

Clinical Skills in Hospitals Project

Respiratory 1

Module 1: Pathophysiology

Module 2: Respiratory assessment

Module 3: Basic airway management

Module 4: Oxygen therapy

Module 5: Airway suctioning

Respiratory 2

Module 6: Rapid sequence intubation

Module 7: Tracheostomy care and management

Module 8: Arterial Blood Gases (ABGs)

Module 9: Non-Invasive Ventilation (NIV)

Module 10: Introduction to mechanical ventilation

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Module 1: Pathophysiology

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Module 4: Oxygen therapy

Module 5: Airway suctioning

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- Dr Antony Tobin, Alicia Martin and Julian Van Dijk from St Vincent's Hospital, Melbourne, for their tireless efforts as the primary authors of Respiratory 1.
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Preface

In 2007 the Department of Human Services commissioned St Vincent's Hospital Melbourne, to design and develop simulation-based training packages for clinical skills trainers in Victorian hospitals.

The project provides Victorian health professionals—specifically, hospital clinical educators—with a resource to deliver simulation-based clinical skills training.

The information in this manual complements current training programs and should be considered as a resource in the workplace, rather than the definitive resource on the topic.

Every effort has been made to provide the most current literature references. Authors have consulted other health professionals and current programs when possible in development to ensure that the modules produced in this package are consistent with current health practices.



Course delivery in condensed form

Sample timetable for one-day workshop

This is an example of how the modules in Respiratory 1 could be combined into a one-day workshop. A sample timetable is provided for a course consisting of Modules 1, 2, 3, 4 and 5.

Course 1 (Modules 1, 2, 3, 4 and 5)

Timing	Activity		Objective
8.30 to 8.45	Introduction—faculty and participants		
8.45 to 9.15	Facilitated discussion		Module 1: 1, 2, 3
9.15 to 9.45	Case scenarios (three)		Module 1: 4
9.45 to 9.55	Summary of main points from Module 1		Module 1: all
10.00 to 10.15	Morning tea		
10.15 to 10.45	Facilitated discussion		Module 2: 1, 2
	Group 1	Group 2	Module 2: 3 and 4
10.45 to 11.20	Scenarios	Skills stations	Module 2: 3 and 4
11.20 to 11.55	Skills stations	Scenarios	Module 2: 3 and 4
11.55 to 12.05	Summary of main points from Module 2		Module 2: all
12.10 to 12.30	Facilitated discussion		Module 3: 1
12.30 to 1.00	Skills stations		Module 3: 2 and 3
1.00 to 1.10	Summary of main points from Module 1		Module 3: all
1.10 to 1.55	Lunch		
2.00 to 2.20	Facilitated discussion		Module 4: 1, 2 and 4
2.20 to 2.45	Skills stations		Module 4: 3, 5
2.45 to 3.15	Case studies		Module 4: 6
3.15 to 3.25	Summary of main points from Module 4		Module 4
3.25 to 3.50	Afternoon tea		Module 5: all
3.15 to 3.30	Afternoon tea		
3.30 to 4.10	Facilitated discussion (with or without DVD)		Module 5: 1, 2, 3, 4 and 5
4.10 to 4.50	Skills stations		Module 5: 4, 5
4.50 to 5.00	Summary of main points from Module 5 Course evaluation		Module 5: all



Respiratory 1

Introduction

Respiratory 1 was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *Respiratory 1* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, where appropriate, educators should adapt content to reflect their local policies, procedures and protocols. This should ensure the relevancy of the package content to learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed within a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages can also be combined into a one- or two-day course, as described in the module outline.

Respiratory 1 should be used as an educational tool to assist the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the Clinical Skills in Hospitals Project (Train-the-Trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate simulation into the teaching of clinical skills.

Aims

Respiratory 1 aims to make participants confident in their application of respiratory knowledge and skills on adults in different environments and settings.

Package structure

Respiratory 1 is the first of two packages, each containing five modules. These packages contain learning opportunities for health professionals at all levels of experience and from all health disciplines. Modules 1, 2 and 3 are regarded as fundamental. Modules 4 and 5 are more difficult, and are regarded as intermediate. *Respiratory 2* contains Modules 6–10, which are considered intermediate to complex.

Level of complexity	Package structure
<p>Complex For participants with more than 4 years experience or who have completed Modules 1–4</p>	<pre> graph TD Pathophysiology --> RespiratoryAssessment[Respiratory assessment] RespiratoryAssessment --> BasicAirwayManagement[Basic airway management] BasicAirwayManagement --> O2Therapy[O2 therapy] BasicAirwayManagement --> AirwaySuctionManagement[Airway suction management] O2Therapy --> AirwaySuctionManagement AirwaySuctionManagement --> RespiratoryPackage2[Respiratory package 2] </pre>
<p>Intermediate For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p>Fundamental For participants in postgraduate years 1–2</p>	

Respiratory 1 includes modules on respiratory pathophysiology, assessment, oxygen therapy, suctioning and basic airway management skills.

Respiratory 1 was designed to develop participants' knowledge, skills and behaviours in the use of respiratory skills and practices. It also provides exposure to increasingly complex scenarios aimed at testing participants' ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants' level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from basic anatomy and physiology for the fundamental modules, up to detailed knowledge of respiratory practices for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have sufficient prior knowledge and skills. Individual educators are responsible for assessing each participant's baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice for the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services' basic and advanced Train-the-Trainer programs. Clinical educators are encouraged to refer to the *Department of Human Services' Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



Module 1: Pathophysiology

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Module 1: Pathophysiology

Authors: Dr Antony Tobin, Julian Van Dijk

Aims

The purpose of this module is to teach, and/or consolidate participants' knowledge of, the pathophysiology of respiratory failure.

Presumed knowledge

This module is targeted to health professionals with a basic understanding of respiratory physiology.

Presumed prior knowledge includes:

1. respiratory anatomy and physiology
2. cardiovascular anatomy and physiology
3. familiarity with common medical conditions.

Objectives

By the end of this module, participants should have:

1. revised the fundamentals of respiratory physiology
2. discussed the types of respiratory failure and their underlying pathophysiology
3. discussed the clinical signs of respiratory failure
4. participated in case scenarios identifying the type of respiratory failure and likely causes.

Background information for educators

Respiratory failure

The term 'respiratory system' refers not only to the lungs, but also includes parts of the brain, nervous system and musculoskeletal system involved in respiration. The principle function the respiratory system is to provide gas exchange appropriate to the body's needs during rest and exercise. This involves the uptake of oxygen and removal of carbon dioxide to meet the body's metabolic requirements. 'Respiratory failure' occurs when the respiratory system cannot meet the body's gas exchange requirements.

Breathing entails the contraction of respiratory muscles to generate a negative intrathoracic pressure. This produces the movement of environmental air into the lungs. Once inside the lung, oxygen moves across the alveolar membrane into the blood, and carbon dioxide (CO₂) is released from the blood into the alveoli. The oxygen is delivered to the body via circulation, and carbon dioxide is exhaled as the intrathoracic pressure rises again during exhalation.

Traditionally, respiratory failure is divided into two types:

1. **oxygenation failure**, which occurs when the normal oxygen content of the blood cannot be maintained by the lungs' usual compensatory mechanisms.
2. **ventilatory failure**, which refers to inadequate alveolar ventilation resulting in increased carbon dioxide levels and reduced oxygen levels.

Oxygenation failure

In the ideally functioning lung, ventilation—or air delivery to the alveoli—is roughly equal to the blood flowing through the alveoli—that is, blood flow and ventilation are matched. Hypoxia and respiratory failure essentially occur when the air and blood movement in the lung is unbalanced, or when in some parts of the lung ventilation is greater than blood flow, and in other parts of the lung blood flow is greater than ventilation. This is inefficient for oxygen uptake, and the lungs' ability to transfer oxygen from the inspired air to blood is reduced, resulting in low oxygen levels or hypoxia.

This process is called 'ventilation/perfusion mismatch' (V/Q mismatch). The body's compensatory mechanism in response to V/Q mismatch is to increase ventilation, which only partially corrects blood oxygenation.

Disease processes in the lung that cause hypoxic respiratory failure can be broadly grouped into:

1. parenchymal diseases
2. airway diseases
3. pulmonary vascular disease.

Examples include:

1. parenchymal—pneumonia, cardiac failure, pulmonary fibrosis
2. airway—asthma, COPD
3. pulmonary vascular—pulmonary embolism.

The normal arterial oxygen tension at sea level in healthy people is approximately 85–100 mmHg, depending on age. This equates to an oxygen saturation of 97–100%. Oxygenation failure is usually defined as an arterial oxygen tension of below 60 mmHg, which equates to an arterial oxygen saturation of 90%. This level is chosen because at oxygen tensions below 60 mmHg, oxygen saturations drop quite quickly (due to the sigmoid shape of the oxygen–haemoglobin dissociation curve). Because oxygen delivery to the tissues is a function of cardiac output, haemoglobin and oxygen saturations, oxygen delivery drops quickly at these levels, potentially causing tissue hypoxia and death.

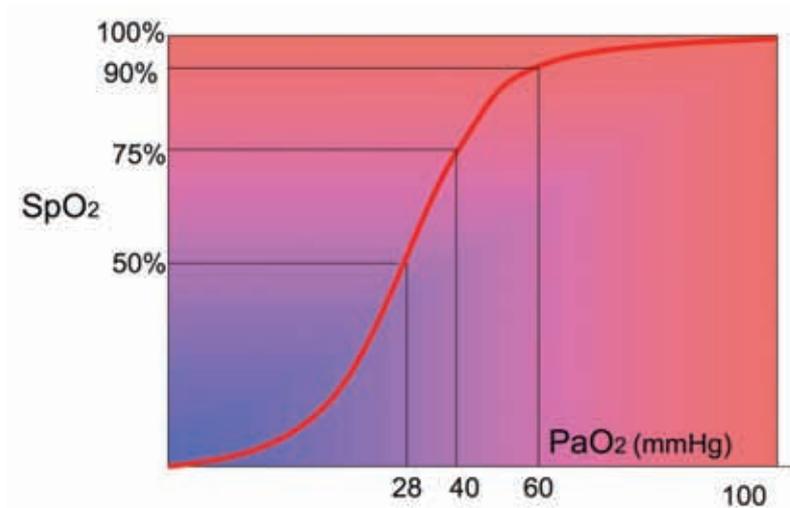


Figure 1: Oxygen-Haemoglobin Dissociation Curve

The figure above shows the an oxygen dissociation curve.

Note: there is very little increase in saturations for increases in PaO₂ above 60 mmHg, whereas relatively small changes in PaO₂ (partial pressure of oxygen in arterial blood) below 60 lead to large changes in saturations. The PaO₂ of normal venous blood is 75%, corresponding to a PaO₂ of 40 mmHg.

Treatment

The principle treatment is supplemental oxygen while therapy is directed at the underlying cause.

Ventilatory failure

‘Ventilation’ is the movement of air in and out of the alveoli, and occurs when signals from the brain are transmitted via the spinal cord and nerves to the respiratory muscles. The respiratory muscles contract and relax in response, causing expansion and contraction of the chest and the movement of air in and out of the lungs. This mechanism is analogous to a pump whose work depends on the stiffness of the lungs, the resistance in the airways (the energy required to move air through the airways), the stiffness of the chest wall and the body’s metabolic needs. Ventilatory failure occurs either when there is some primary failure in the pump mechanism (brain, spine, nerves or muscle) or the work demanded of the pump is too great.

Carbon dioxide levels are inversely proportional to alveolar ventilation. When ventilatory failure occurs, movement of air in and out of the alveoli is reduced relative to the body’s needs, and consequently, carbon dioxide levels increase. As carbon dioxide levels increase, oxygen tension in the alveoli decreases, leading to arterial hypoxia. Hypoxia may also occur due to an intrinsic lung process that causes ventilatory failure due to excessive work demands, for example, severe pneumonia.

The causes of ventilatory failure can be divided into several broad groups: primary pump failure and excessive work.

1. Primary pump failure

- a. central nervous system (CNS)—stroke, trauma, drugs (morphine, sedatives)
- b. spinal cord—trauma, demyelination, compression, polio
- c. peripheral nerves—demyelination, drugs, trauma, myasthenia gravis
- d. muscles—myositis.

2. Excessive work

- a. parenchymal—pneumonia, cardiac failure, pulmonary fibrosis
- b. airway—asthma, chronic obstructive pulmonary disease (COPD), upper airway obstruction
- c. chest wall—kyphoscoliosis, fractured ribs, pleural thickening/effusions
- d. metabolic—acidosis (diabetic ketoacidosis (DKA), renal failure).

Normal arterial CO₂ levels are 35–45 mmHg with an associated pH of 7.35–7.45. Ventilatory failure is said to be present when the arterial pCO₂ level is above 45.

Treatment

Hypoxia kills, and while supplemental oxygen does not address the underlying problem in ventilatory failure it is vital that supplemental oxygen is given to prevent tissue hypoxia.

Treatment to reverse alveolar hypoventilation depends on the underlying cause. Respiratory depression due to drugs may be reversed with specific antagonists (morphine reversal with naloxone) and hypoventilation due to lung pathology (for example, acute pulmonary oedema (APO) or asthma) may be reversed by specific treatment. However, alveolar hypoventilation often requires mechanical assistance with a respiratory pump while the underlying problem is treated. This may be administered non-invasively, via a tight-fitting facemask, or invasively, by tracheal intubation. These techniques allow time for treatments to take effect and the underlying process causing hypoventilation to resolve.

CO₂ retainers requiring oxygen therapy often lead to treatment confusion amongst health professionals. As mentioned above, hypoxia kills, and oxygen therapy should not be withheld if indicated. However, this group of patients will require informed health professional management for the duration of that therapy. Points on safe oxygen therapy for pCO₂ retaining patients are covered in *Respiratory 1—Module 4: Oxygen therapy*.

