and improving the quality of clinical care. The goals of such systems are to:

- Build a culture of trust and honesty;
- Foster organizational commitment to continuous improvement;
- Establish rigorous monitoring, reporting, and response systems;
- Evaluate and respond to key aspects of organizational performance.

The Bristol Inquiry (2001, UK) and the Douglas Inquiry into obstetric and gynaecological services at the King Edward Memorial Hospital (2001, Australia) clearly demonstrate the importance of the active involvement of the health system's board of directors (or the peak management body) in the governance of clinical safety and quality.

In these cases, the board of directors and senior management failed to respond to important safety and quality issues, and patients and families experienced serious and avoidable adverse events.

Both cases revealed evidence of:

- A closed culture unsupportive of openly disclosing errors and adverse events;
- Failure by management to respond effectively to known clinical problems;
- Non-existent or ineffective systems to monitor, report, and respond to performance problems, errors, and adverse events;
- Poor communication with patients and families, particularly when things went wrong;
- Poor management of complaints and potential medical negligence cases;
- Inadequate training and credentialing to ensure clinicians were sufficiently skilled;
- Inadequate morbidity and mortality monitoring and review systems;
- Poor clinical and emotional outcomes for patients and families.

From these cases and from the progressive maturation of governance systems in health care, principles of clinical and corporate governance have arisen that are validly applied to retrieval systems. These include the establishment of clearly documented and active systems.

The Board or Governance Committee

The range of potential structures that a retrieval service may report to in the context of clinical governance is varied. These structures will be jurisdiction specific, and may for instance include the Medical Standards Committee within an ambulance service; the Quality and Clinical Improvement Board Committee for the Board of an independent service; or perhaps a Divisional Clinical Management Committee within a hospital-based system. Importantly, such a body must carry appropriate designated authority; have direct board access; and be qualified to provide advice and support for the retrieval service. A body that is inadequately qualified, cannot provide an

arbitration point for the retrieval service, cannot provide informed advice, and is unable to critique performance of the service adequately.

The role of this committee is quite diverse. It fundamentally is a checkpoint to ensure all necessary structures and processes are in place and functioning well. With these in place, the quality of outcomes is likely to be satisfactory (and will be monitored). The Board will ensure that the culture and direction (vision and mission) of the service will be aligned with the organization, and that staff will be credentialed, working within the scope of practice, and be part of an active performance management or development programme. Medication, clinical protocols and practices, research, and ethics will all receive oversight from this group. The board, or equivalent, is not an operational entity; its role is to check, guide, align, and support management to operationalize these governance features.

Retrieval service director

Each service must be under the proper direction and governance of a medical director who must be a suitably qualified medical practitioner. The medical director must have an executive position in the organization structure, with major input into formulating and updating the organization's clinical governance structures and processes.

The director must be registered in the state(s) in which their service operates and be experienced and credentialed in the type of care the service provides.

If the service is a critical care organization, the director must have recognized specialist qualifications, credentialing, and certified scope of practice (or certificate of completion of training (CCT)) in emergency medicine, anaesthesia, or intensive care.

The director must have direct clinical involvement with the service.

Duties and responsibilities of the director

These include:

- Recruitment of staff and management of succession and staff development.
- Coordination and responsibility for a teaching programme.
- Setting up an ongoing review of medical guidelines and protocols for patient care.
- Organization and implementation of the quality management programme.
- Selection of appropriate medical equipment.
- Overall responsibility for the licensing, proper storage, and written accountability of scheduled drugs including narcotics.
- Documentation of standard procedures, guidelines, policies, protocols, or algorithms for case coordination and clinical care provision.

Guidelines for retrieval clinicians

Clinical guidelines provide an essential support for retrieval clinicians who often operate in hostile environments with minimal support, and with the most challenging patients. Having said that, all retrieval services operate within a geographical clinical zone, and clinical practice in retrieval should reflect this system. There is little point in exhaustive development of

textbook level retrieval clinical guidelines when the fundamentals already exist within a jurisdiction or in the wealth of published (and maintained) evidence-based guideline material that is available.

It is strongly recommended that where possible, retrieval services link their core guidelines to standard and non-contentious sources (e.g. national bodies)—they work as an interface between hospitals in the system—adoption of the recommendations of a peak body (governing body) is in effect a neutral but system-supporting position. In addition, most retrieval services do not have the academic and institutional resources of large hospitals; so maintenance of in-house developed, evidence-based guidelines (requiring revision, monitoring of publications and literature, etc.) is often beyond their capability. Peak bodies (governing bodies) are resourced to do this work and to provide this material to the broader clinical community.

Practical guidelines for retrieval clinical and coordination staff take several forms.

Standard operating procedure (SOP)

These documents are designed to explain 'how the system works' at a practical level. They describe procedures, and may relate to any and all processes, including call taking, documentation completion, coordination decision-making, safety practices, manual handling, and communication processes. SOPs drive safety and standardization in high-risk settings, and ensure that things happen the way they should—variation is reduced, staff can anticipate next steps.

Medical staff frequently struggle with perceived restrictions in SOPs due to the culture of the profession, the 'art of medicine', and the usual autonomy of the doctor; however, this reality must be managed during induction to a retrieval service, and early learning must establish a commitment in all staff to the value of standardization to safety.

Clinical practice guidelines (CPGs)

CPGs should take known standard clinical practices and describe the way that they will be applied within a specific clinical service. These practices may be diagnostic (e.g. use of ultrasound), therapeutic (e.g. use of blood products) or interventional (e.g. method used for rapid sequence intubation (RSI)). They will describe any restrictions by professional group or designation, and may also describe methods for audit and compliance checking, as well as outcome measurement.

In retrieval, CPGs should also include consideration and guidance in regard to the specific environmental application of a practice element and any additional risk. This contextualization of clinical practice to the retrieval and transfer setting is important in the transition of the medical practitioner to become a retrieval expert. Medical staff working in retrieval should be senior and clinically capable—therefore guidelines should not aim to 'teach medicine', but to convey the environment of this practice and to bridge the gaps between standard hospital practice and the transport and prehospital settings.

Checklists

Use of checklists in high-risk clinical settings has become routine. These should be developed and made available to retrieval staff and must cover

a range of activities from routine daily kit checks to a checklist for trouble shooting a ventilator failure in flight.

In addition to application in the field, checklists may be of value for case coordinators when providing clinical advice during a case. This will ensure consistent advice in unusual circumstances; for example, management of a failed intubation in a remote rural setting, by phone, with a paramedic and GP at the referral point. Such checklists can be accommodated within case coordination IT systems, providing both prompts for the coordinator and a mechanism for documenting advice provided.

Electronic decision support

Both coordination and retrieval response can now be supported by quite sophisticated clinical information systems that provide electronic decision support in real time during a case. This will be detailed in the following section on IT systems and data; however, an example may include automatic activation of a live guideline link once a clinician selects a principal problem or diagnosis for the patient.

Policy

Policy sets the agenda for operational staff by defining what the organization expects to happen or not happen, in terms of an action occurring or not. ('Procedures' on the other hand describe how things should happen.) Policy is often therefore pitched at an organization or system level rather than at a patient level.

Support staff guidelines

Standard processes for case referral, call taking, trouble shooting, escalation, incident reporting, and documentation enable support staff to meet the challenges of the often pressured retrieval service environment. Well-documented and accessible guidelines, manuals, and SOPs should be available to support staff.

Equipment management systems

Standardized kits, supported by uniform checking and stocking systems, as well as appropriate regular biomedical engineering support ensures reliability of kits and equipment. Retrieval staff must feel confident that every kit and every piece of equipment taken on a mission is complete and in top working order. Kits should be checked on a daily basis and sealed when complete, to be available for subsequent use. Drugs of addiction are normally stored separately according to local regulation and are then added to a kit prior to departure.

Special kit items may be added according to specific case needs, however, kits should be as generic as possible.

A comprehensive biomedical engineering service and schedule of equipment maintenance is important to ensure all remains functional and reliable. Scheduled equipment replacement and hardware 'refresh' programmes are needed.

New equipment should be introduced to a service after a defined process of assessment and evaluation and after completion of a procurement and purchasing process.

Occupational health and safety

The retrieval environment provides increased exposure to health and safety risk, and formal policies and procedures are required to minimize impacts. Most jurisdictions will apply specific regulated approaches to the management of:

- Hazardous materials;
- Manual handling and lifting;
- Fatigue management;
- Infection prevention;
- Protective apparel; and
- Training and reporting of incidents.

In addition, the management of staff well-being through psychological support strategies, crisis intervention systems after critical event exposure, and general wellness and health promotion are important components of retrieval practice.

Human resources

Credentialing

Effective clinical governance of retrieval services should include practitioner credentialing and the specific definition of the practitioners' scope of clinical practice (SoCP). A defined process should verify that each clinician working for a retrieval service only provides clinical services for which they have demonstrated competence.

Competency is the combination of skills, knowledge, attitudes, values, and abilities that support an acceptable safe and quality practice and effective performance in the practitioner's retrieval service role.

Credentialing and defining a SoCP for practitioners practicing with a retrieval service protects:

- Patients, by ensuring services, and treatments are provided by competent, qualified, and skilled practitioners suitably equipped to deliver safe and quality care.
- Practitioners, by ensuring that they take responsibility only for services and treatments for which they are skilled and experienced to perform in the retrieval environment.
- The retrieval services, government, and the community from unnecessary human cost and financial losses.

Credentialing for retrieval services can be defined as the formal process to verify the qualifications, experience, professional standing, and other relevant professional attributes of practitioners for the purposes of forming a view about their competence, performance, and professional suitability to provide safe, quality clinical services within a specific retrieval organizational environment.

The process should be standardized, auditable, and supported by a transparent policy or guideline specific to the retrieval service. There is an overarching responsibility on those involved in the process of credentialing to act with due care and diligence, and to ensure procedural fairness at all times.

Scope of clinical practice

Defining the retrieval practitioners' SoCP directly follows on from credentialing and involves delineating the extent of an individual practitioner's clinical practice within the retrieval environment. This definition is based on the individual's credentials, competence, performance and professional suitability, and the needs, capability, and capacity of the retrieval service to support the practitioners' SoCP.

Process for credentialing and determining a SoCP

A prime requirement of a robust credentialing and SoCP process is establishing and managing an appropriately-convened retrieval service credential committee or group, with an identified decision maker. The membership will be dependent on the size of the retrieval service.

The principles of procedural fairness, transparency, and accountability should underpin the process of assessment of credentials and delineation of SoCP. Conflicts of interest should be appropriately managed.

The committee or group considering applications should examine the following, as a minimum, in making their determinations:

- Verification of the practitioners' registration status with their national or state authority.
- Current curriculum vitae and verification of identity.
- Evidence of any mandatory qualifications and the training, experience, and skills required for the appointed position.
- Documented evidence of participation in relevant professional development activities.
- Professional references.
- The processes should be consistent with any local, regional, state, or national healthcare standards and requirements for credentialing.

Retrieval medicine specific considerations

Medical specialist training in a critical care specialty is a highly desirable prerequisite. In addition, all staff must demonstrate specific training and skills relating to the retrieval environment, clinical care in transport settings, and personal and crew behaviours.

Given the diverse professional backgrounds of those medical practitioners currently participating in the prehospital and retrieval medicine arena worldwide, each retrieval service should be highly specific in its definitions and requirements for credentialing and conferring a SoCP. Tiered definitions reflecting experiential and competency-based criteria should articulate the various skill levels and subsets within retrieval medical practice (e.g. prehospital and retrieval medicine, paediatric retrieval medicine) until specific postgraduate vocational training programmes are developed.

Recruitment

Most retrieval services recruit at two levels, registrar (advanced trainee in a critical care discipline) or consultant (specialist trained medical practitioner). Both groups require induction and appropriate retrieval training before formally being credentialed as a retrieval clinician. In general, the base description of the retrieval registrar is that they are selected as a very competent, senior/advanced trainee in a critical care discipline, who typically is highly motivated and is able to operate with high levels of autonomy (though

they are comprehensively supported). Retrieval consultants are selected as highly competent specialists in a critical care discipline, who often have pre-existing experience in retrieval and transport medicine, and who typically are highly motivated and are able to operate with high levels of autonomy, have excellent leadership and communication skills, and are able to manage complex challenging environments—both clinical and logistic. They are diplomatic, calm, and understand how to support staff who may be working at the edge of their physical and cognitive capability.

Many services also employ paramedic and nursing staff. Staff from these disciplines are required to be high performing, extremely competent individuals with appropriate clinical qualifications and credentialing. Individual jurisdictions will determine the degree of clinical independence of these clinical staff, depending on jurisdictional regulation, and organizational policy regarding control and scope of autonomous practice.

Processes of recruitment are generally driven by local jurisdictional policy and industrial relations/employment regulation. A common sequence is:

- Approval of a business case to employ staff/increase staff.
- Development of a position (role) description which includes explicit, key selection criteria.
- Advertisement of the position for an appropriate period.
- Receipt of applications in which candidates are required to provide a covering letter 'stating their case' and motivations; a statement addressing key selection criteria; and a curriculum vitae.
- Shortlisting by an expert and balanced selection committee.
- Interview using structured and consistent methods which may include both behavioural and theoretical questioning.
- Formal assessment of interview performance by a balanced, expert selection committee.
- Psychometric testing may be considered.
- Review of professional references.
- Review of base level credentialing compliance (qualifications, declarations of good standing, insurance compliance, identification verification, registration compliance).
- Preparation of contract and appointment conditions.