Respiratory failure summary		
Type 1 Oxygenation failure PaO ₂ < 60 mmHg	Type 2 Ventilation failure PaCO ₂ > 45 mmHg	
	Primary pump failure	Excessive work
Potential courses	Potential courses	Potential courses
Parenchymal Pneumonia Cardiac failure Pulmonary fibrosis Airway Asthma COPD Pulmonary vascular Pulmonary embolism	CNS Stroke Trauma Drugs Spinal cord Trauma Demyelination Compression Polio Peripheral nerves Trauma Demyelination Drugs Myasthenia gravis Muscle Myositis	Parenchymal Pneumonia Cardiac failure Pulmonary fibrosis Airway Upper airway obstruction Asthma COPD Chest wall Kyphoscoliosis Fractured ribs Plural thickening Effusions Pneumothoraces Metabolic Acidosis (DKS/renal failure)

Recognising respiratory failure

Because the causes of respiratory failure are varied, no one clinical presentation describes it satisfactorily, but some features are common to most cases:

- respiratory compensation
- increased sympathetic tone
- haemoglobin desaturation.
- tissue hypoxia.

A. Respiratory compensation

1. tachypnoea—tachypnoea is generally present; however, in some causes of ventilatory failure, bradypnoea (low respiratory rate) may be the cardinal sign, for example, narcotic overdose or cerebrovascular accident or terminal event
2. use of accessory muscles—in an attempt to increase ventilation or overcome excessive work of breathing, the shoulder girdle, neck and arm muscles are used to augment ventilation
3. nasal flaring—a sign of increased respiratory drive
4. intercostal, suprasternal or supraclavicular recession—signs of large intrathoracic pressure changes
5. paradoxical abdominal movement—the abdomen and chest rise and fall in synchrony in normal respiration; dysynchrony is a sign of impending fatigue or muscle weakness.

B. Increased sympathetic tone

1. tachycardia
2. hypertension
3. sweating.

C. End-organ hypoxia

1. altered mental status:
 - a. hypoxia may cause confusion, agitation or disorientation
 - b. hypercapnia may cause drowsiness or coma
2. bradycardia and hypotension (late signs).

D. Haemoglobin desaturation

1. cyanosis
2. pulse oximetry
3. arterial blood gas analysis.

Recognition of respiratory failure summary**A—Respiratory compensation**

Tachypnoea
Use of accessory muscles
Nasal flaring
Intercostal, suprasternal, supraclavicular recession
Paradoxical abdominal movement

B—Increased sympathetic tone

Tachycardia
Hypertension
Sweating

C—End organ hypoxia

Altered mental state:

- confusion
- agitation
- disorientation

Bradycardia and hypotension (late sign)

D—Haemoglobin desaturation

Cyanosis
Pulse oximetry
Arterial blood gas analysis

Learning activities

Participants work through case scenarios with the facilitator to illustrate the different mechanisms of respiratory failure and highlight the differences between hypoxic and hypercapnic respiratory failure.

Timing	Activity	Objective
30 minutes	Facilitated discussion	1, 2 and 3
30 minutes	Case scenarios (three) 1. 65-year-old smoker 2. 76-year-old obese woman 3. 87-year-old diabetic smoker	4
10 minutes	Summary	All
5 minutes	Evaluation	

Time: 1 hour 15 minutes

Facilitated discussion

The facilitator may use the PowerPoint presentation to summarise this information, but should not give a didactic lecture—instead promoting open discussion. This should include sharing and reflection on participants' knowledge and previous experiences. Suitable question time should be accommodated.

Case scenarios

The facilitator introduces three case scenarios for discussion, each requiring approximately 10 minutes.

Instructions

The facilitator can instruct the group to work through each case in groups of two, or as a larger group of up to six.

Allow 5–10 minutes for each group to identify the type of failure and contributing factors.

Reconvene the groups and discuss their findings as a whole.

To aid the post-scenario discussion, points that you would expect different discipline group to identify are provided.

Note: Arterial blood gas (ABG) results are provided as part of the data set for each scenario. However, depending on the level of experience or area of clinical work, not all disciplines will have experience in ABG interpretation. It is not the objective of this module to teach ABG interpretations—this is the focus of the ABG module in Respiratory 2.

Encourage participant groups with minimal or no understating of ABGs to consider the CO₂ and O₂ values only, and what might cause these abnormalities.

Encourage experienced health professionals familiar with ABGs to present their analyses of the ABGs provided and discuss how these support their finding.

Scenario 1		
Setting: Surgical unit		
65-year-old smoker calls for a nurse two days after an open cholecystectomy. He complains of breathlessness and chest pain.		
SpO ₂ = 87% on room air.		
Arterial blood gas results		
ABG	Normal values	Scenario 1 results
pH	7.35–7.45	7.44
PaCO ₂	35–45	33
PaO ₂	80–100	58
HCO ₃	22–26	24

Expected identifiable courses of respiratory failure and contributing factors

General nursing and allied health professionals are expected to recognise hypoxic respiratory failure and suggest post-operative chest infection or atelectasis as the cause for hypoxia.

More advanced health professionals are expected to recognise hypoxic respiratory failure and consider a broad list of potential causes, including infection, pulmonary embolism, infective exacerbation, pain with atelectasis and myocardial ischaemia with pulmonary congestion.

Assessment and management can be mentioned, but is not the focus of the module.

Scenario 2		
Setting: Surgical unit		
A 76-year-old obese woman with a past history of vascular disease and hypertension is found unconscious on routine observations 1 hour after returning from major abdominal surgery.		
SpO ₂ = 83% on room air.		
Arterial blood gas results		
ABG	Normal values	Scenario 2 results
pH	7.35–7.45	7.28
PaCO ₂	35–45	80
PaO ₂	80–100	48
HCO ₃	22–26	29

Expected identifiable courses of respiratory failure and contributing factors

General nursing and allied health members should recognise hypercapnic respiratory failure with associated hypoxia. In the pre-operative setting they should consider anaesthetic causes (such as narcotics) as the cause for the respiratory failure. They should clearly identify the mechanism by which anaesthetic drugs may cause post-operative ventilatory failure—namely: CNS depression (residual neuromuscular blockade, but a more advanced diagnosis). In discussing the associated hypoxia, they should recall that hypercapnia causes hypoxia without necessarily associated lung abnormalities.

More advanced health professionals are expected to consider anaesthetic drugs with or without obstructive sleep apnoea, cerebrovascular event, obesity hypoventilation syndrome exacerbated by anaesthesia and abdominal splinting. They should note that the hypoxia is purely due to hypoventilation (using the alveolar gas equation) and hence a central cause drug or cardiovascular accident (CVA) is most likely.

Scenario 3

Setting: Medical unit

An 87-year-old male smoker with a past history of diabetes and hypertension presents with severe breathlessness following a recent flu-like illness.

He is febrile 38.1 and chest X-ray (CXR) demonstrates extensive bilateral consolidation.

SpO₂ = 79% on mask O₂ at 8 litres per minute.

Arterial blood gas results

ABG	Normal values	Scenario 3 results
pH	7.35–7.45	7.21
PaCO ₂	35–45	50
PaO ₂	80–100	49
HCO ₃	22–26	20

Expected identifiable courses of respiratory failure and contributing factors

General nursing and allied health members should recognise hypercapnic respiratory failure with associated hypoxia. The recent infective illness should raise the possibility of pneumonia. They should recall that parenchymal diseases generally cause hypoxic respiratory failure. Through discussion of the mechanism of hypercapnic respiratory failure, they should deduce that the pneumonia is causing hypoxia, but also that the excessive work of breathing led to hypoventilation.

More advanced health professionals are expected to consider superadded airways disease or cardiac failure as potentially contributing to hypercapnic respiratory failure. Medical professionals may also recognise the mixed acidosis.

Resources

Resource	Quantity	Additional comments
Facilitators	2:12	
PowerPoint presentation	1	CD in back cover of module
Case study handouts	1 set	Module Appendices 1a—1c
Summary sheets	1 set	Module Appendices 2 and 3

Summary

The summary reinforces the content covered in the facilitated discussion and scenarios. The summary should also allow time for participants to reflect on what they have learned. No new information should be introduced.

Major points to revise in the summary include:

- major functions of the respiratory system
- characteristics of hypoxic and hypercapnic respiratory failure
- mechanisms of hypoxic and hypercapnic respiratory failure
- clinical features of respiratory failure.

Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

Reference

1. The oxyhaemoglobin dissociation curve calculator at: <http://www.ventworld.com/resources/oxydisso/oxydisso.html>

Module 1: Pathophysiology—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

1. Overall

How would you rate this module?

poor fair good very good outstanding

2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>Respiratory 1</i> Learning objectives of Module 1: Pathophysiology	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
Revised fundamentals of respiratory physiology	<input type="checkbox"/>				
Discussed the types of respiratory failure and their underlying pathophysiology	<input type="checkbox"/>				
Discussed the clinical signs of respiratory failure	<input type="checkbox"/>				
Participated in case scenarios identifying the type of respiratory failure and likely causes	<input type="checkbox"/>				
Revised fundamentals of respiratory physiology	<input type="checkbox"/>				

3. Important learning outcomes

What are the three most important things you have learned from this module?

4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in understanding respiratory pathophysiology	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

5. Future module implementation

Do you think the module should be altered in any way? yes no

If yes, what recommendations do you have?

Thank you

PowerPoint presentation

- Clinical Skills in Hospitals Project

Respiratory Package 1 MODULE 1. 'Pathophysiology'

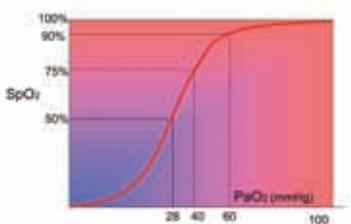


- ### Module Outline

 - Discussion
 - Skills stations
 - Scenarios
 - Summation
 - Evaluation
- ### Respiratory Failure

Oxygenation Failure

Ventilation Failure
- ### Oxygen-Haemoglobin Dissociation Curve



Oxygen-Haemoglobin Dissociation Curve
- ### Causes ?

Respiratory Failure Summary		
Type 1 Oxygenation Failure PaO ₂ < 60mmHg	Type 2 Ventilation Failure PaCO ₂ > 45mmHg	
Potential Courses ?	Primary Pump Failure	Excessive Work
Parenchymal	Potential Courses ?	Potential Courses ?
Airway	CNS	Parenchymal
Pulmonary Vascular	Spinal Cord	Airway
	Peripheral Nerves	Chest Wall
	Muscle	Metabolic
- ### Assessment

Recognition of Respiratory Failure Summary
A – Respiratory Compensation
Tachypnoea Use of accessory muscles Nasal Flaring Intercostal, Suprasternal, Supraclavicular Recession Paradoxical Abdominal Movement
B – Increased Sympathetic Tone
Tachycardia Hypertension Sweating
C – End Organ Hypoxia
Altered Mental State Confusion Agitation Disorientation Bradycardia & hypotension (Late Sign)
D- Haemoglobin Desaturation
Cyanosis Pulse oximetry Arterial blood gas analysis

7.

Scenario 1

Setting: Surgical Unit

65 year old smoker calls for a nurse 2 days after an open cholecystectomy. He complains of breathlessness and chest pain.

SpO₂ = 87% on room air.

Arterial Blood Gas Results

ABG	Normal Values	Scenario 1 Results
pH	7.35 - 7.45	7.44
Pa CO ₂	35 - 45	33
Pa O ₂	80 - 100	58
HCO ₃	22 - 26	24

8.

Scenario 2

Setting: Surgical Unit

A 76 yo obese woman with a past history of vascular disease and hypertension is found unconscious on routine observations 1 hour after returning from major abdominal surgery.

SpO₂ = 83% on room air.

Arterial Blood Gas Results

ABG	Normal Values	Scenario 2 Results
pH	7.35 - 7.45	7.28
Pa CO ₂	35 - 45	80
Pa O ₂	80 - 100	48
HCO ₃	22 - 26	29

9.

Scenario 3

Setting: Medical Unit

AN 87 year old male smoker with a past history of diabetes and hypertension presents with severe breathlessness following a recent flu-like illness. He is febrile 38.1 and

CXR demonstrates extensive bilateral consolidation.

SPO₂ = 79% on mask o₂ at 8l/min

Arterial Blood Gas Results

ABG	Normal Values	Scenario 3 Results
pH	7.35 - 7.45	7.21
Pa CO ₂	35 - 45	50
Pa O ₂	80 - 100	49
HCO ₃	22 - 26	20

10.

Summary

Summary

Evaluations



Appendix 1: Case scenarios arterial blood gas results

Scenario 1

Setting: Surgical unit

A 65-year-old smoker calls for a nurse two days after an open cholecystectomy. He complains of breathlessness and chest pain.

SpO₂ = 87% on room air.

Arterial blood gas results

ABG	Normal values	Scenario 1 results
pH	7.35–7.45	7.44
PaCO ₂	35–45	33
PaO ₂	80–100	58
HCO ₃	22–26	24

Scenario 2

Setting: Surgical unit

A 76-year-old obese woman with a past history of vascular disease and hypertension is found unconscious on routine observations 1 hour after returning from major abdominal surgery.

SpO₂ = 83% on room air.

Arterial blood gas results

ABG	Normal values	Scenario 2 results
pH	7.35–7.45	7.28
PaCO ₂	35–45	80
PaO ₂	80–100	48
HCO ₃	22–26	29

Scenario 3

Setting: Medical unit

An 87-year-old male smoker with a past history of diabetes and hypertension presents with severe breathlessness following a recent flu-like illness.

He is febrile 38.1 and chest X-ray (CXR) demonstrates extensive bilateral consolidation.

SpO₂ = 79% on mask O₂ at 8 litres per minute.

Arterial blood gas results

ABG	Normal values	Scenario 3 results
pH	7.35–7.45	7.21
PaCO ₂	35–45	50
PaO ₂	80–100	49
HCO ₃	22–26	20

Appendix 2: Respiratory failure summary

Respiratory failure summary		
Oxygenation failure PaO ₂ < 60 mmHg	Ventilation failure PaCO ₂ > 45 mmHg	
	Primary pump failure	Excessive work
Potential courses	Potential courses	Potential courses
Parenchymal Pneumonia Cardiac failure Pulmonary fibrosis	CNS Stroke Trauma Drugs	Parenchymal Pneumonia Cardiac failure Pulmonary fibrosis
Airway Asthma COPD	Spinal cord Trauma Demyelination Compression Polio	Airway Upper airway obstruction Asthma COPD
Pulmonary vascular Pulmonary embolism	Peripheral nerves Trauma Demyelination Drugs Myasthenia gravis	Chest wall Kyphoscoliosis Fractured ribs Plural thickening Effusions Pneumothoraces
	Muscle Myositis	Metabolic Acidosis (DKS/renal failure)

Appendix 3: Recognising respiratory failure

Recognition of respiratory failure summary
A—Respiratory compensation
<p>Tachypnoea</p> <p>Use of accessory muscles</p> <p>Nasal flaring</p> <p>Intercostal, suprasternal, supraclavicular recession</p> <p>Paradoxical abdominal movement</p>
B—Increased sympathetic tone
<p>Tachycardia</p> <p>Hypertension</p> <p>Sweating</p>
C—End organ hypoxia
<p>Altered mental state:</p> <ul style="list-style-type: none"> ■ confusion ■ agitation ■ disorientation ■ Bradycardia and hypotension (late sign)
D—Haemoglobin desaturation
<p>Cyanosis</p> <p>Pulse oximetry</p> <p>Arterial blood gas analysis</p>

Module 2: Respiratory assessment

Introduction

Respiratory 1 was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *Respiratory 1* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, where appropriate, educators should adapt content to reflect their local policies, procedures and protocols. This should ensure the relevancy of the package content to learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed within a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages can also be combined into a one- or two-day course, as described in the module outline.