Professional development

Retrieval services recognize the value of the learning organization and of evidence-based practice. They therefore will establish systems to support continuing education, knowledge currency and transfer, and skills maintenance. Retrieval practitioners must remain compliant with regulated continuing medical education (CME) standards and with organizational requirements that may be a component of contracts. It is unacceptable for any clinician to be active in a retrieval service if they are not active participants in an annual CME programme.

The minimum standards for such a programme include:

- Participation in case review and audit programmes.
- Completion of a predetermined number of retrieval missions.
- Maintenance of skills as demonstrated through peer review and observation, or participation in supervised skills-based simulation scenarios.

- Compliance with platform awareness and safety training schedules.
- Maintenance of clinical knowledge currency through access to appropriate academic educational sources.
- Completion of an annual plan for professional development and skills maintenance.

Performance management

Retrieval services should implement a performance management system that includes continuous feedback, and an annual review of performance and credentials for each practitioner and staff member. This is consistent with standard governance systems. Nursing, paramedic, trainee, or registrar supervision and performance management follows standard training college or industrial systems and requirements.

Performance management is a process for establishing a shared workforce understanding about what is to be achieved at an organizational level. It is about aligning the organizational objectives with the employees' agreed measures, skills, competency requirements, development plans, and the delivery of results.

The goals of a system of performance management are to:

- Ensure that employees understand their role in working towards the goals and objectives of the retrieval service.
- Ensure that employees have the skills and resources they need to do what is expected of them.
- Promote regular feedback and discussion about contribution and professional development.
- Recognize and encourage continued optimal performance.
- Ensure effective people management processes and supportive working environments.

A retrieval service must have a performance management system that includes continuous feedback, and at least a biannual formal review of performance and annual review of credentials, registration, and qualifications. This is consistent with most standard government and health sector policy and systems.

The practical basis of performance management requires observation and monitoring through numerous mechanisms that may include:

- Observed clinical practice (e.g. peer 'buddy' missions).
- Incident reporting and review programmes.
- Completion of reflective case reports.
- Review of clinical records and recordings through audit systems.
- Evidence of contribution to required service functions.
- Maintenance of log books and records of case profiles.
- Video recording of cases for subsequent review.
- Documented compliance with credentialing requirements.

Quality improvement

Indicator measurement

An indicator is a quantitative performance measure that produces data on a given area selected for quality assessment and improvement. The reliability and validity of an indicator determine its usefulness. Indicators are

not direct measures of quality, but are simply screening measures to review performance and highlight areas for investigation or improvement.

Indicator threshold points act as a focal or flagging trigger for the indicators to which they are assigned. Indicator measurement should occur within a clear reporting interval and link to an agreed system for subsequent implementation and monitoring of improvement.

Indicators of basic or key functional areas are continuously monitored. They may be intermittently augmented by focused survey of other areas of activity. Such focused surveys initiate an assessment, review, improve, and reassess cycle. The impetus for such focused surveys may be problem or issue identification, or they may be part of a cyclical plan.

Table 2.1 is an example of a consolidated and focused indicator suite intended for use by multiple retrieval services for benchmarking and comparison; again it is not exhaustive but is intended to be representative of key markers of quality and performance.

Clinical documentation

As in all clinical settings, documentation is required to be of a high standard. Retrieval medicine fundamentally operates at the intersection of different levels and locations of care. Communication from the referrer needs to be captured, assessment and care by the retrieval service must be documented, and the handover process must be recorded such that a progression of care and communication is clearly detailed.

The principles of retrieval case documentation are that it be contemporaneous; comprehensive regarding assessment, intervention, and risk; and provided in copy at the time of transition of care to another practitioner. Clinical documentation tools and forms require careful design to drive comprehensive and effective information recording for retrieval coordination and clinical response. See examples in Figs 2.1–2.4.

For the purposes of quality management, documentation and data collection must be continuously reviewed through audit or other data checking mechanisms (e.g. electronic data quality and edit check systems). The results of reviews can be reported organizationally and also as feedback to individuals.

For further information on data collection in manual and electronic systems see ➔ Data and information management, pp. 50–3, in this chapter.

Case follow-up and feedback

Feedback in retrieval medicine is particularly important in closing loops. If one considers the retrieval patient journey as almost circular, it commences with the referring hospital, transitions via a retrieval service, moves on to a receiving (often tertiary) hospital, and is completed by the return to community for the patient. Each arm of this care is isolated from each other, and there is little natural flow of information between these services. Retrieval systems are well positioned to implement 'multidirectional feedback'.

The retrieval service should ideally follow-up on all patients transferred within 24 hours. Information such as final diagnosis can be checked against retrieval diagnosis (or identified problem list), and feedback can be sought about the stability of the patient after retrieval, and about the

Table 2.1 A consolidated and focused indicator suite intended for use by multiple retrieval services for benchmarking and comparison. Key performance indicators (KPIs)

Indicator	Definition	Rationale
Total cases	Number of cases referred to the service for any reason (clinical advice, bed access, primary response, retrieval, major trauma transfer, etc.)	Measure of case activity
Primary medical response	Number of prehospital primary response cases crewed by retrieval service medical staff	Measure of primary response case activity
Medical retrievals	Number of inter-hospital transfers crewed by retrieval service medical staff	Measure of coordinated, medical escorted inter-hospital transfer
Activation time for time-critical cases	Time of beginning of initial call to time crew tasked, for category 1 cases. Reported per platform (rotary, fixed wing, road)	Measure of activation time (responsiveness) for the highest urgency cases
Mobilization time for time-critical cases	Time from crew tasked to doors closed, for category 1 cases. Reported per platform (rotary, fixed wing, road)	Measure of mobilization time (responsiveness) for the highest urgency cases
Appropriate skill set available at tasking time	The proportion of category 1 cases where the desired skill set is available for tasking	Matching of skill set to clinical need of the patient reflects optimal resourcing and coordination practice
Airway intervention in transit	Cases where ETT, LMA, or surgical airway placement occurs in transit between the primary site and destination	Anticipation of airway intervention requirements is a key indicator of maturity of educational, training, and quality practices in retrieval medicine
Temperature monitoring	Temperature is monitored (more than one reading) during retrieval of an invasively ventilated patient	Monitoring of temperature reflects whole patient focus in the critical care setting. Temperature maintenance relates to clinical outcomes in many case types
Intubation at first pass	The completion of endotracheal intubation at first laryngoscopy and attempt at tube placement	Training, preparation, and skill capability is reflected in first pass rates, which are also associated with the risk of airway and ventilation complications and failed airway scenarios
Maintenance of appropriate $EtCO_2$	$EtCO_2$ is within a defined range on arrival at the destination hospital in intubated trauma patients (primary response and IHT)	Reflects optimized ventilation and perfusion status in trauma patients with trauma. A proportion of neurotrauma patients will have therapeutic hyperventilation

$EtCO_2$: end-tidal CO_2; ETT: endotracheal tube; IHT: inter-hospital transfer; LMA: laryngeal mask airway.