Respiratory 1 should be used as an educational tool to assist the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the *Clinical Skills in Hospitals Project* (Train-the-Trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate simulation into the teaching of clinical skills.

Aims

Respiratory 1 aims to make participants confident in their application of respiratory knowledge and skills on adults in different environments and settings.

Package structure

Respiratory 1 is the first of two packages, each containing five modules. These packages contain learning opportunities for health professionals at all levels of experience and from all health disciplines. Modules 1, 2 and 3 are regarded as fundamental. Modules 4 and 5 are more difficult, and are regarded as intermediate. *Respiratory 2* contains Modules 6–10, which are considered intermediate to complex.

Level of complexity	Package structure
<p>Complex For participants with more than 4 years experience or who have completed Modules 1–4</p>	<pre> graph TD Pathophysiology --> RA(Respiratory assessment) RA --> BAM[Basic airway management] BAM --> OT(O2 therapy) BAM --> ASM[Airway suction management] ASM --> RP2[Respiratory package 2] </pre>
<p>Intermediate For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p>Fundamental For participants in postgraduate years 1–2</p>	

Respiratory 1 includes modules on respiratory pathophysiology, assessment, oxygen therapy, suctioning and basic airway management skills.

Respiratory 1 was designed to develop participants' knowledge, skills and behaviours in the use of respiratory skills and practices. It also provides exposure to increasingly complex scenarios aimed at testing participants' ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants' level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from basic anatomy and physiology for the fundamental modules, up to detailed knowledge of respiratory practices for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have sufficient prior knowledge and skills. Individual educators are responsible for assessing each participant's baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice for the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services' basic and advanced Train-the-Trainer programs. Clinical educators are encouraged to refer to the Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



Module 2: Respiratory assessment

Author: Dr Antony Tobin

Aims

This module presents a framework for the thorough assessment of patients presenting with respiratory symptoms and respiratory disease.

Presumed knowledge

This module is aimed at health professionals with clinical experience of patients and respiratory disease who wish to refine their approach to the assessment of respiratory patients. It assumes an understanding of:

1. basic anatomy
2. respiratory pathophysiology (Module 1)
3. some knowledge of common illnesses that result in respiratory symptoms
4. clinical experience, including interaction with patients presenting with respiratory symptoms.

Objectives

1. Revise the initial approach to the unresponsive subject.
2. Learn a method for the systematic assessment of subjects with respiratory symptoms.
3. Use respiratory assessment skills to take a respiratory history.
4. Perform a respiratory assessment on a manikin or subject.

Background information for educators

This module breaks down respiratory assessment into four broad categories:

1. initial assessment
2. history
3. vital signs and observation
4. examination.

Initial assessment

Quickly assess patient responsiveness.

If unresponsive, proceed to BLS:

- call for help
- **D**anger – assess for hazards
- **R**esponse – check patient for response to stimuli - verbal or physical
- **A**irway – airway patency—positioning and airway clearance
- **B**reathing – assess breathing and provide rescue breathing if needed
- **C**irculation – cardiac compressions if unresponsive and not breathing
- **D**efibrillation using AED.

If the patient is responsive, assess their respiratory system function in a logical manner. The exact order and focus depend on the severity of symptoms and perceived urgency.

History

Together with observation, the patient's history provides most of the information required for assessing the respiratory system. History may be very brief in emergency situations, but quite long and detailed when assessing sub-acute or chronic problems. Items to consider in the history include:

1. presenting complaint—why has the person presented today?
2. current symptoms:
 - a) shortness of breath—breathlessness is a subjective sensation that breathing is excessive, difficult or uncomfortable for the given circumstance—it may be sudden or gradual in onset, persistent or intermittent, related to exertion or occur at rest, and it may be related to posture, such as lying down (orthopnoea)
 - b) cough—cough may be dry or productive, and may reflect respiratory or cardiac disease
 - c) sputum—the colour and quantity should be determined; yellow or green sputum often—but not always—signifies infection
 - d) haemoptysis—determine amount and whether it is fresh or old
 - e) pain—determine its site and nature; pleuritic pain is chest pain that increases on inspiration and should be differentiated from cardiac pain, musculoskeletal and oesophageal pain
3. recent procedures and problems—recent operations, anaesthetics or medical problems (such as stroke or myocardial infarction) may be relevant to new respiratory problems
4. past history—especially cardiac and pulmonary problems and smoking history
5. drugs and allergies—drugs may give some indication of underlying problems when the subject cannot give a detailed history.

Observation and vital signs

Detailed observation, in addition to measurement of vital signs, is often sufficient to generate a working diagnosis, which is then confirmed with examination and investigations.

1. Vital signs, along with observation, are an essential part of the respiratory assessment, and include:
 - a) respiratory rate—this should be timed over 30 seconds; normal is between 10 and 20
 - b) heart rate—tachycardia is a common sign in respiratory distress and reflects increased sympathetic activity; bradycardia is a late sign of severe hypoxia
 - c) blood pressure
 - d) SpO₂—pulse oximetry is the most important of the vital signs in the respiratory assessment because it provides immediate assessment of oxygenation and guides the need for initiation or modification of oxygen therapy.
2. Conscious state:
 - a) alert, orientated and calm suggests that there is adequate respiratory reserve/compensation exists
 - b) ability to speak—the ability to speak comfortably is a marker of the severity of breathlessness; ability to speak only in short phrases or single words suggests severe breathlessness
 - c) agitated, anxious, restlessness or confused—while this may represent primary neurological problems or other systemic disease, hypoxia may be present
 - d) drowsy, lethargic or morning headaches—these should prompt consideration of carbon dioxide retention, although again, it may represent primary neurological disease.
3. Comfort at rest—simply assessing whether the patient is comfortable lying or sitting is often a good guide to the severity of disease.
4. Respiratory effort and breathing pattern—both the effort related to breathing and its rate and rhythm should be observed:
 - a) accessory muscle use—the shoulder girdle and neck muscles act as accessory muscles of respiration and are inactive at rest; use of the shoulder and neck muscles in respiration at rest suggests increased work of breathing
 - b) depth rate and rhythm—rapid, shallow breathing is the body's usual response to increased work of breathing whereas deep regular breathing is often seen in metabolic disorders such as diabetic ketoacidosis or renal failure; cyclical breathing where deep breathing alternates with shallow breathing or apnoea is called Cheyne-Stokes respiration, and is seen in heart failure or neurological disease

- c) prolonged or forced expiration suggests airflow obstruction—generally, inspiration and expiration are roughly equal in length; prolonged expiration suggests airflow obstruction, which may be accompanied by pursed-lip breathing, especially in COPD.
5. Respiratory noise—at rest this is abnormal, and should prompt an assessment of airway patency:
- a) snoring—this occurs due to partial obstruction of the upper airway by the tongue/soft tissues of the pharynx, and while common during sleep and generally harmless, it may be associated with airway compromise and obstruction in the setting of anaesthesia, neurological disease or in people with obstructive sleep apnoea
 - b) stridor—this is an inspiratory noise caused by narrowing of the upper airway at the level of the larynx, and may be due to aspiration of vomit or a foreign body, or caused by swelling from allergy or infection; stridor is a medical emergency and should prompt a call for assistance
 - c) wheeze—this may be inspiratory, expiratory or throughout the respiratory cycle; expiratory wheeze is often heard in asthma, COPD and cardiac failure; wheeze present throughout the respiratory cycle may be due to tumour or a foreign body.
6. Chest/abdominal wall movements:
- a) normally, the chest and abdomen rise and fall together, and movement of the left and right chest is symmetrical—this is best observed by standing at the foot of the bed
 - b) paradoxical respiration—the chest and abdomen usually rise and fall in synchrony during normal breathing; in-drawing of the abdomen as the chest rises and vice versa suggests muscle fatigue or weakness or an obstructed airway
 - c) use of accessory muscles of respiration reflects the work of breathing
 - d) in-drawing of the costal margins on inspiration is a sign of hyperinflation.
7. Appearance:
- a) cyanosis—this is a bluish colour of the lips and tongue due to deoxygenated haemoglobin, which is difficult to detect, except in severe hypoxia
 - b) anaemia—low haemoglobin causes pallor of the skin and may be the cause of breathlessness
 - c) sweating and flushing may be due to fever, hypercapnia or excessive work of breathing.

Examination: Palpation and auscultation

Palpation and auscultation provide additional information above that of history and observation, but involve more advanced skills which require practice.

1. Palpation

- a) tracheal position—the trachea should be midline, and deviation may reflect collapse or scarring of the lung (moves towards the pathology) or tension pneumothorax or pressure from a tumour/fluid (moves away from the pathology)
- b) chest wall tenderness
- c) chest expansion should be symmetrical—this can be appreciated by placing your hands on the upper chest and watching the rise and fall of your hands.
- d) tactile fremitus—these are coarse breath sounds due to retained secretions, and may be felt as a vibration of the chest wall
- e) lymph nodes axillary, supraclavicular and cervical nodes—these may be present in chest diseases such as cancer or tuberculosis
- f) subcutaneous emphysema—this may be felt as a crackling sensation under the fingers, and is due to air escaping from the lung and tracking into the subcutaneous tissues in the setting of a pneumothorax or pneumomediastinum.

2. Percussion

Percussion is performed by placing the index finger of your left hand in an intercostal space and tapping the finger with the middle finger of your right hand to determine the 'note' of the underlying tissue—air being resonant and fluid; solid tissue dull.

This requires practice to learn the technique and to appreciate normal and abnormal sounds:

- a) resonance—normally, the note is resonant, which indicates that air is present in a usually air-filled organ
- b) dullness occurs when the lung is consolidated, as in pneumonia, or when there is a pleural effusion
- c) hyperresonance occurs when there is more air than normal in the chest (hyperexpanded lungs of emphysema or pneumothorax).

3. Auscultation

Use of a stethoscope to listen to breath sounds can add additional information to the respiratory assessment, but requires practice to differentiate normal from abnormal sounds.

4. **Breath sounds**

Listen for sounds of normal air entry before trying to identify additional sounds:

- a) degree of air entry throughout the chest—should be equal
- b) quality of breath sounds—normal breath sounds are described as ‘vesicular’; that is, they are soft in nature and are heard over the lung fields; bronchial breath sounds are harsh and are heard over a consolidated lung and over the trachea
- c) length of inspiration and expiration—normally, expiration is shorter than inspiration; in obstructive lung disease expiration increases and is often associated with wheeze.

5. **Additional sounds**

Additional sounds are extra sounds due to pathology in the lungs (airways or pleura):

- a) wheezes—continuous sounds, ranging from a low-pitched snoring quality to a high-pitched musical quality, which may clear with coughing and are heard in asthma and COPD
- b) crackles—discrete, crackling sounds heard on inspiration and are heard in heart failure (fine), infection (fine to coarse) and fibrosis (coarse and harsh, and sound like Velcro)
- c) pleural rub—a creaking sound from pleural irritation, heard on inspiration or expiration.

Learning activities

Timing	Activity		Objective
20 minutes	Facilitated discussion		1, 2
	Group 1		
35mins	Scenarios	Skills stations	3 and 4
35 minutes	Skills stations	Scenarios	3 and 4
5 minutes	Summary		All
5 minutes	Evaluation		

Total time: 1 hour 40 minutes

Facilitated discussion

The instructor should lead the participants in a discussion of respiratory assessment in relation to case scenarios incorporating the schemata (history, observation and examination) provided in the background information. This discussion should use the disease-specific case scenarios to highlight the importance of each component of the assessment, as well as the need for flexibility to suit the particular case scenarios. Utilisation of PowerPoint presentations that allow the case scenarios to evolve in a stepwise pattern are suggested, in order to emphasise the logical nature of assessment, the prime importance of history and observation and to allow and encourage participant involvement.

Skill station

The skill station activity for this session is to perform a respiratory assessment focusing on palpation and auscultation, as described in the background information. Therefore, it is suggested that live models be used. These may be participant volunteers, other faculty, or other volunteers as available to facilitators. Thus, participants can actually conduct a respiratory examination. This also allows the facilitator to demonstrate important auscultation landmarks and palpation techniques.

The activity is based on Payton's clinical skill teaching method, with the facilitators demonstrating the process. The time allotment of 30 minutes should provide sufficient opportunity for each participant to practise palpation and auscultation twice.

Previously unrecognised respiratory abnormalities might be found when using volunteers. Facilitators should ensure that there is a process in place at their particular institution to review such findings and make appropriate referrals to the relevant medical specialist if required. This process should be clearly outlined to volunteers when they are recruited for this purpose.

Simulations

The aim of these scenarios is to provide opportunities for participants to conduct a full respiratory assessment (both physical and respiratory history taking) in order to determine the type of abnormality found. It is intended that participants will work in group of two, and will only do one of the possible three scenarios. Each scenario should take 15 minutes to complete.

The simulations provided require a manikin that has a range of respiratory sounds available. Manikins such as METI or Laerdal Simman are examples of these. Pre-programming of the manikin may be required for the three scenarios presented.

To run the simulation, the case is presented by the facilitator while two participants conduct a respiratory examination. The facilitator delivers information as the examination progresses. At certain stages the facilitator will ask the participants about their findings and conclusions.

Respiratory observation and examination scenarios

Scenario 1

Mr X is a 65-year-old man who has long-standing breathlessness on exertion. He recently caught a cold from his grandchild and now presents to the emergency department with worsening breathlessness.

You examine his chest and auscultate his lungs.