Adult Retrieval Victoria
ARV
Coordinators of Critical Care Services

PATIENT RECORD
1300 36 86 61

Entered Database: RASO ☐ Coordinator ☐
Patient Follow Up: ☐ Clinical Review: ☐
VACIS Entered: ☐ Director Review: ☐
Times Entered: ☐ Final Check: ☐

☐ DEFINED PATIENT ☐ NEURO DEFINED PATIENT ☐ PUBLIC TO PRIVATE ☐ VIDEOCONFERENCE

PATIENT SURNAME | PATIENT ADDRESS: | ARV ID

PATIENT FIRST NAME | VACIS ID

Date:	Time:				Principal Problem:
RASO:	Coordinator:				
Referring Hospital:					Clinical History:
Referring Person:					
Referrer Position:	Cons	GP	Reg	HMO	
	Nurse	DTM	Metro Clinician	Rural Clinician	
	Flight Coord	Para	Other:		
Referrer Unit:	ED	ICU	CCU	Ward	
	OR	Other:			
Contact Number 1:					
Contact Number 2:					
Gender:	Male	Female			
Age:	Date of Birth:				
Insurance Type:	None	Work Cover	DVA Gold		
	TAC	Full Private			
Arrival Date:	Arrival Time:				
Next of Kin Aware:	Yes	No			
Reason for Transfer:	ICU / HDU / CCU / Ward bed unavailable				
Specialised Services Required	Major Trauma				
ECMO Transfer	Appropriate Staff unavailable				
Other:					

(The below questions should only be asked between the hours of 0000 and 0800)		
Are you only looking for a Critical Care Bed?	Yes	No
Do you require assistance with the retrieval of a patient?	Yes	No
Do you require advice regarding the clinical management of a patient?	Yes	No

Coordinator Contact Initiated:	
Coordinator Contact Time:	
Reason Coordinator Contact Time > 15mins:	

Infectious Risk:	No	
	Yes	Details:
Patient has ID wrist band:	Yes	If "NO" RASO request

Past History:	Previous Medications:
Allergies:	

Fig. 2.1 ARV Coordinator patient record 1.
Reproduced with permission from Adult Retrieval Victoria.

Patient's Approx Weight: If pt's weight is over 110kgs please include the following (cm) -	Height:	Waist:	Patient Width: 

Observations:

Current:				Worst in last 4hrs:		Interventions / Supports:							
HR		Rhythm		HR		IV	x 1	x 2	FiO_2		O/NGT		
BP	/	CVP		BP	/	ETT	Size	Lip length	TV		IDC		
MAP		$ETCO_2$		MAP		Laryngoscopic Gd:		1 2 3 4	Rate		Drains		
Resp Rate		O_2 R_x		Resp Rate		Intubation difficulty?			PEEP		ICC		
SpO_2		Temp		SpO_2		CVC / site / date			PIP		CXR		
GCS				GCS		Art. Line / site / date			NIV		Cx Collar		

Investigations: (include date/time)

pH		PO_2		pCO_2		HCO_3		BE	
pH		PO_2		pCO_2		HCO_3		BE	
Hb		WCC		Plat		CRP		Lactate	
Na		K		Urea		Creatinine		eGFR	
Cl		Bic		Ca		Mg		PO_4	
Trop 1		Trop 2		APTT		INR		Gluc	

ECG / Imaging:	Fluids:	Drugs/Infusions:
	Urine Output:	**Inotropes:**

Complexity:	Low	Medium	High	**Notes:**
Stability:	Stable	Previously unstable within the last 4hrs	Unstable	
Urgency:	Acute (less than 90mins)		Non Acute (less than 4hrs)	
	Scheduled (planned	Time Critical (Immediate)	Transfer Not Required	

Retrieval Team:				
Consultant	Regional Consultant	Registrar	Regional Registrar	Flight MICA
Flight Paramedic	Metro MICA	Regional MICA	Metro Paramedic	Regional Paramedic

Retrieval Doctor:					
Responding ARV Service:	Metro	Geelong			
Principal Transport Platform:					
Fixed Wing	HEMS 1	HEMS 2	HEMS 3	HEMS 4	HEMS 5
HATS	Metro CPAV	Metro Emerg	Rural CPAV	Rural Emerg	

Destination Arranged By:	Referring Hospital	ARV
Destination Hospital:		
Destination Unit:		
Destination Doctor:		**Coordinator's Signature:**

Fig. 2.2 ARV Coordinator patient record 2.

Reproduced with permission from Adult Retrieval Victoria.

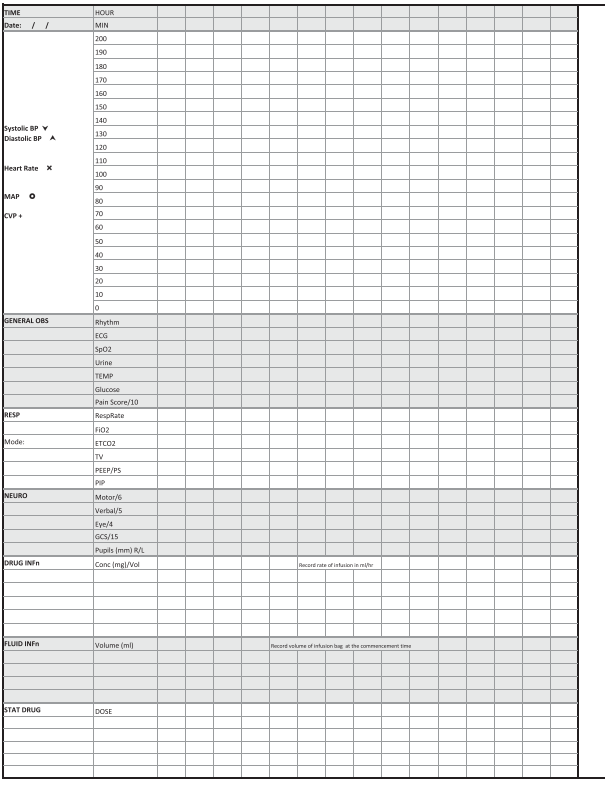

Fig. 2.3 ARV Retrieval physician record 1.

Reproduced with permission from Adult Retrieval Victoria.

appropriateness and effectiveness of retrieval care. This information can be transferred to a referrer by phone or email, and this interaction can also be an opportunity for the retrieval service to provide feedback to the referrer regarding pre-retrieval care and patient preparation for care. When performed in a quality improvement culture, such interactions close loops, provide education, and build important relationships.

Feedback systems are ideally supported by smart IT systems, which automate, and support clinician case follow-up and feedback.