Allow time for two participants to conduct a respiratory examination and history.

Scenario 1—Questions and responses

1. Describe what you hear. What disease process this may represent?

- mannequin with wheeze.

2. What features are important to elicit on history?

- why he presented now
- nature of breathlessness (relation to exertion/rest/activities of daily living) and severity
- associated symptoms—fever, cough, sputum, chest pain
- past history and medications—whether he has lung disease (asthma or emphysema)—his medication may give an indication of lung or other problems
- cigarette smoking history.

3. What observed features suggest that Mr X has severe breathing difficulty? What effect could drugs have?

- vital signs—increased RR, increased HR, SpO₂
- sweating
- inability to speak in sentences
- agitation or restlessness
- use of accessory muscles.

Scenario 2

Ms Y is a 22-year-old overseas student preparing for her university exams. She presents to the emergency department with breathlessness and pain.

You examine her chest and auscultate her lungs.

Allow time for two participants to conduct a respiratory examination and history.

Scenario 2—Questions and responses

1. Describe what you hear. What disease process this may represent?

- pneumonia
- manikin with bronchial breath sounds.

2. What features are important to elicit on history?

- nature of breathlessness and severity
- pain and nature—pleuritic
- associated symptoms—fever, cough, sputum, haemoptysis
- past history and medications—previous lung infections, tuberculosis.

3. What other signs might you expect to find on examination?

- dullness to percussion
- pleural rub over the area of consolidation
- crackles—common in infection.

Scenario 3

Mr Z develops breathlessness at 5.00 am on the morning following an operation to bypass a blocked artery in his leg. RR is 32, BP 190/100, SpO₂ = 85% on 6 litres of oxygen via a Hudson mask.

You examine his chest and auscultate his lungs.

Allow time for two participants to conduct a respiratory examination and history.

Scenario 3—Questions and responses

1. Describe what you hear. What disease process this may represent?

- APO manikin with crackles.

2. What features are important to elicit on history?

- if there is chest pain present, its nature—cardiac compared to pleuritic
- if there is there any sputum—and if it is the pink frothy of APO
- past history and medications—ischaeamic heart disease.

Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have learned. No new material should be introduced.

Major points to recap in the summary include:

- initial assessment
- history
- observations and vital signs
- examination:
 - palpation
 - auscultation
 - breath sounds
 - additional sounds
- finishing comments on skill stations and scenarios.

Resources

Resource	Quantity	Additional comments
Facilitators	1:6	3 facilitators for a group of 12
Stethoscopes	6	Participants might want to bring their own
Manikin	1 to 2	Must have chest sound capacity
PowerPoint presentation	1 CD	Back cover of module
Alcohol swabs	1 pack	For cleaning stethoscope ear pieces

Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

References

1. Moore T. 2007 Respiratory Assessment in Adults. *Nursing Standard* 21(49): 48–58
2. Simpson H. 2006 Respiratory Assessment. *British Journal of Nursing*. 15(9): 484–488
3. Jevon P., Ewens B. 2001 Assessment of the Breathless Patient. *Nursing Standard*. 15(16): 48–53
4. Stevens S, Becker K. 1988 Respiratory Assessment. *Nursing* 18(1): 57–63
5. Habel M. *Respiratory Assessment: Adult and Child*, available at <http://www.nceus.com/resp/respframe.html> (accessed 4 February 2008)

Module 2: Respiratory assessment—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

1. Overall

How would you rate this module?

poor fair good very good outstanding

2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>Respiratory 1</i> Learning objectives of Module 2: Respiratory assessment	Strongly disagree	disagree	Slightly agree	Agree	Strongly agree
Revise the initial approach to the unresponsive subject	<input type="checkbox"/>				
Learn a method for the systematic assessment of subjects with respiratory symptoms	<input type="checkbox"/>				
Use respiratory assessment skills to take a respiratory history	<input type="checkbox"/>				
Perform a respiratory assessment on a manikin or subject	<input type="checkbox"/>				

3. Important learning outcomes

What are the three most important things you have learned from this module?

4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in performing a respiratory assessment	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

5. Future module implementation

Do you think the module should be altered in any way? yes no

If yes, what recommendations do you have?

Thank you

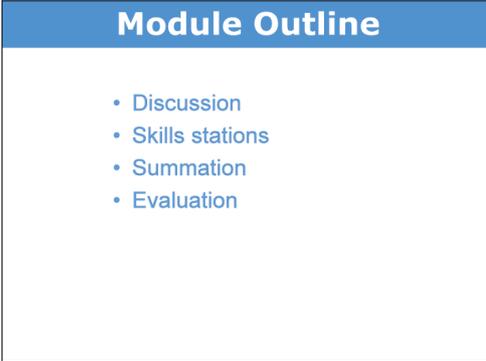
PowerPoint presentation

1. 

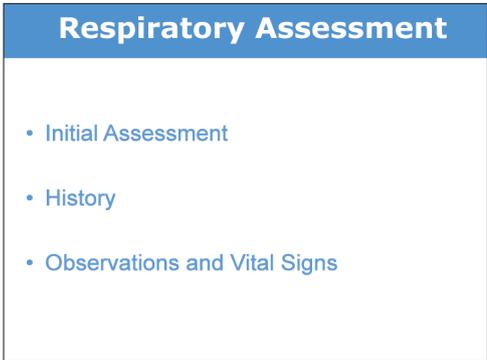
Clinical Skills in Hospitals Project

Respiratory Package 1
MODULE 2.
'Respiratory Assessment'

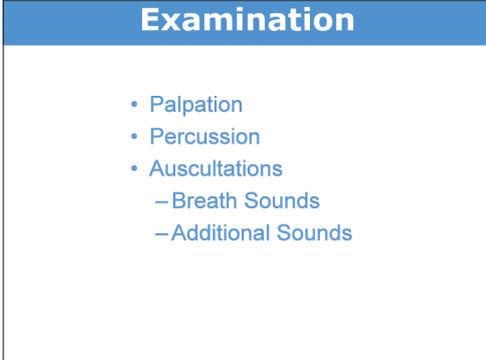
StV

A Victorian Government initiative
2. 

Module Outline

 - Discussion
 - Skills stations
 - Summation
 - Evaluation
3. 

Respiratory Assessment

 - Initial Assessment
 - History
 - Observations and Vital Signs
4. 

Examination

 - Palpation
 - Percussion
 - Auscultations
 - Breath Sounds
 - Additional Sounds
5. 

Summary

Skill Stations

Scenarios

Summary

Evaluations
6. 



Module 3: Basic airway management

Introduction

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Aims

Respiratory 1 aims to make participants confident in their application of respiratory knowledge and skills on adults in different environments and settings.

Package structure

Respiratory 1 is the first of two packages, each containing five modules. These packages contain learning opportunities for health professionals at all levels of experience and from all health disciplines. Modules 1, 2 and 3 are regarded as fundamental. Modules 4 and 5 are more difficult, and are regarded as intermediate. *Respiratory 2* contains Modules 6–10, which are considered intermediate to complex.

Level of complexity	Package structure
<p>Complex For participants with more than 4 years experience or who have completed Modules 1–4</p>	<pre> graph TD Pathophysiology --> RA[Respiratory assessment] RA --> BAM[Basic airway management] BAM --> OT[O2 therapy] BAM --> ASM[Airway suction management] OT --> RP2[Respiratory package 2] ASM --> RP2 </pre>
<p>Intermediate For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p>Fundamental For participants in postgraduate years 1–2</p>	

Respiratory 1 includes modules on respiratory pathophysiology, assessment, oxygen therapy, suctioning and basic airway management skills.

Respiratory 1 was designed to develop participants' knowledge, skills and behaviours in the use of respiratory skills and practices. It also provides exposure to increasingly complex scenarios aimed at testing participants' ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants' level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from basic anatomy and physiology for the fundamental modules, up to detailed knowledge of respiratory practices for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have sufficient prior knowledge and skills. Individual educators are responsible for assessing each participant's baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice for the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services' basic and advanced Train-the-Trainer programs. Clinical educators are encouraged to refer to the Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



Module 3: Basic airway management

Authors: Dr. Stuart Dilley, Julian Van Dijk

Aims

The purpose of this module is to teach, and/or consolidate the participants' knowledge of, individual clinical skills necessary for providing adult basic airway management.

Presumed knowledge

This module is targeted to health professionals with little or no experience in airway management. However, they are expected to have a basic knowledge of:

1. upper airway anatomy—mouth, tongue, mandible, pharynx, larynx
2. respiratory physiology—breath sounds, ventilation cycle.

Objectives

By the end of this module, participants should have:

1. identified the indications that require basic airway management
2. practised basic airway manoeuvre techniques, both manual and equipment-assisted on a manikin.
3. practised ventilation on a manikin using bag-and-mask circuits and mouth-to-mask kits.

The purpose of this module is to teach participants the skills of basic airway management, rescue breathing and use of specific equipment.

Background information for educators

Airway or respiratory compromise may be a precursor to cardiac arrest. However, timely intervention and appropriate management of the airway and respirations may avoid progression to a cardiac arrest.

Airway

Death due to airway obstruction is rapid, but easily preventable. The airway may become obstructed by foreign bodies, including dentures, secretions and food, or from the patient's own anatomical structures, usually the tongue. In the unconscious patient, muscle tone and cough reflexes are reduced or absent, putting the patient at risk of airway obstruction. Obstruction may be partial or complete, and may rapidly progress from one to the other.

Airway management is indicated when:

1. the patient is unconscious
2. the patient has an obstructed airway
3. rescue breathing is required.

Patients who have collapsed and fallen to the ground from a standing position are unlikely to have sustained a significant neck injury. However, those who struck their head on an object as they fell, or patients who are unconscious due to significant trauma (for example, motor vehicle accident, fall from height) are at greater risk of cervical spine injury. Consider potential cervical spine injury in these patients. The cervical spine should be immobilised with a cervical collar (or other means, until a collar is available), and airway manoeuvres selected accordingly. However, airway management takes precedence over possible cervical spine injury.

Indications of an obstructed airway in a patient who attempts to breathe include:

1. paradoxical chest movements (chest collapses with attempts to inhale)
2. noisy breathing, stridor, gurgling
3. cyanosis.

In patients who are not breathing or attempting to breathe, airway obstruction may not become evident until attempts at rescue breathing commence.

The mouth and upper airway should be inspected for the presence of secretions and foreign bodies which could contribute to airway obstruction. Such obstruction may be relieved by:

1. turning the patient on their side to drain secretions
2. using suction if available
3. manually removing solid foreign bodies with fingers
4. removing ill-fitting dentures.

After removal of foreign bodies from the mouth and upper airway, the head tilt/chin lift method is most commonly used to maintain the airway. Lifting the chin serves to lift the tongue off the posterior pharyngeal wall by lifting the mandible forward. The rescuer should:

1. position themselves at the side of the patient's head
2. place one hand on the patient's forehead
3. use the thumb and fingers of the other hand to lift the patient's chin
4. tilt the head (not the neck) backwards.



Figure 1: Head tilt/chin lift

Alternatively, the jaw thrust method may be used. This technique is appropriate if there is a suspicion of cervical spine injury, but can be used on any patient. The rescuer should:

1. position themselves at the top of the patient's head
2. place their fingers behind the angle of the mandible on both sides
3. exert pressure with the fingers to thrust the mandible upwards, moving the tongue away from the posterior pharyngeal wall
4. use the thumbs to keep the mouth open.



Figure 2: Jaw thrust

Oropharyngeal (Guedel) airways are simple devices that can assist in obtaining and maintaining an airway. Oral airways should be sized and inserted as follows:

1. Measure from the corner of the patient's mouth to angle of jaw/tip of earlobe.
2. Initially insert upside-down.
3. Rotate 180 degrees as the device is introduced further into the mouth.

Another way of inserting an oropharyngeal (Guedel) airway is to use a tongue depressor and direct visualisation:

1. Measure from the corner of the patient's mouth to angle of jaw/tip of earlobe.
2. Open the patient's mouth and insert a tongue depressor against the tongue, applying light pressure in order to visualise the oral cavity.
3. Insert the oropharyngeal tube without turning it upside-down first, and slide into position.

Nasopharyngeal airways are another option to help improve airway maintenance.

1. Determine the size required, by measuring the flange end at the tip of the nose and the bevel end to the tip of ear on the same side. A size 6–6.5 is a good starting size, because the nasal septum can be quite tight.
2. On insertion, angle for the corner of the opposite eye.
3. On insertion, take care when applying pressure to move the device past the nasal septum.
4. The nasopharyngeal may be tied in situ for short periods; however, pressure care (for the nasal passage used) must be considered with this device if used over several days.



Figure 3: Nasopharyngeal airway tied in situ

When using either oropharyngeal and nasopharyngeal airways, consider contraindications such as:

- facial fractures
- recent ear, nose and throat (ENT) surgery
- high international normalised ratio (INR) or activated partial prothrombin time (APTT) due to haemorrhaging risks
- excessive force required to insert device.

Breathing

Once the unconscious patient's airway is cleared, the rescuer should check whether the patient is breathing, and:

1. Look and feel for chest and abdominal movement.
2. Look and feel for air movement from the mouth and nose.

If adequate breathing is present, the patient should be rolled on their side, maintaining an open airway. Stay with the patient and check regularly for breathing and pulse until help arrives.

If the unconscious patient is not breathing after the airway is opened, rescue breathing should be commenced:

1. Give two initial breaths, allowing one second per inspiration.
2. Check for signs of life (unconscious, unresponsive, not moving, not breathing normally).
3. If signs of life are absent, commence chest compressions.
4. Continue chest compressions and rescue breathing at a ratio of 30:2.

The technique of rescue breathing depends somewhat on the equipment available to the rescuer. Mask-to-mouth ventilation has a theoretical advantage over mouth-to-mouth ventilation in that a barrier exists between patient and rescuer, affording some protection against infectious disease and cross-contamination. The risk of transmission of infectious disease by mouth-to-mouth ventilation is extremely low—no cases of human immunodeficiency virus (HIV) or hepatitis B transmission have ever been reported³. Bag-mask ventilation has the added advantage of allowing the rescuer to provide supplemental oxygen when this is available.

For mouth-to-mouth rescue breathing, the rescuer should:

1. Position themselves at the side of the patient's head.
2. Obtain and maintain an open airway as described above.
3. Slightly open the patient's mouth and pinch the patient's nose.
4. Take a big breath and blow air into the patient's lungs.
5. Look for a rise of the patient's chest to indicate movement of air into the lungs.
6. Remove mouth from the patient to allow escape of air.
7. Turn the head to observe the patient's chest falling and feel the exhaled air.

For mouth-to-mask rescue breathing, the rescuer should:

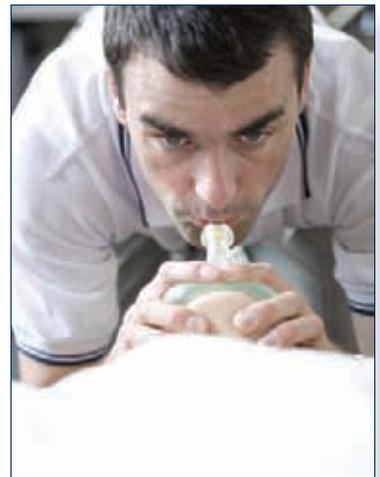
1. Position themselves at the at the patient's head.
2. Obtain and maintain an open airway.
3. Use two hands to hold the mask in place.
4. Place the narrow end of the mask over the bridge of the nose.
5. Push down firmly on the mask with thumbs and fingers while simultaneously lifting the jaw into the mask to create a seal.
6. Blow air into the patient's lungs by blowing through the mouthpiece of the mask.
7. Look for a rise in the patient's chest.
8. Remove mouth from mask to allow exhalation.
9. Observe for falling of the chest wall and feel for exhaled air.



Figure 4: Mask-to-mouth



Alternative mask grip



Viewing chest rise and fall

For most health professionals in the hospital setting, a bag-mask device is favoured for rescue breathing. Responders should be familiar with the parts of such a device:

1. facemask
2. valve
3. pressure relief valve (not fitted to all devices, prevents excessive pressure being delivered to the patient's lungs)
4. ventilation bag
5. oxygen inlet connection
6. oxygen reservoir bag.

For bag-mask rescue breathing, the rescuer should:

1. Position themselves at the patient's head.
2. Connect bag-mask device to maximal oxygen flow if available.
3. Obtain and maintain an open airway.
4. Hold the mask firmly in position with one hand.
5. Place the narrow end of the mask over the bridge of the nose.
6. Push firmly on the mask with thumb and index finger while simultaneously lifting the jaw into the mask to create a seal.
7. Blow air into the patient's lungs by compressing the ventilation bag.
8. Look for a rise in the patient's chest.
9. Allow for expiration, observing for fall of the chest wall.
10. Two hands may be required to hold the mask in place, in which case, a second person may be employed to compress the ventilation bag.



Figure 5: Correct placement of mask(nose to chin) Single operator technique



Double operator technique

Learning activities

Timing	Activity	Objective
20 minutes	Facilitated discussion	1
30 minutes	Skills stations	2, 3
5 minutes	Summary	All
5 minutes	Evaluation	

Total time: 1 hour

Facilitated discussion

The facilitator should lead a discussion amongst participants about the issues covered in the background information, for example, basic airway manoeuvres and equipment use and indications. The facilitator should not give a didactic lecture, but instead promote open discussion and knowledge sharing amongst participants. Participants should be encouraged to describe any real-life experiences they have encountered.

PowerPoint slides are available for the facilitator to use to summarise these main points at the end of the discussion or to act as triggers for discussion if these were not identified by participants.

Skills stations

The skills stations allow participants to practise basic airway management skills, such as assessing airway patency and the use of airway equipment on appropriate models, while receiving feedback in a structured format from peers and/or facilitators.

This activity, and the resources outlined, are based on three facilitators and 12 participants, a ratio of 1:4. Each facilitator should have access to one airway manikin suitable for teaching airway and breathing management. One airway manikin is required for use with nasopharyngeal and oropharyngeal airways. Two Resus Anne-type manikins are required for bagging-mask ventilation and manual airway handling.

Participants should be guided through the three airway skill stations skills (manual airway handling, airway devices and ventilation) using Peyton's four-step model¹⁰. Feedback should be provided at the completion of the skill. It is envisaged that each participant spends 30 minutes between each of the three skill stations (10 minutes at each).

Skill station 1: manual airway handling: assessing airway patency, head tilt, chin lift.

Skill station 2: insertion of airway management devices such as oropharyngeal and nasopharyngeal airways.

Skill station 3: mouth-to-mask and bag-and-mask ventilation.

Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have learned. No new material should be introduced.

Major points to recap in the summary include:

- indications for manual airway management
- the importance of:
 - checking for patency of airway
 - clearing airway obstructions
 - use of airway-specific equipment to aid ventilation
 - airway management techniques
 - achieving adequate ventilation.

Participants should be encouraged to review the appropriate hospital guidelines in their own time to reinforce the skills acquired in this module. They should be offered access to equipment and educators in the future to allow them to practise these skills if they need to improve their skill level or confidence. Participants might also be encouraged to seek clinical opportunities to observe and participate in basic airway management to put these skills into a clinical context.

Resources

Resource	Quantity	Additional comments
Facilitators	1:4	3 facilitators required for a group of 12
Airway capable manikins	3	Allows for three skill stations
Mouth-to-mask face mask	1	
Bag-and-mask circuit	1	
Oropharyngeal airways	1 set	3 adult sizes required
Nasopharyngeal	1 set	A size 6 and a size 6.5
PowerPoint presentation	1 CD	Back of module cover
Gloves: small, medium, large	Group size	Directed as per group size

Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

References

1. Australian Resuscitation Council, Guideline 4: Airway. February 2006
2. Australian Resuscitation Council, Guideline 5: Breathing. February 2006
3. Arend C., 2000 Transmission of Infectious Diseases Through Mouth-to-Mouth Ventilation: Evidence-Based or Emotion-Based Medicine? *Arq Bras Cardiol* 74: 86–97
4. Australian Resuscitation Council, Guideline 6: Compressions. February 2006
5. Hallstrom A., Cobb L., Johnson E. and Copass M. 2000 Cardiopulmonary Resuscitation by Chest Compression Alone or with Mouth-to-Mouth Ventilation. *N Engl J Med* 342: 1546–1553
6. International Liaison Committee on Resuscitation 2005 *Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care*. Part 3: Defibrillation. *Circulation* 2005 112: iii_17–iii_24
7. Australian Resuscitation Council, Guideline 11.7: Equipment and Techniques in Adult Advanced Life Support. February 2006
8. International Liaison Committee on Resuscitation 2005 *Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care*. Part 2: Adult Basic Life Support. *Circulation* 2005 112: iii_5–iii_16
9. Peyton J. 1998. *Teaching and Learning in Medical Practice*. Manticore Europe Ltd, Great Britain.

Module 3: Basic airway management—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

1. Overall

How would you rate this module?

poor fair good very good outstanding

2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>Respiratory 1</i> Learning objectives of Module 3: Basic airway management	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
Identified the indications that require basic airway management	<input type="checkbox"/>				
Practised basic airway manoeuvre techniques both manual and equipment assisted on a manikin	<input type="checkbox"/>				
Practised ventilation on a manikin using bag-and-mask circuits and mouth-to-mask kits	<input type="checkbox"/>				

3. Important learning outcomes

What are the three most important things you have learned from this module?

4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in performing basic airway management	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

5. Future module implementation

Do you think the module should be altered in any way? yes no

If yes, what recommendations do you have?

Thank you

PowerPoint presentation

1. **Clinical Skills in Hospitals Project**

**Respiratory Package 1
MODULE 3.
'Basic Airway
Management'**


2. **Module Outline**

 - Discussion
 - Skills stations
 - Airway
 - Breathing
 - Summation
 - Evaluation
3. **Airway Management
Indications**

 - No signs of life
 - Unconscious
 - Unresponsive
 - Not Moving
 - Not breathing normally
4. **Airway Management**

 - Clear mouth and airway
 - Head tilt / chin lift
 - Jaw thrust
 - Oro-pharyngeal airway
5. **Assisted Ventilation**

 - Mouth-to-mask
 - Bag-mask

 - Unobstructed airway
 - Good seal
 - Observe rise and fall of chest
6. **Summary**

Summary

Evaluations

Module 4: Oxygen therapy

Introduction

Respiratory 1 was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *Respiratory 1* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, where appropriate, educators should adapt content to reflect their local policies, procedures and protocols. This should ensure the relevancy of the package content to learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed within a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages can also be combined into a one- or two-day course, as described in the module outline.

Respiratory 1 should be used as an educational tool to assist the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the Clinical Skills in Hospitals Project (Train-the-Trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate simulation into the teaching of clinical skills.

Aims

Respiratory 1 aims to make participants confident in their application of respiratory knowledge and skills on adults in different environments and settings.

Package structure

Respiratory 1 is the first of two packages, each containing five modules. These packages contain learning opportunities for health professionals at all levels of experience and from all health disciplines. Modules 1, 2 and 3 are regarded as fundamental. Modules 4 and 5 are more difficult, and are regarded as intermediate. *Respiratory 2* contains Modules 6–10, which are considered intermediate to complex.

Level of complexity	Package structure
Complex For participants with more than 4 years experience or who have completed Modules 1–4	<pre> graph TD Pathophysiology --> RA[Respiratory assessment] RA --> BAM[Basic airway management] BAM --> O2[O2 therapy] O2 --> ASM[Airway suction management] ASM --> RP2[Respiratory package 2] style O2 stroke:#f00,stroke-width:2px </pre>
Intermediate For participants in postgraduate years 3–4 or who have completed Modules 1 and 2	
Fundamental For participants in postgraduate years 1–2	

Respiratory 1 includes modules on respiratory pathophysiology, assessment, oxygen therapy, suctioning and basic airway management skills.

Respiratory 1 was designed to develop participants' knowledge, skills and behaviours in the use of respiratory skills and practices. It also provides exposure to increasingly complex scenarios aimed at testing participants' ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants' level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from basic anatomy and physiology for the fundamental modules, up to detailed knowledge of respiratory practices for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have sufficient prior knowledge and skills. Individual educators are responsible for assessing each participant's baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice for the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services' basic and advanced Train-the-Trainer programs. Clinical educators are encouraged to refer to the Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



Module 4: Oxygen therapy

Authors: Julian Van Dijk, Dr Antony Tobin, Alicia Martin, Dr Stuart Dilley, Maria Loader

Aims

The purpose of this module is to teach, or refresh participants' knowledge of, the use of oxygen therapy principles and practice for adult patient in hospital care.

Presumed knowledge

This module is targeted to health professionals who would normally administer and or prescribe supplementary oxygen for patient therapy. They are expected to have completed Modules 1–3 of *Respiratory 1* and have a basic knowledge of:

1. the principles of normal respiratory function
2. the difference between oxygenation (Type 1) and ventilation (Type 2) failure
3. patient respiratory assessment.

Objectives

By the end of this module, participants should be able to:

1. discuss how to determine a patient's oxygen therapy requirements
2. discuss the indication and limitations of each O₂ delivery method
3. demonstrate setting up O₂ delivery equipment and a humidified circuit
4. discuss oxygen therapy contraindications for specific patient groups
5. identify correct documentation methods for oxygen therapy specific to their health service
6. participate in a group analysing respiratory case-based scenarios.

Background information for educators

The aim of *Respiratory 1—Module 4: Oxygen therapy* is to provide participants with a practical understanding of oxygen therapy in the clinical setting by exploring considerations of treatment such as assessment, monitoring, delivery methods and limitations.

Participants starting this module should have completed *Respiratory 1—Module 1: Pathophysiology*. Participants require an understanding of these definitions and concepts as used in clinical practice:

- gas exchange principles
- oxygenation failure: Type 1 failure
- ventilation failure: Type 2 failure
- hypoxia and hypoxemia.

Oxygen therapy

Oxygen therapy is used so frequently in clinical practice that many practitioners apply a mask or nasal prongs without considering an assessment of need, dose, delivery method, duration of therapy, limitations and documentation.

Health professionals with responsibilities for oxygen therapy prescription and management must actively promote high standards of practice in the use of this therapy.

The following background information reflects best practice oxygen prescription, and includes:

- assessment of oxygen need
- delivery method and dose
- duration of therapy
- limitations
- documentation.

Definitions

This module uses several terms with specific meanings related to oxygen therapy and respiratory function.

SpO₂: oxygenation saturation as measured by a pulse oximetry monitor and written as a percentage, with normal values of 97–100%.

Hypoxia: lack of oxygen at the tissue level.

Hypoxemia: lack of oxygen in arterial blood. Measured as PaO₂ < 60 mmHg.

FiO₂: the fraction of inspired oxygen in the total gas being delivered.

The next two definitions refer to the partial pressure of arterial oxygen and carbon dioxide. These values are generated by performing an arterial blood gas (ABG) test on a patient. This module does not expect that participants have experience in analysing ABG results. This is an advanced clinical skill which is developed in Respiratory 2.

For the purpose of this module, interpretation of these values will be explained by the module facilitator. However, participants will have exposure in identifying normal and abnormal patient values for PaO₂ and PaCO₂.

PaO₂: partial pressure of oxygen in arterial blood—normal values are 80–100 mmHg.

PaCO₂: partial pressure of carbon dioxide in arterial blood—normal values are 35–45 mmHg.

Assessing oxygenation needs

Hypoxia results from insufficient oxygen delivery to tissues to meet normal metabolic needs. The causes of poor tissue oxygenation range from disorders of the respiratory system which impair normal oxygenation and ventilation through to altered oxygen delivery states such as shock and anaemia. In all cases, oxygen therapy is indicated in order to prevent hypoxia and stabilise a patient's condition while underlying causes are identified and treated.

Accurate assessment of a patient's needs for supplementary oxygen is vital, particularly in the more acute settings, to ensure appropriate oxygen dosing.

Respiratory 1—Module 1: Pathophysiology defined key issues in recognition of respiratory failure (see summary table below).

The physical assessment of patients, taking into account both subjective and objective data, is vital. Further monitoring, including the use of pulse oximetry and pathology tests such as ABGs, should be used to confirm suspicions and findings as part of the total assessment.

Recognition of respiratory failure summary
A—Respiratory compensation
Tachypnoea
Posturing
Use of accessory muscles
Nasal flaring
Intercostal, suprasternal, supraclavicular recession
Paradoxical abdominal movement
B—Increased sympathetic tone
Tachycardia
Hypertension
Sweating
C—End organ hypoxia
Altered mental state:
<ul style="list-style-type: none"> ■ confusion ■ agitation ■ disorientation ■ Bradycardia and hypotension (late sign)
D—Haemoglobin desaturation
Cyanosis
Pulse oximetry
Arterial blood gas analysis

Monitoring

Two main methods are used to assess oxygenation status:

- arterial blood gases
- pulse oximetry.