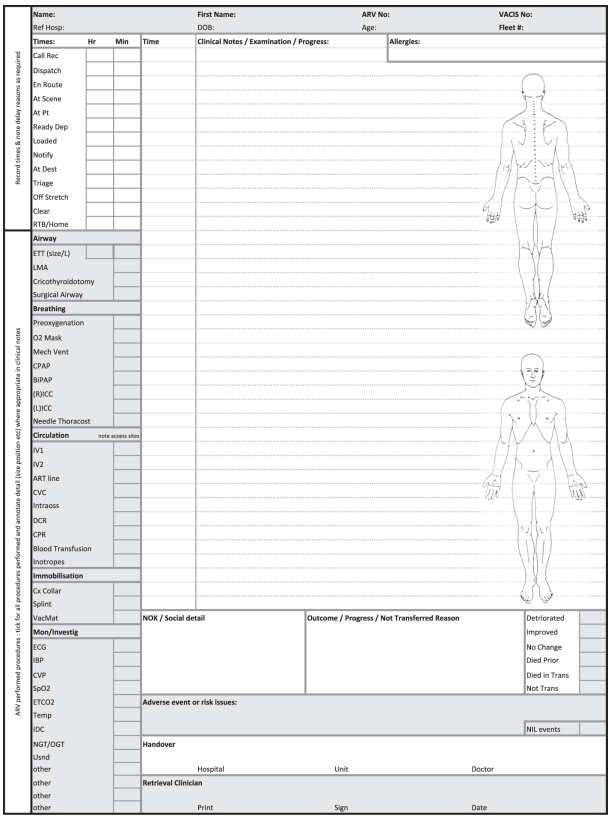

Fig. 2.4 ARV Retrieval physician record 2.
Reproduced with permission from Adult Retrieval Victoria.

Audit

In many health services, audit has again become popular as a component of quality management (see Fig. 2.5 for audit processes). In the past, when continuous quality improvement systems relied more heavily on trend analysis and indicator management to identify improvement opportunities, audit and single case review became somewhat frowned upon as an almost anecdotal, individual-rather-than-system, bullish, or coarse method.

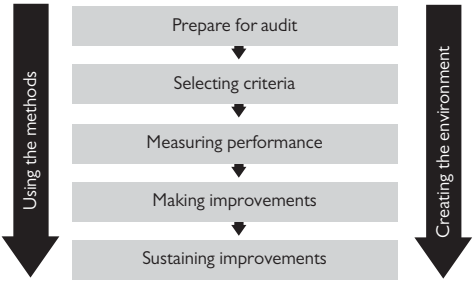

Fig. 2.5 Audit processes.

In the UK, NICE (the National Institute for Health and Care Excellence) has defined audit as:

> . . . a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the review of change. Aspects of the structure, process and outcome of care are selected and systematically evaluated against explicit criteria. Where indicated changes are implemented at an individual, team, or service level and further monitoring is used to confirm improvement in healthcare delivery.

A Cochrane review published in 2006 concluded that:

> Audit and feedback can be effective in improving professional practice. When it is effective, the effects are generally small to moderate. The relative effectiveness of audit and feedback is likely to be greater when baseline adherence to recommended practice is low and when feedback is delivered more intensively.

It is recommended that audit processes form a component of retrieval quality strategies, and that to be at all effective, they must be methodical, look for system issues, and must have an effective communication arm. However, case audit remains a relatively poor improvement tool and should not receive undue commitment or resource.

Operational case review

Due to the high-risk nature of retrieval practice, it is advised that all cases be subjected for a general review as part of clinical governance processes. Such review may appropriately be performed within a peer setting, utilizing a standard methodology; it should check compliance with organizational standards and seek learning and teaching opportunities. Ideally case review is captured within the retrieval information system, to allow trend analysis, and to ensure compliance.

There are three key components to operational case review:

1. Ensuring completion of documentation, information system data entry, and communication processes.
2. Screening for sentinel events or indicators such as:
   - Drug guideline variation
   - Failed airway
   - Death in transit
   - Unplanned major procedure in transit
   - Procedural guideline variance
   - ETT dislodged
   - Arrest in transit
   - Second crew dispatched
   - Equipment failure
   - ETT in transit
   - Massive transfusion
   - Failure to reduce pain score
   - Hypotension in transit
   - Hypothermia.
3. Assessment of coordination and retrieval activity against expected standards of practice such as:
   - History taking
   - Plan formulation
   - Documentation
   - Handover crew selection
   - Platform selection
   - Clinical assessment
   - Patient examination
   - Drugs
   - Interventions
   - Mission times.

Where operational review highlights significant issues, a case may then be referred for assessment under a more formal incident review processes.

Incident management and complaints

Incident review is the process by which an adverse event, or other significant issue, complaint, or policy breach may be investigated. The aim of such investigation should be:

- To determine system factors that may have contributed to the event;
- To assess the severity of outcome impact and the likelihood of recurrence (together these represent the risk matrix);
- To determine individual errors and contributing factors;
- To formulate a risk mitigation outcome; and to
- Assign responsibility for implementation of improvement strategies.

This is clearly a complex process and requires a clear methodology and a policy framework.

The process of case review should follow these general steps and may involve more than one assessor depending on the significance of the issue:

- Record date, source, and circumstance of the case referral for review;
- Record staff involved;

- Data reviewed in investigation of case;
- Clinical summary;
- Case chronology;
- Analysis and classification of care issues:
  - Patient or case assessment;
  - Failure to monitor or observe;
  - Judgement issue;
  - Incorrect decision;
  - Not seeking help;
  - Technical error;
  - Communication;
  - Other/none.
- Assessment of contributing factors;
- Action required including priority and timeframes (and by whom);
- Further review required;
- Feedback to stakeholders;
- Educational opportunity captured.

Handover standards and processes

Clinical handover is the transfer of professional responsibility and accountability for some or all aspects of care for a patient to another person or professional group. In the retrieval setting this may involve the transfer of incomplete and evolving patient information between the referring hospital, retrieval service, and receiving hospital. The use of a standard process for clinical handover is important in protecting the continuum of care and in preventing risk through miscommunication. The information that is transferred between healthcare providers should include all relevant data, be accurate and unambiguous, and occur in a timely manner.

There are many effective methods for handover organization. These need to be tailored to the clinical setting, urgency, patient stability, and physical environment. Most methods utilize acronyms as an aide memoire, such as ISOBAR (Table 2.2).

Table 2.2 ISOBAR: An acronym for effective handover organization

I	Identify yourself and the patient and ensure all receiving staff are identified
S	Situation: Is the one sentence statement of the patient's scenario or reason for transfer
O	Observations: Provide current observations and any recent pertinent changes
B	Background: Is the more detailed presentation of recent clinical history
A	Agreed plan: Is the current understanding of planned actions, interventions, etc.
R	Read back: Is the check of information and responsibility transfer, checked, or agreed by the receiver

Accreditation

The principal goals of accreditation are:

- To facilitate clinically safe, expeditious, and cost effective transport of patients.
- To provide an objective mechanism for evaluation of compliance with accreditation standards.
- To offer compliance with accreditation standards as a marker of excellence for retrieval services.
- To provide a framework through which personnel and organizations involved in aeromedical and road retrieval services can improve the services they provide.

Accreditation of retrieval services may happen at several levels. In general, 'whole service' accreditation systems are uncommon but are emerging.

Accreditation as a component of general health systems; utilization of standard health service accreditation tools and processes occurs in some regions.

Accreditation of training positions for registrars in retrieval posts may be facilitated by specialist training colleges.

For organizations:

- EURAMI (European Aero-Medical Institute) is a German-based accreditation service which provides voluntary standards-based accreditation of aeromedical services.
- The Commission on Accreditation of Medical Transport Systems (CAMTS) is an independent, non-profit agency which audits and accredits fixed wing and rotary wing air medical transport services as well as ground inter-facility critical care services in the US to a set of industry-established criteria.
- In Australia the Aeromedical Society of Australasia publishes standards, however, accreditation is not mandated.

Corporate governance

Corporate governance is a framework of rules and practices by which a management structure ensures accountability, fairness, and transparency in the organization's relationship with its all stakeholders (financiers, customers, management, employees, government, and the community).

This framework consists of:

- Explicit and implicit contracts between the firm and the stakeholders for distribution of responsibilities, rights, and rewards;
- Procedures for reconciling organizational goals and outcomes with the duties, privileges, roles, and performance of its components;
- Procedures for proper supervision, control, and information-flows to serve as a system of checks and balances.

Organizational structure

Retrieval services are multidisciplinary healthcare units comprising different professional groups working in close proximity to perform high-risk interventions under unpredictable circumstances. Such services require considerable investment in organizational structure to remain effective and sustainable. A retrieval service should have an operational group (the teams performing the tasks) and a management group (organizing the teams). It is essential that several (if not most) members of the management group can also work in the operational group. If this is not the case, the management group can quickly become distant from the realities and day-to-day needs of the service.

Management structure should focus around four or five key portfolios:

- Clinical operations;
- Training, education, and standards;
- Business support (including budget, finance, contracts, HR);
- Quality improvement;
- Systems support (including technical and IT).

Services that provide neonatal and paediatric retrieval should have this as an additional portfolio that should sit within the same structure.

Within each portfolio there should be adequate representation of professional groups. In particular, the operations portfolio should have a broad membership base. For example, in a service that utilizes doctors, paramedics, and nurses a representative from each profession will ensure that different opinions can be voiced and acted on and will ensure harmony on the operational base.

All portfolios should report to a medical director of service. The director must assemble a multidisciplinary team with which to work. The strength of such a 'team of leaders' allows a director to provide strategic oversight, and to act as a guide and mentor whilst encouraging delegated responsibility for portfolio development and management. The retrieval service director should normally be involved in clinical service delivery. Most retrieval services promote a flat organizational structure and a strong sense of teamwork—important factors in maintenance of a safety-focused, supportive culture. The hierarchical distinction in this doctor/paramedic/nurse

team should be arbitrary and all staff should play to each other's strengths and work side by side in the leadership team.

All staff in the service should be aware that they work in an emergency service and must have a good understanding of the other personnel outside of health care that work in this sphere. Management in particular should have a close relationship with ambulance, fire, police, and aviation, as well as hospital staff and management.

Culture

Organizational culture is core to the performance and success of a service. In organizational behaviour settings, culture has several possible definitions, but is often reduced to 'the way we do things around here'. In essence it is the face of the values that exist within an organization. Values and culture can be allowed to develop organically (with some risk) or they can be moulded and encouraged or discouraged by leaders—by simply defining these things and using them as a cornerstone to organizational process they will flourish. Values and the resulting culture can be positive or negative.

For example a retrieval service may recognize its core values of working safely, valuing team, open communication, and clinical excellence. When the organization takes these explicit values and uses them as a formal cornerstone, a constant checkpoint for activities and processes, the values are reinforced, and increase in impact. Referring back to the values in meetings, planning processes, development of new approaches, introduction of new systems, drugs, clinical paradigms, etc. is key to their significance.

Negative cultural features such as disrespect, intolerance, exclusion, ruthless competition, and communication failure are common in rigid, hierarchical organizations and must be actively managed and minimized.

Priorities and strategy

Priority setting and development of strategy are important in organizational processes. Priorities are set at the highest level by an organization's vision and mission; however, they need to be developed more explicitly for each planning and action cycle. This is typically a period of 3–5 years, with annual action plans providing a structured approach to immediate priority activity. The process of planning needs to be considered and active, and essentially looks at the following questions:

- What do we do (or believe we do)?
- Are we doing it—are there gaps in quality or quantity of what we do?
- What else do we need to do (future)?
- What are the priorities?
- What is the effort?
- Do we have the resource/can we obtain the resource?
- How, when, and who will we do these things in the next year/2 years?

The strategic plan needs to exist as a common document and be reviewed through each annual cycle and remain a reference point in management meetings and performance evaluations as well as contributing to the professional development and performance management of key staff.

Budget and finance

Every retrieval service is a multi-million dollar business and therefore requires a professional, competent approach to budget and financial management. Most retrieval services exist within a larger organization—an ambulance service, hospital, or health department, and as such are generally required to follow and meet organizational standards around budget, expenditure delegation, reporting, analysis, probity, conflict of interest, and so on.

Privately funded, benevolent funded, or stand-alone services are required to meet such standards also within corporate frameworks, company regulation and legislation, and board of management processes.

All retrieval service expenditure is driven by two principal components: staff costs and platform costs. These two elements tend to rise in proportion to service activity, however, with good planning and processes, such growth should not be linear—most organizations are capable of delivering economies of scale by optimizing staff use, role development, rostering, and platform management. Other costs such as administration, consumables, and stock items have both fixed and variable (activity-related) components and tend to be a much smaller component of expenditure.

Budget and finance management in the service must follow a cycle of activity, with annual planning, and monthly review of expenditure against budget. A mid-cycle review of year-to-date performance and extrapolation to full-year outcome allows modification of activity or systems to meet the budget.

Risk management

Beyond management of operational/clinical risk, which is generally intuitive to retrieval practitioners, the retrieval service needs to have a formal approach to organizational risk. Risk may be viewed in a range of dimensions and categories, and any item of risk should be viewed from the perspectives of its likelihood (to eventuate), and the potential impact should the event occur.