Arterial blood gases

Arterial blood gases are used to determine a patient's respiratory and metabolic acid base status. This module does not cover interpretation principles, but we are here interested in the normal value of O₂ and CO₂ which this test provides.

ABGs identify the amount of oxygen dissolved in the arterial blood, in terms of the partial pressure (Pa) of that gas. The unit of measurement is mmHg (millimetres of mercury). The interpretation of the result takes into account the fraction of inspired oxygen (FiO₂) which a patient receives at the time of this blood test.

The normal partial pressure of oxygen arterial blood, for a FiO₂ of 21% (room air) is:

$$\text{PaO}_2 = 80\text{--}100 \text{ mmHg}$$

Note: When taking an ABG sample to send to pathology, you must document the FiO₂ (if known) or the O₂ flow rate on the pathology slip.

Pulse oximetry

Pulse oximetry (SpO₂) measures the amount of oxygen carried by haemoglobin in the capillary system. This reading is generated via a skin probe, which can be attached to peripheral parts of the body (such as fingers and earlobes—finger probes are commonly used on adults).

The most common method of determining a patient's oxygen status is via pulse oximetry. Therefore it is a useful tool, which is non-invasive (compared to ABGs), easy to use and provides both continued real-time monitoring as well as a quick status check of a patient's condition.

The normal range is:

$$\text{SpO}_2 = 97\text{--}100\%$$

Pulse oximetry limitations

While the use of SpO₂ monitoring is common, cheap and accessible, several limitations should be considered. Probe measurement can be affected by the following issues:

- a light source above the probe
- nail polish
- shaking or tremor of the hand or fingers
- darker skin

- peripheral vasoconstriction—poor perfusions
- irregular rhythms.

SpO₂ measurement can also be affected by patient-related conditions such as:

- anaemia
- changes in a patient's temperature, pH status and the PaCO₂, which all affect the ability of oxygen binding to haemoglobin.

Machine error is also a consideration. SpO₂ monitors should be routinely checked by the biomedical engineering department of your health service.

The relationship between ABGs and SpO₂ results is best illustrated using the oxygen-haemoglobin dissociation curve. The normal PaO₂ value 80–100 mmHg corresponds to SpO₂ values above 95% to 100%. However, if the PaO₂ value falls to 60 mmHg, the corresponding SpO₂ is now 90% (yellow lines). Hypoxia is clinically defined as **PaO₂ ≤ 60 mmHg**, so a SpO₂ of 90% means a patient is clinically hypoxic.

Other SpO₂ values of interest:

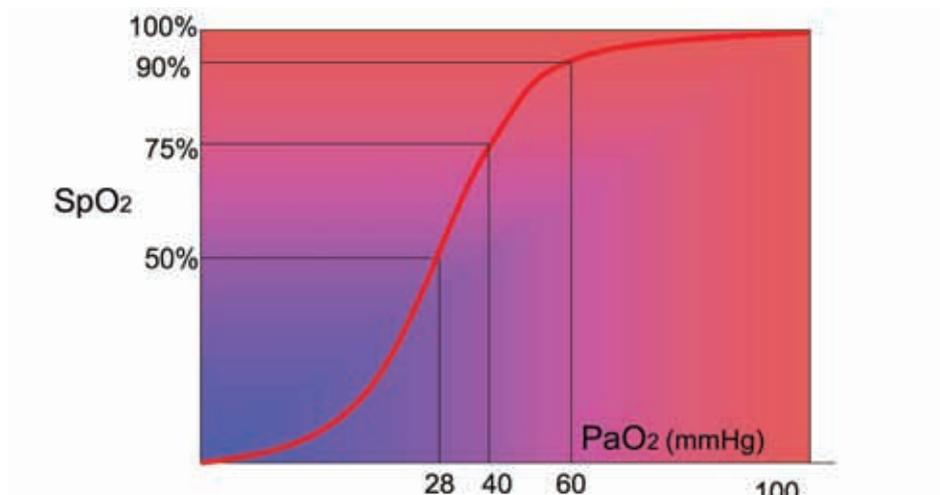


Figure 1: Oxygen-Haemoglobin Dissociation Curve

- 97–100% young person awake
- 95% older person awake
- 95% young person asleep
- 93% lower limit of normal
- 90% mild respiratory failure
- 85% respiratory failure
- 75% venous blood oxygen level, which correlates with a PaO₂ of 40 mmHg (of the total oxygen inhaled during inspiration, two-thirds return to the lungs, and under normal conditions we only use one-third of the oxygen inspired—this means that the venous system provides some reserve to manage changes in oxygen consumption)
- 60% unconscious
- 50%, which occurs with a PaO₂ of 28 mmHg.

Administering O₂ therapy

FiO₂ and flow demand

When choosing the oxygen delivery system it is important to consider both FiO₂ and flow concepts. As mentioned previously, the FiO₂ is the fraction of oxygen in the total gas being delivered. What FiO₂ the patient receives is determined by two factors: first, flow rate from the oxygen delivery device, and second, the inspiratory flow demand determined by the patient. For example, a patient has a respiratory flow demand of 20 litres per minute, and is being supplied 100% oxygen at 6 litres per minute. The patient still needs to inspire 14 litres of room air in order to meet the inspiratory flow demand of 20 litres per minute. This means that the gas entering the lungs is approximately one-third 100% oxygen and two-thirds room air. Consequently, the FiO₂ received by the patient is approximately 50%, even though they are being supplied 100% from the oxygen supply.

Patient flow demand	100% oxygen supply	Room air entrained	FiO ₂
20 litres per minute	6 litres per minute	14 litres per minute	50%

This is an important consideration, because a patient's respiratory status can change quickly, leaving current oxygen therapy inadequate to meet FiO₂ requirements.

For example, if the same patient mentioned above increases their flow demand to 40 litres per minute, without any changes to the oxygen supplied, the FiO₂ changes to 35%, because the patient is now entraining 34 litres per minute to maintain the increased flow demand.

Patient flow demand	100% oxygen supply	Room air entrained	FiO ₂
40 litres per minute	6 litres per minute	34 litres per minute	35%

Thus, regular assessment of a patient who receives oxygen therapy is vital to ensure that the therapy maintains the patient's needs.

The table below overviews oxygen delivery methods based on a patient flow demand of approximately 20 litres per minute.

Methods of oxygen delivery

Device	Flow rates	Expected FiO ₂	Comments
Nasal prongs	2 litres per minute 4 litres per minute	Approximately 23–28% Approximately 32–36%	Never run more than 4 litres per minute
Standard mask	6 litres per minute 8 litres per minute	Approximately 45–50% Approximately 55–60%	Never less than 6 litres per minute
Non re-breather mask	8 litres per minute	Approximately 60 to > 80%	
High-flow humidified system	Set as per Venturi system	Accurate for 28–60% Approximate for > 60%	
Intubated closed circuit system	As per FiO ₂ settings	Accurate for 23–100%	

Note: FiO₂ does not rise above 60% for a mask-based system, because they are not sealed circuits, meaning that room air will be entrained and dilute the 100% O₂ supply.

Nasal prongs

Nasal prongs are used to supply low flow at 2–4 litres per minute. Common indications are:

- home O₂ therapy
- COPD exacerbation if patient is a CO₂ retainer
- weaning from O₂ therapy as the patient improves.

Advantages

- patients can speak and eat unencumbered
- this method can be used if patients are mouth breathers, because the nasal passage is acting as a small reservoir
- it is easily portable.

Disadvantages

- this method should not be used for flow rates greater than 4 litres per minute due to drying of the nasal mucosa.

Face masks

Face masks provide higher flow of O₂ for patients:

- not able to maintain desired SpO₂ on nasal prongs
- pre-and post-operative (consider two factors here: sedation changes the respiratory pattern, and post-operatively, shock is a factor that oxygen is treating)
- patient experiencing chest pain
- any patient who suddenly deteriorates
- first aid.

Advantages

- Higher flow rate of 6–8 litres per minute increasing the FiO₂ to 45–60%.

Disadvantages

- patients may find the mask claustrophobic
- the flow rate must be 6 litres per minute or greater, because less than 6 litres per minute may lead to the patient re-breathing exhaled CO₂
- used for long periods, a face mask can lead to drying of the oral and upper airway mucosa.

Non re-breather mask

These face masks have a reservoir bag attached and exhalation valves on either side of the mask. The system aims to provide a higher FiO₂ than a normal face mask system.

The higher FiO₂ is achieved by having a tight fit, minimising the amount of entrained room air, because the exhalation valves are on either side of the mask. As the patient inhales, the reservoir bag provides most of the gas required to meet the patient's flow demand. Because the reservoir contains 100% oxygen, the inhaled gas reaching the lungs has a higher FiO₂ than can be achieved with a normal mask.

When the patient exhales, the exhalation valves open, due to the positive pressure behind them, and CO₂ is cleared. This minimises the risk of re-breathing CO₂.

Advantages

- Higher flow rate of 8 litres per minute increasing the 60–80%
- useful in the acute hypoxic patient who can maintain an airway.

Disadvantages

- this type of mask is tight fitting
- possible sticking of exhalation valves
- used for long periods, a face mask can lead to drying of the oral and upper airway mucosa.

Venturi devices

The Venturi device enables you to set a desired FiO_2 and provide higher flow rates to the patient than can be achieved with a normal face mask system. The advantages are a known FiO_2 level, delivered at high-flow rates to the patient. This is achieved when oxygen is supplied via a narrow tube at the base of the system, which opens into a wider chamber with an adjustable aperture. Room air is drawn into the system and supplied to the patient via wide-bore tubing. The increased flow rate is achieved because the high pressure supply of O_2 into the chamber creates a low pressure, whereby room air is entrained into the system to equalise the pressure.

The higher the FiO_2 is set, the smaller the aperture in the chamber becomes, and as a result, the lower the flow rate delivered to the patient. In the table below, the FiO_2 at 98% reduces the flow rate the patient receives to 10 litres per minute.

Different systems are available, and they all have slightly different settings. Health professionals should familiarise themselves with the system at each health service. The example here is from an Aquapak system.

FiO_2	Flow meter—litres per minute	Total flow to patient—litres per minute
28%	5	55
35%	8	45
40%	10	42
60%	10	20
98%	10	10

Advantages

- FiO_2 can be set with a high level or accuracy
- this method provides high-flow rates to patients.

Disadvantages

- lower flow rates are delivered at higher FiO_2 settings
- the unit may be noisy.

Note: High-flow-rate O_2 therapy should only be used as part of a humidified system.

Humidification

Humidified therapy is required when using high-flow O_2 therapy to prevent drying of the patient's respiratory mucosa and secretions. Normal wall or bottled supplies of oxygen have no humidity at all, due to the extreme corrosion this would cause.

There are two types of humidification: cold and heated systems.

The cold system provides humidification by mixing sterilised water with high-flow air. The result is a nebuliser-type effect which produces a large particle mist. This mist is more likely to condensate in the tubing, and has minimal effect on hydrating the deeper airway structures.

The heated system is better, in terms of creating a smaller particle vapour which can penetrate deeper into the airway system. There are several different systems with the heated options. The gold standard in heated humidification is one that maintains the desired heat throughout the circuit directly to the mask. This is achieved by a heating cable lining the full length of the oxygen tubing, which greatly increases humidification of the airways, aiding the natural process of sputum clearance.

Note: Facilitators should review the equipment at their health service to determine what systems are available.

Indications for high-flow humidified systems

These should be used:

- if a patient cannot maintain the desired SpO₂ with a face mask
- to deliver more effectively low FiO₂ therapy to patients who are CO₂ retainers
- to assist sputum clearance:
 - for patients on O₂ therapy for long periods
 - for patients using nasal prongs, but with copious amount of sputum
- for all tracheotomy patients.

Double humidified system and tusks

The use of a double humidified system greatly increases the flow rate to the patient, as well as increasing the FiO₂. The use of such systems is indicated when the desired SpO₂ is not achieved using a single system.

This type of system should not be employed before a medical review of the patient is completed. A double system is the maximum ward level of oxygen therapy.

Tusks

Tusks are only used in a double high-flow humidification system. The purpose of adding tusks into the system is to provide an oxygen reservoir to meet some of the inspiratory demand, and so deliver a higher FiO₂.

A double high-flow humidification system—with or without the addition of tusks—should not be employed until after a medical review of the patient.

During the discussion of humidification systems in use, it is important to identify:

- monitoring water levels within the system
- condensation care of tubing
- length of tubing—no longer than 1.3 m (130 cm) is recommended, due to increased dead space
- infection control policy concerning length of use per circuit (circuit changes weekly are commonly recommended)
- circuits should be placed lower than the patient, to avoid condensation running into the patient's mouth or tracheostomy

Caring for patients on O₂ therapy

Patients receiving supplementary oxygen require regular monitoring to determine:

1. response to therapy
2. tolerance to weaning trials as supplementary O₂ is reduced or removed.

At the beginning of a shift, staff involved in caring for patients on O₂ therapy should:

- review the patient's condition
- document the SpO₂ on O₂ and room air
- review treating units orders regarding acceptable SpO₂
- question whether the appropriate O₂ device is being used
- check all O₂ equipment:
 - connections at O₂ supply point
 - if using humidification, check the system is set up correctly, that the humidifier is on and there is water in the humidifier—common issues are lack of water in the system and condensation in wide-bore tubing.

As a general guide for health professionals administering oxygen, ask the following questions:

- Why am I giving this patient O₂ therapy?
- What are the patient's requirements?
- What are the medical orders?
- What system will work best?
- How will I assess the effectiveness of the O₂ therapy?

Clinical documentation

Clinical documentation is a key requirement for the use of supplementary oxygen therapy. O₂ therapy requires medical orders and should specify parameters for both increasing and decreasing O₂ therapy. Patient progress notes should reflect the course of therapy, documenting issues such as response to therapy, weaning trial outcomes and changes in oxygen prescription by medical staff.

Bedside charts should record the room air SpO₂ results at the beginning and end of each shift, as well as changes in the dose or method of O₂ therapy.

Oxygen therapy and CO₂ retainers

There is much concern about the use of oxygen therapy for known CO₂ retaining patients. Known CO₂ retaining patients must be properly assessed on admission. Clear medical orders written stating acceptable SpO₂ levels, O₂ dose and methods of delivery are essential.

CO₂ retainers are patients who have a disease process that leads to a chronic change in the normal hypercapnoeic drive. As discussed in Module 1, increases in the CO₂ level are the primary stimulus driving normal ventilation.

The CO₂ retaining patient has reduced sensitivity to high CO₂ levels, which leads to a dulled response from the respiratory centres of the brain. The body compensates by relying on a hypoxic stimulus to breath. Supplementary O₂ can depress this adapted ventilation, causing further CO₂ retention.

Hypercapnoea presents with signs and symptoms of:

- increased pulse rate
- increased blood pressure
- warm periphery
- patients may complain of a headache.

If the hypercapnoea is severe, other signs and symptoms may be:

- confusion
- drowsiness
- mental dullness and slowness to respond
- twitching (asterixis).

Initial treatment for the symptomatic hypercapnoeic patient is to:

- notify the treating unit for urgent medical review
- position the patient in a sitting-up position to aid ventilation
- ensure low-flow O₂ is given to keep saturations at the level requested by medical staff, or 90% if no orders are given
- prepare to conduct ABGs.

The aim of oxygen therapy for these patients is to provide the minimum required, while preventing further hypercapnoea.

The guide for administering supplementary oxygen is determined by acceptable SpO₂ parameters. These are normally quite low, for example, 88–92%.

Learning activities

These learning activities relate the background information to oxygen therapy equipment used in the clinical educator's health service setting. A case study is included for participants to consider treatment principles related to management protocols specific to that health service.

Timing	Activity	Objectives
20 minutes	Facilitated discussion	1, 2, 4
25 minutes	O ₂ therapy skill stations: <ul style="list-style-type: none"> ■ O₂ therapy setup ■ health service O₂ equipment ■ humidification 	3, 5
15 minutes	Case studies (two)	6
5 minutes	Summary	All
5 minutes	Evaluation	

Total: 1 hour 15 minutes

Facilitated discussion

The facilitator may use the PowerPoint presentation to summarise this information, but should not give a didactic lecture—instead promoting open discussion. This should include sharing and reflection on participants' knowledge and previous experiences. Suitable question time should be accommodated.

During the facilitated discussion, specific equipment used at the educator's health service should be shown or demonstrated to the group. Identifying where items are stored and relevant policy documents to support their use is also important.

Educators may want to restrict the facilitated discussion to the principles of O₂ therapy, and then use the skill stations to explore equipment and application considerations further.

Skills stations

The three clinical skills stations allow participants to demonstrate the use of specific oxygen therapy equipment.

Clinical skill station 1

Set up the station to review basic O₂ delivery equipment and oxygen regulators used in the educator's health service. Apply the masks and devices to a manikin to demonstrate correct application to a patient.

Bedside documents and checklists required for correct setup monitoring of these therapies should be included in any demonstration.

Clinical skill station 2

Set up the station to review humidification circuit setup and care. If both heated and unheated systems are used in the clinical areas, both should be demonstrated.

Bedside documents and checklists required for correct setup monitoring of these therapies should be included in any demonstration.

Clinical skill station 3

Set up the station to review the correct use of pulse oximetry equipment used to assess patients in the educator's health service. Review the difference between accurate readings as shown, compared to an inaccurate reading.

Feedback for participants is also recommended using the Pendleton method—see the Resources section.

Case scenario

The case study can be presented as a PowerPoint slide or as an individual handout for each member of the group.

The aim is to encourage discussion about the case, then the facilitator should summarise and conclude the discussion and case.

Two cases can be used for this activity.

Case study 1

Mr Robinson has severe pneumonia. You check his ABGs and determine that he is not a CO₂ retainer.

However, he is hypoxic, **PaO₂ = 50 mmHg, SpO₂ = 80%** with oxygen running at an **FiO₂ of 0.4 (40%)** via a cold humidified circuit.

You notice that Mr Robinson has copious, thick secretions.

As the health professional managing this patient, what will you do?

Possible action and discussion points

The facilitator can prompt with questions about possible actions that the group may take. We recommend that when participants indicate they might increase the FiO_2 , the facilitator indicates that there is no improvement. Possible actions:

- assess the patient's work of breathing
- suction the patient to further aid breathing if indicated
- change the patient to a heated humidified circuit
- consider increasing the patient's FiO_2 to 0.45 (45%)
- if no response to this, further increase the FiO_2 to 0.5 (50%)
- if no response to increased FiO_2 of 0.5 (50%), then:
 - consider adding a double circuit
 - consider that patient is receiving the maximum O_2 does available on the wards
 - consider adding tusks after a medical review
- call for a medical review.

Case study 2

Mrs Tanner returned from theatre early this morning after a laparotomy.

Part a

Currently Mrs Tanner receives supplementary **oxygen at 4 litres per minute via a Hudson face mask.**

Is this okay?

What are the potential dangers?

What should be done?

Once these questions have been discussed, move onto Part b.

Part b

Now Mrs Tanner receives supplementary **oxygen at 6 litres per minute via a Hudson face mask, $\text{SpO}_2 = 98\%$.**

When and how do you wean her oxygen?

Possible action and discussion points

The facilitator can prompt with questions about possible actions that the group may take.

Part a

There is a high chance that the patient is re-breathing her own CO₂. At 4 litres per minute, this is an inadequate dose for a face mask.

The oxygen level should be increased to a minimum of 6 litres per minute to prevent this risk.

Reconsider the patient's O₂ therapy needs, taking into account that she has had surgery.

Part b

- Has the patient been back on the ward for more than 8 hours?
- Assess the patient for normal vital signs—are they stable?
- Does her chest sound clear?
- Consider the possibility that there was a large blood loss intra-operatively.
- Is she anaemic? (Perhaps check post-op full blood examination (FBE) results).
- Trial the patient on nasal prongs at 3 litres per minute, and review SpO₂.
- Review with treating unit.

Summary

The summary session reinforces content covered in the learning activities, and is an opportunity for participants to reflect on what they have learned. No new material should be introduced.

Major points to recap in the summary include:

- assessing oxygenation needs:
 - monitoring
 - SpO₂
- oxygen administration:
 - FiO₂
 - flow demand
- method of delivery
- humidification
- caring for patients on oxygen therapy:
 - Use checklists to assess correct use of O₂ therapy
 - CO₂ retainers.

Resources

Clinical skill station 1

Resource	Quantity	Additional comments
Wall-mounted O ₂ supply and regulator	1	
Standard face mask	1	
Standard nasal prongs	1	
Re-breather mask	1	
Fine-bore extension tubing and connectors	1 set	

Clinical skill station 2

Resource	Quantity	Additional comments
Wall-mounted O ₂ supply and regulator	1	
Cool humidification circuit	1	Cold humidification
Venturi system	1	
Length of wide-bore corrugated tubing	1	
Sterile water for circuit	1	
Warmed humidification circuit	1	Warm humidification
Venturi system	1	
Length of wide-bore corrugated tubing	1	
Sterile water for circuit	1	

Clinical skill station 3

Resource	Quantity	Additional comments
Pulse oximeter	2	Useful to have two to demonstrate with
Relevant documentation to rescored results	1 set	
Relevant policy documents	1 set	

Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

References

1. Bateman N.T. and Leach R.M. 1998 ABC of Oxygen: Acute Oxygen Therapy. *BMJ* 317: 798–801
2. Pierce L. 2007 *Guide to Mechanical Ventilation and Intensive Respiratory Care*. W.B. Saunders Company. Sydney
3. St Vincent's 2006 *St Vincent's Health Clinical Policy Manual: Oxygen Policy*
4. Pilbeam S. 1998 *Mechanical Ventilation Physiological and Clinical Applications*. Mosby. Sydney

Module 4: Oxygen therapy—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

1. Overall

How would you rate this module?

poor fair good very good outstanding

2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>Respiratory 1</i> Learning objectives of Module 4: Oxygen therapy	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
Discuss how to determine a patient's oxygen therapy requirements	<input type="checkbox"/>				
Discuss the indication and limitations of each O ₂ delivery method	<input type="checkbox"/>				
Demonstrate the setting up of O ₂ delivery equipment and a humidified circuit	<input type="checkbox"/>				
Discuss oxygen therapy contraindications for specific patient groups	<input type="checkbox"/>				
Identify correct documentation methods for oxygen therapy specific to your health service	<input type="checkbox"/>				
Participate in a group, analysing respiratory case-based scenarios	<input type="checkbox"/>				

3. Important learning outcomes

What are the three most important things you have learned from this module?

4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in setting up oxygen therapy equipment	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

5. Future module implementation

Do you think the module should be altered in any way? yes no

If yes, what recommendations do you have?

Thank you

PowerPoint presentation

- Clinical Skills in Hospitals Project**

**Respiratory Package 1
MODULE 4.
'Oxygen Therapy'**
- Module Outline**

 - Discussion
 - Skills stations
 - Summation
 - Evaluation
- Assessing Oxygenation Needs**

Recognition of Respiratory Failure Summary	
A – Respiratory Compensation	Tachynoea Posturing Use of accessory muscles Nasal Flaring Intercostal, Suprasternal, Supraclavicular Recession Paradoxical Abdominal Movement
B – Increased Sympathetic Tone	Tachycardia Hypertension Sweating
C – End Organ Hypoxia	Altered Mental State Confusion Agitation Disorientation Bradycardia & hypotension (Late Sign)
D- Haemoglobin Desaturation	Cyanosis Pulse oximetry Arterial blood gas analysis
- Monitoring**

 - Pulse Oximetry
– Normal Values 97% -100 %
 - Arterial blood Gases
– Normal Values 80 – 100 mmHg
- Oxygen-Haemoglobin Dissociation Curve**
- Administering O2**

FiO2 and Flow Demand
- Administering O2**

FiO2 and with Increased Flow Demand
- Methods of Delivery**

Device	Flow Rates	Expected FiO2	Comments
Nasal Prongs	2 L/min 4 L/min	Approximately 23 – 28% Approximately 32 – 36%	Never run more than 4 L/min
Standard Mask	6 L/min 8 L/min	Approximately 45 – 50% Approximately 55 – 60%	Never less than 6 L/min
Non Re-breather Mask	8 L/min	Approximately 60 – >80%	
High Flow Humidified System	Set Per Venturi system	Accurate for 28 – 60 % Approximate for > 60%	
Intubated Closed circuit System	As per FiO2 settings	Accurate for 23 – 100 %	

9. **Humidification**
- Indications
 - Cold Systems
 - Heated Systems
 - Double Humidification Systems
10. **Patients on O₂ Therapy**
- As your self these questions
- Why am I giving this patient O₂therapy ?
 - What are the patient's requirements ?
 - What are the medical orders ?
 - What system will work best ?
 - How will I assess the effectiveness of the O₂ therapy ?
11. **O₂ Therapy and CO₂ Retainers**
- Hypercapnoeic Drive
 - Hypoxic drive with chronic CO₂
- Supplementary O₂, which increases O₂ level, may depress ventilation and cause higher levels of CO₂
12. **Case Study 1**
- Mr Robinson has severe pneumonia.
- You have checked the patients ABG's and determined that he is not a CO₂ retainer.
- However he is hypoxic, PaO₂ = 50 mmHg / SpO₂ 80% with oxygen running at a FiO₂ of 0.4 (40%) via a cold humidified circuit.
- You have noticed that Mr Robinson has copious thick secretions
- As the health professional managing this patient what will you do?**
13. **Case Study 2**
- Mrs Tanner is a patient who returned from theatre early this morning, following a laparotomy
- Part A**
- Currently Mrs Tanner is receiving supplementary oxygen at 4 L /min via a Hudson face mask.
- Is this Ok?**
What are the potential dangers?
What should be done?
14. **Case Study 2**
- Mrs Tanner is a patient who returned from theatre early this morning, following a laparotomy
- Part B**
- Now Mrs Tanner is receiving supplementary oxygen at 6 L /min via a Hudson face mask. SpO₂ = 98%
- When and how do you wean their oxygen?**
15. **Summary**
- Summary
- Evaluations



Module 5: Airway suctioning

Introduction

Respiratory 1 was developed as a teaching and learning tool for Victorian clinical educators. The information contained in each module was developed using evidence-based resources and examples of best practice. Where expert opinion varies, a discussion section is included. However, it is not within the scope of *Respiratory 1* to address the full spectrum of local variations. Variations can occur in several areas, including practices relating to types of equipment used, infection control processes, practice guidelines and so on. Therefore, where appropriate, educators should adapt content to reflect their local policies, procedures and protocols. This should ensure the relevancy of the package content to learners.

The modules are designed to be discrete courses in their own right. They are timetabled so they can be completed within a 1–2 hour timeframe. This timeframe was chosen after we received feedback from clinical educators requesting shorter courses, because health professionals often have limited time to educate away from patients. However, the packages can also be combined into a one- or two-day course, as described in the module outline.

Respiratory 1 should be used as an educational tool to assist the teaching of clinical skills. It is structured as a guide to assist clinical educators, and uses many concepts taught in the Clinical Skills in Hospitals Project (Train-the-Trainer courses). Educators are encouraged to build on this resource by adding their own scenarios which incorporate hospital/health service protocols, policies and other resources. Each module is designed as a lesson plan to incorporate simulation into the teaching of clinical skills.

Aims

Respiratory 1 aims to make participants confident in their application of respiratory knowledge and skills on adults in different environments and settings.

Package structure

Respiratory 1 is the first of two packages, each containing five modules. These packages contain learning opportunities for health professionals at all levels of experience and from all health disciplines. Modules 1, 2 and 3 are regarded as fundamental. Modules 4 and 5 are more difficult, and are regarded as intermediate. *Respiratory 2* contains Modules 6–10, which are considered intermediate to complex.

Level of complexity	Package structure
<p>Complex For participants with more than 4 years experience or who have completed Modules 1–4</p>	<pre> graph TD Pathophysiology --> RespiratoryAssessment[Respiratory assessment] RespiratoryAssessment --> BasicAirwayManagement[Basic airway management] BasicAirwayManagement --> O2Therapy[O2 therapy] O2Therapy --> AirwaySuctionManagement[Airway suction management] AirwaySuctionManagement --> RespiratoryPackage2[Respiratory package 2] style AirwaySuctionManagement stroke:#f00,stroke-width:2px </pre>
<p>Intermediate For participants in postgraduate years 3–4 or who have completed Modules 1 and 2</p>	
<p>Fundamental For participants in postgraduate years 1–2</p>	

Respiratory 1 includes modules on respiratory pathophysiology, assessment, oxygen therapy, suctioning and basic airway management skills.