> Risk Management can be defined as coordinated activities to direct and control an organisation with regard to risk. It is a process that logically and systematically establishes the context, identifies, analyses, evaluates, treats, monitors and communicates risks associated with any activity, function or process in a way that will enable organisations to minimize losses and maximize opportunities. Risk management is as much about identifying opportunities as avoiding or mitigating losses. (AS/NZS ISO 31000:2009)

Perhaps the most pressing risk that any retrieval service faces is that of interruption to business continuity through disaster (such as fire, flood, and electrical failure). The impact of such a catastrophe is immense, and all services must have clear provision for this scenario—relocation to an alternative base, alternative communications systems, emergency rosters, callback systems, and recruitment systems must all be considered and planned for.

Contract management

Modern retrieval medicine requires significant interplay with other parties and much of this is driven by contracts. The following are areas of service likely to be managed through contracts—depending on the service there can be several others:

- Aviation service provision (helicopter, fixed wing, jet);
- Minor medical equipment purchase (fluids, laryngoscopes, drugs);
- High level equipment purchase and servicing (monitors, ventilators);
- Equipment preparation for use on aviation platforms;
- Human resources;
- Communications (mobile phones, radios);
- Legal;
- Cleaning.

Contract management can be complex and costly. Small wording changes can lead to significant changes in service provision and subsequent cost. Sound legal advice is necessary as many contracts can be worth millions of dollars. For example, a rotary wing service provision contract may provide 10 million dollars of service a year and the contract life might be 5+5 years making the contract value 100 million dollars. This is in every sense 'big business' which may be exposed to the darker side of the business world with side deals, incentives, fierce competition, and legal challenges all realities. This aspect of retrieval practice can be challenging and access to robust corporate governance and contract management departments through existing health system infrastructure is essential. The business management portfolio of a service is fundamental to management of contracts, and its full integration with clinical services and the retrieval service management team, ensures that clinical priorities remain key drivers in all business decisions.

Management reporting (financial and activity)

A standard reporting suite should be available to retrieval service management to allow rapid oversight of performance, and simple tracking of key parameters. Commonly, management reporting is dominated by metrics and activity data, together with financial material. However, it must provide a balanced view of finance and expenditure, activity, quality indicators, risk management, and human resource. Other types of management report at macro or organization-wide level and include finance reports, compliance reports, planning reports, etc.

Education

As a relatively new area of specialized clinical practice, education in prehospital and retrieval medicine is rapidly evolving. Retrieval practitioners must have in-hospital training and experience in emergency medicine, anaesthesia, and intensive care medicine. Once equipped with the relevant in-hospital critical care skills and experience, education and training in retrieval medicine must focus on their application in the challenging and unpredictable out-of-hospital environment.

Educational requirements in retrieval medicine can be divided into the domains of knowledge, skills, and culture, and are specific to the service and its environment.

Knowledge

Clinicians in prehospital and retrieval medicine require knowledge of how patient assessment and clinical management apply at prehospital scenes, small referring facilities, and during patient transfer. This includes managing with limited personnel and equipment.

Although the patients are the same as the ones prehospital and retrieval clinicians see in the hospital situation, it is the challenges that location, resources, and environment play in the management of the patients' acute pathophysiology that can be the biggest hurdle in application of their clinical knowledge.

Aviation and altitude physiology and its relationship to both patient pathophysiology and retrieval team functioning is important additional knowledge that is required.

Skills

Clinical skills

Technical, clinical skills training in retrieval medicine is mostly concerned with teaching how and when to apply existing critical care skills in a resource-depleted and often challenging environment. These skills do, however, need to be provided with the highest level of reliability and competency and without unnecessary time delay. Complex, unstable patients often tolerate procedural complications poorly. Anticipation of risk in undifferentiated clinical settings is important and is also particularly difficult.

Non-clinical skills

Clinicians require a complex set of non-clinical skills to keep themselves safe and obtain access to their patients. These types of skills will be service specific, but may include:

- Helicopter underwater escape training (HUET);
- Winch rescue;
- Navigation;
- Vertical rescue;
- Motor vehicle crash extrication techniques;
- Rapid response driver training;
- Scene safety;
- Safety around aircraft;
- Radio operation and protocols;
- Mass casualty and disaster management, including hazardous materials (HAZMAT) and urban search and rescue (USAR) response.

Culture and attitude

Human factors training is essential in prehospital and retrieval medicine, to maximize both individual and team performance and optimize patient outcome. Successful retrievals are dependent on clinical skills, teamwork, leadership, and communication.

The nature of the retrieval environment means that prehospital and retrieval clinicians must be able to rapidly integrate into already established rescue and medical teams (e.g. prehospital scene, rural hospital emergency department, regional hospital ICU (intensive care unit)), and look to utilize all the capabilities available in these environments in order to orchestrate the optimal outcome for the patient. In the majority of situations the team will be welcomed by the individuals already caring for the patient, but in a minority of situations this may not be the case, or referring staff may be stressed by a clinical scenario which has tested them, their co-workers, and health service systems. In these situations retrieval practitioners require a variety of communication tools and personality styles to allow them to perform their role, to involve and value referring hospital staff, to educate where appropriate, and to ultimately provide the best possible patient care.

Developing these non-clinical human factor skills is a vital component of prehospital and retrieval team education, and structured training around crew resource management is essential.

In developing human factor skills, education and training should include the concepts of:

- The shared mental model;
- Situational monitoring and cross monitoring;
- Advocacy and assertion;
- Conflict resolution.

It is also important that retrieval clinicians and services develop techniques and skills to allow for cognitive support in times of high stress. These can include a range of tools and processes that allow the practitioner to rely less on personal thinking, memory, or knowledge when under pressure, and more on a cognitive aid such as:

- Checklists and callbacks;
- Talk through;
- Standardized handover;
- Clear role delineation;
- Time out;
- Briefs and debriefs;
- Standard operating procedures (SOPs).

The development and uptake of all of these occurs most effectively in an educational framework, but can also be supported within a policy and governance framework. The concept of actively acknowledging culture defined as ‘the way we do things around here’ is extremely important particularly when it promotes values such as safety, team support, attention to detail, excellence, and caring.

Education resources

Most retrieval services provide in-house inductions for new employees and ongoing training as continuous professional development (CPD). Many retrieval operations perform a competency assessment following induction and a period of supervised practice.

A common progression or model for training to specialist competency level usually requires at least six months of retrieval practice and meets the following general structure:

- Induction: Didactic and skills-based education;
- Determination of base skill competency;
- Mentored or 'buddy' supervised missions;
- Certification for independent practice;
- Continued learning and knowledge consolidation (tutorial, simulation, literature, online education, reflective practice, mentoring, etc.);
- Exposure to an appropriate caseload;
- Summative assessment (examination, skills assessment, scenario-based evaluation of competence, etc.);
- Certification.

The nature of prehospital and retrieval medicine means that direct contact 'on the job' teaching and training is often difficult. Weight and space limitations in aircraft and vehicles often mean that the ability for extra crewmembers to come on a mission is limited. These restrictions constrain the quantity and efficiency of the 'bedside/scene' education process considerably. These challenges can in part be mitigated by access to education in 'down time', with use of electronic education aids such as web-based learning systems and digital recording of material, and use of peer-to-peer feedback, reflection, and log books.

Simulation

A consequence of these bedside and scene limitations is that prehospital and retrieval services have enthusiastically adopted simulation training for both clinical and non-clinical skills.

Simulation allows for high consequence, low frequency clinical and environmental conditions to be replicated so that clinicians can develop both their decision-making skills as well as their technical and clinical skills in a controlled environment. The opportunity to rehearse and debrief ensures that when faced with similar situations on a mission, teams will be well-drilled and understand the consequences of their decisions and actions.

Online resources

Prehospital and retrieval is well represented in the rapidly burgeoning area of FOAMed (free open-access meducation).

Sites of interest to prehospital and retrieval clinicians include:

www.resus.me
PHARM at www.prehospitalmed.com
www.lifeinthefastlane.com
www.intensivecarenetwork.com

Courses

There are a multitude of useful life-support courses that will help provide a starting point for prehospital and retrieval physicians to build on in the course of developing their prehospital and retrieval knowledge and experience.

These include:

- ATLS or EMST (Advanced Trauma Life Support or Early Management of Severe Trauma);
- ALS (Advanced Life Support);
- APLS (Advanced Paediatric Life Support);
- MIMMS (Major Incident Medical Management Support);
- ALSO or MOET (Advanced Life Support in Obstetrics or Major Obstetric Emergencies and Trauma);
- STaR (Safe Transfer and Retrieval).

Most of these have limited direct retrieval content, but provide at least a valid safe starting point for the management of the acutely unwell patient.

The British Association of Immediate Care delivers more specific courses in prehospital care in the UK. London's air ambulance also runs an intensive one-week course in prehospital critical care.

Qualifications

Diploma in retrieval and transport medicine (DipRTM)

This diploma run by the Royal College of Surgeons of Edinburgh is open to doctors, nurses, and paramedics. This two day, exam-based qualification consists of both a theoretical written component and a practical skills-based component.

Diploma in immediate medical care

The Royal College of Surgeons of Edinburgh also runs this diploma with a similar format to the DipRTM. Although its focus is on prehospital medicine, for most clinicians working in this area their work is often a mixture of both prehospital and pure retrieval. As such this diploma is a worthwhile consideration in addition to the DipRTM.

Fellowship in prehospital emergency medicine

This relatively recent sub-specialty fellowship for physicians focuses on the specialist provision of on-scene and in-transit critical care and is the responsibility of the Intercollegiate Board for Training in Prehospital Emergency Medicine in the UK. It accepts specialist trainees in emergency medicine, anaesthesia, intensive care medicine, or acute medicine. Development of similar training system qualifications are likely to be formalized in other countries such as Australia.

Emergency medical services (EMS) fellowships

In the United States a number of institutions deliver EMS fellowships. Fellows are trained in EMS operations, research, and leadership. Many fellows progress to becoming EMS medical directors.

University postgraduate qualifications

There are also a number of universities that offer postgraduate courses and qualifications in retrieval medicine (graduate certificate through to masters level). Most are completed in conjunction with active clinical practice in retrieval medicine that forms a clinical unit or component of the qualification. Qualifications without clinical experience or courses completed via distance education alone are of limited value.

Research

As a relatively new medical specialty, prehospital and retrieval medicine is still in the process of developing a research base and culture. A lot of current prehospital and retrieval practice is extrapolated from traditional hospital-based studies. As prehospital and retrieval medicine progresses, developing a strong evidence base is essential to ensure we provide the optimal care for our patients by evaluating current practice and potential future developments.

There are, however, many difficulties in conducting research in the retrieval environment. Patient numbers are relatively low and the case mix is very heterogeneous. The ability to separate prehospital and retrieval management from the ongoing hospital management can make it difficult to isolate specific prehospital actions and link them to patient outcome. Time is limited for additional interventions and information recording, especially on primary missions, and available manpower is minimal. As well as this there are multiple difficulties around patient consent in critically patients that contribute to the challenges.

EUPHOREA (European Prehospital Research Alliance) is an informal network of mainly European researchers aiming at promoting research in prehospital critical care and overcoming some of these difficulties.

Conferences

A number of academic conferences are organized specifically for retrieval medicine specialists:

- Europe
  - Airmed conference organized by the European HEMS & Air Ambulance Committee (EHAC);
  - Glasgow Retrieval Conference by the Emergency Medical Retrieval Service (EMRS).
- North America
  - Critical Care Transport Medicine Conference by the Air Medical Physician Association (AMPA);
  - Air Medical Transport conference by the Association of Air Medical Services (AAMS).
- Australasia
  - Aeromedical Society of Australasia (ASA) and Flight Nurses Australia (FNA) Annual Conference.

Data and information management

Written

Written data remains a feature of many health systems despite advances in digital technologies, and will remain the necessary backup system in case of IT system failure.

The principles of written data management in retrieval services are the same as in general health settings.

The layout and design of forms must be clear and simple, and guide or assist the user to capture the necessary information in a clinically logical sequence, and where possible to provide support for processes and decision-making. Legibility is a basic standard to be met, as is completeness and clarity—the rationale for decision-making must be clear, and actions taken or advised must be documented. Retrieval services using written data collection must extract key elements for electronic storage, processing, and reporting.

Most retrieval services capture coordination processes electronically, whilst many still use written data and case forms for the retrieval clinical patient record.

Examples of manual retrieval service forms are provided earlier in this chapter.

It is recommended that any written record is digitized, and all records must be retained and have privacy requirements met according to regulations within a local health or government system.

Electronic data

In retrieval services, the concept of the electronic medical record is a fundamental part of the digital systems requirement. Beyond this, however, information systems that support logistics, processes, and decision-making are important in the achievement of best outcomes and efficiency.

It is an expectation that core information in case assessment, coordination, and retrieval clinical practice be captured in electronic format, however, there is much to be gained in applying information systems that are more than unidimensional data collection tools.

Ubiquitous web-based systems are now available which provide advanced functionality such as: electronic case referral, clinical decision support, guideline management, advanced communications, mobile platforms, integration with service directories, linkage to telehealth and diagnostic systems, and access to the patient's longitudinal electronic medical record.

Audio records

Retrieval services must record all telephone consultations and conversations regarding case management. In many jurisdictions this practice is a regulated requirement, especially where the retrieval service is formally incorporated within the state or national emergency system.

Recordings must be digital and of high quality and be able to be retrieved for quality management and incident review. Calls must be retained and accessible for up to 10 years, depending on local regulation. If possible, call recording should support instant playback capability to allow immediate