Respiratory 1 was designed to develop participants' knowledge, skills and behaviours in the use of respiratory skills and practices. It also provides exposure to increasingly complex scenarios aimed at testing participants' ability to combine these individual skills, work as a team and problem solve in more difficult situations.

Educators delivering these modules should be aware of participants' level of experience and choose appropriate modules. Modules presume an increasing level of knowledge as they progress, ranging from basic anatomy and physiology for the fundamental modules, up to detailed knowledge of respiratory practices for the complex modules. Novice participants (such as first-year graduates) are expected to start with the fundamental modules, and only move onto intermediate and more complex modules as they demonstrate proficiency. More experienced participants may start at the intermediate level if the educator is satisfied that they have sufficient prior knowledge and skills. Individual educators are responsible for assessing each participant's baseline knowledge and determining which modules they need to complete. More specific descriptions of presumed knowledge are outlined in each module.

The design of these packages presumes that the clinical educators using them have knowledge and expertise in current best practice for the teaching of clinical skills and conducting facilitated discussions. Knowledge and expertise are presumed commensurate with the Department of Human Services' basic and advanced Train-the-Trainer programs. Clinical educators are encouraged to refer to the Department of Human Services' *Clinical Skills Facilitators Manual* for theory on:

1. Peyton's model for teaching clinical skills
2. leading small group discussions
3. giving feedback
4. crisis resource management skills.



Module 5: Airway suctioning

Author: Alicia Martin

Aims

The purpose of this module is to teach, and/or consolidate the participants' knowledge of, clinical skills necessary for safely and effectively performing suctioning.

Presumed knowledge

This module is targeted to health professionals with little or no experience in suctioning. However, they are expected to have a basic knowledge of the following modules:

1. *Respiratory 1—Module 1: Pathophysiology*
2. *Respiratory 1—Module 2: Respiratory assessment.*

Other presumed prior knowledge includes:

1. upper airway anatomy: mouth, tongue, pharynx, larynx, trachea, oesophagus
2. cardiovascular anatomy and pathophysiology: blood pressure, circulation, oxygenation.

Objectives

By the end of this module, participants should have:

1. revised the most recent evidence base behind suctioning
2. identified the indications for suctioning
3. identified local/hospital policies and procedure, particularly clean compared to sterile techniques, and open compared to closed systems
4. practised the basic technique of suctioning on a simulated manikin (orally and nasally), and also through the following airways: Guedel, nasopharyngeal, and tracheostomy
5. familiarity with suction canisters and troubleshooting of suction/canisters.

The purpose of this module is to teach participants the technique of suctioning. This module is not intended to cover airway insertions—this is covered in Module 3.

Background information for educators

Suctioning an airway can be necessary to maintain its patency and to clear the airway of secretions, blood or vomit. It may occur as part of an acute response to an emergency situation. Other common situations where suctioning is required is in patients with an impaired cough rendering them ineffective in clearing their own secretions. This commonly occurs in patients with artificial airways, such as those with a tracheostomy or endotracheal intubation.

Potential negative side-effects of suctioning include:

1. hypoxia
2. tracheal mucosal damage
3. raised intracranial pressures (ICP)
4. cardiac arrhythmias (due to vagus nerve stimulation)
5. nosocomial pneumonia
6. it can be potentially painful and anxiety provoking for patient.

Suctioning should only be conducted when clinically necessary. Therefore, health professionals must follow guidelines, and also perform individual patient assessments before, during and after suctioning.

Evidence

The evidence base:

- highlights the lack of an individualised assessment in clinical practice
- reveals ongoing contention between clean compared to sterile techniques
- contains few evaluations of the effectiveness of suctioning
- is scant regarding the most effective (including cost-effective) equipment, especially regarding open compared to closed circuits
- clearly demonstrates that saline installations before suctioning should not occur, due to the adverse effects of decreased oxygen saturation, increased nosocomial pneumonia and increased ICP
- clearly demonstrates that hypoxemia may result after suctioning
- contains contentious research on the effectiveness of pre-suctioning hyperventilation (although research has mainly focused on newborns, not adults).

Consult local policies on clean compared to sterile techniques, open compared to closed systems, and pre-oxygenation.

Indications for suction include that the patient:

1. cannot cough effectively to clear retained secretions
2. cannot maintain airway patency due to obstruction of sputum, vomit or blood
3. has sudden respiratory distress, including increases in ventilator airway pressures, or if PaO₂ or SpO₂ suddenly decreases
4. shows sudden increases or decreases in HR, RR or BP.

No absolute contraindications to suctioning exist.

Frequency (Level IV evidence)

Only when necessary—not routinely.

Evidence suggests no more than three passes of a catheter per session to reduce risks of tracheal mucosa damage.

Duration (Level IV evidence)

Recommend < 10–15 seconds per suction to decrease the risks of listed side-effects. Doubling suction time can potentially double the decreases in PaO₂ levels and the increase incidence of tracheal trauma.

Suction pressure

Recommend 80–120 mmHg. Higher pressures increase the risks of side-effects.

If unable to measure mmHg, then set the suction strength so that you feel only light suction on the glove on your fingertip.

Suction units

Most hospitals have a wall-mounted Venturi suction system. This should be checked at the beginning and end of each shift, as well as immediately prior to suctioning. The suction tubing will then be connected to a suction canister. These connections must all be tightly fitted to ensure efficient suction. Refer to local infection control procedures regarding the changing of suction canisters.

Portable suction units are available in the absence of wall-mounted suction systems. These must be regularly serviced. Some portable suction units require a vacuum build-up time—refer to the manufacturer's advice.



Figure 1: Standard ward wall-mounted suction system

Pre-oxygenation (Level III evidence)

Refer to local policy. Ventilated patients are often pre-oxygenated at FiO₂ 100% for 2 minutes.

Catheters (Level IV evidence)

The size of catheter should occlude no more than half the internal diameter of the artificial airway. This is to avoid greater negative pressures in the airways and also to minimise drops in SpO₂/PaO₂.

Multi-eyed catheters cause less trauma than single-eyed catheters because pressure is dissipated. Multi-eyed catheters also negate the need to rotate a catheter on withdrawal.



Figure 2: Multi-eyed catheter and close up of catheter tip (note the catheter size information on packets)

Clean compared to sterile technique (Level IV evidence)

This refers to whether gloves are sterile or clean. Consult local policy. In most ward situations, the clean technique is sufficient.

Open compared to closed systems

Some ICU settings use closed (or 'in-line') systems, whereby a catheter remains connected to either the ETT or tracheostomy inside a closed lumen. Evidence varies on how frequently these should be changed—one review recommends that they should be changed every 48 hours. Level IV evidence suggests closed systems may be associated with reduced rates of cross-infection.

The 'open technique' refers to connecting an individual catheter for each session of suctioning. Refer to local policy.



Figure 3: A closed suction system as used on a tracheotomy patient (note the operator's hand pressing the blue button to activate suction)

Depth of suctioning

This refers to deep compared to shallow suctioning. Some patients can cough their secretions partway up their airways, and may only require shallow suctioning to clear secretions. For deep suctioning, insert the catheter far enough down to stimulate a cough. Do not push further once initial resistance is met. If the catheter meets resistance, then pull back by 1–2 cm before applying suction.

Monitoring

HR, rhythm (including bradycardias and premature beats), BP and SpO₂ should be monitored before, during and after suctioning. If the patient develops arrhythmias, a decrease in SpO₂ or decreased conscious state, then stop suctioning immediately and administer high-flow and/or high FiO₂. If SpO₂ remains low, also assess for mucous plugging, pneumothorax and changes in lung function. Call a MET or code in the event of a serious adverse reaction.

Outcome measures

These include:

- volume of secretions removed
- frequency of suctioning
- auscultation findings
- changes to ABGs or SpO₂
- cardiovascular, neurological, haemodynamic or pulmonary changes
- presence of tracheal mucosal damage
- prevalence of atelectasis or pneumonia
- patient comfort levels.

Suctioning patients with head injuries

Suctioning can cause cumulative increases to intracranial pressure, arterial pressure and cerebral perfusion pressure, so only two consecutive suctionings are recommended (rather than three). Allow patients to rest for 10 minutes post-suctioning, before other activities that may increase the above pressures.

How to suction—a step-by-step process

1. Assess the need to suction, including vital signs.
2. Explain the procedure to the patient.
3. Ensure hands are clean (refer to local hand hygiene infection control policy).
4. Ensure suction is connected, and turn suction on to appropriate negative pressure (80–120 mmHg).

5. Don goggles and gloves (clean or sterile).
6. Peel back the catheter packaging. Connect the end of the catheter to the suction tubing. Ensure the catheter is at least half the diameter of the artificial airway.
7. Insert catheter (without suction engaged) to the desired depth (deep or shallow).
8. Apply continuous suction (not intermittent) and maintain continuous suction during withdrawal (when using a closed system, apply continuous suction by depressing the suction valve).
9. Slowly withdraw catheter (without rotation or twirling), over 10–15 seconds.
10. Disconnect catheter from suction tubing.
11. Rinse suction tubing with normal saline/sterile water.
12. Wrap catheter around dominant hand and pull off glove inside out, ensuring catheter remains inside the glove. Dispose of the suction catheter and gloves.
13. Turn off suction.
14. Conduct hand hygiene post-procedure.
15. Repeat no more than three times per session if necessary.
16. Re-assess patient, including vital signs.
17. Assess outcome measures.

The accompanying DVD contains demonstrations of this step-by-step process for a range of situations.

Learning activities

Suggested learning activities and timetable are outlined below.

Timing	Activity	Objective
30 minutes	Facilitated discussion	1, 2, 3
10 minutes	DVD	4, 5
40 minutes	Skills stations	4, 5
10 minutes	Summary	All
10 minutes	Evaluation	

Total: 1 hour 40 minutes

Facilitated discussion

The purpose of this exercise is for the facilitator to lead a discussion amongst participants about the issues covered in the background information, for example, indications for suctioning, potential side-effects and the evidence base. The facilitator may use the PowerPoint presentation to summarise this information, but should not give a didactic lecture—instead promoting open discussion. This should include sharing and reflection on participants' knowledge and previous experiences. Suitable question time should be accommodated.

The facilitator may also show the DVD provided as another aid to the initial discussion. Each chapter is designed using Payton's clinical skill teaching method. Two versions of each suctioning skill are demonstrated: one performing the skill in real time without discussion, and one performing the skill with narration of the steps during the procedure.

DVD chapter details	
Chapter	Feature
1	Oral airway suction demonstrated
2	Oral airway suction demonstrated and discussed
3	Oropharyngeal airway suction demonstrated
4	Oropharyngeal airway suction demonstrated and discussed
5	Nasopharyngeal airway suction demonstrated
6	Nasopharyngeal suction demonstrated and discussed
7	Open system tracheotomy suction demonstrated
8	Open system tracheotomy suction demonstrated discussed
9	Closed system tracheotomy suction demonstrated
10	Closed system tracheotomy suction demonstrated discussed
11	Endotracheal tube suction demonstrated
12	Endotracheal tube suction demonstrated and discussed

Skills stations

The skills stations allow participants to practise their suctioning skills on appropriate models, and via common artificial airways. During this practice session participants should receive feedback in a structured format from peers and/or facilitators.

First, the basic skill of suctioning is practised. This is followed by a case study, provided below.

A ratio of one facilitator to four (1:4) participants is recommended. Each facilitator should have one manikin suitable for having artificial airways in situ, and suitable to allow suctioning via these airways. A second airway manikin is desirable, to allow participants not directly being instructed or observed to practise before or after their turn.

Participants should be guided through each step of the process by the facilitator (as outlined above) for the first suction. For the second suction, the participants should tell the facilitator what they are doing at each step. For the third suction, feedback should only be given by the facilitator/peers at the completion of suctioning.

Case study

82-year-old man admitted with severe pneumonia.

Currently: slightly agitated.

Febrile, HR 80 (SR), SpO₂ = 88% on 2 litres (desaturating), BP 140/65.

Auscultation: coarse bibasal creps.

Co: very weak, moist, non-productive.

Bibasal expansion: poor.

Nasopharyngeal airways already in situ.

At the conclusion of your complete assessment you deduce that the patient has sputum retention, with difficulty expectorating due to weak cough.

Part a

You decide you need to suction the patient.

Participants should demonstrate suctioning the patient via the nasopharyngeal airway.

Part b

Once you have followed the correct procedures (as per the step-by-step guidelines), you discover that the suction isn't working. What do you do?

- Check equipment:
 - Is the suction unit turned on at the wall?
 - Is the suction tubing connected to the wall-mounted suction unit?
 - Is the suction tubing connected to the suction catheter you are using?
- Check operator technique, ensuring that the suction vent on catheter is occluded when suction is required.

Resource list

Resource	Quantity	Additional comments
Facilitators	3	1:4 ratio for a group of 12
PowerPoint presentation	1	Provided in module
DVD	1	Provided in module
Suction (wall or portable)	2	
Suction canisters	1	
Suction catheters size 10, 12, 14	10 of each size	
Manikin with intubatable airway	1–2	
Nasopharyngeal airways	1 set	
Guedel airways	1 set	
Tracheostomy	1 size 7	
Goggles	1 per participant	
Gloves	1 box per size	
Lubricant	1 bottle or 10 packs	
Feedback sheets	12	One for each participant
Evaluation forms	3	As a prompt for each facilitator

Summary

The summary reinforces the content covered in the facilitated discussion and skills stations. It should also allow time for participants to reflect on what they have learned. No new information should be introduced.

Major points to revise in the summary include:

- indications for suctioning
- potential adverse effects of suctioning
- the importance of individual patient assessment
- the importance of monitoring before, during and after suctioning
- the importance of using objective measures to evaluate the effectiveness of suctioning.

Participants should be encouraged to review the references in their own time to reinforce the skills acquired in this module. They should be offered access to equipment and educators in the future to allow them to practise these skills if they need to improve their skill level or confidence. Participants might also be encouraged to attend and observe a real patient being suctioned in order to put these skills into a clinical context. An educator to observe each participant's first suctioning on a real patient would be ideal.

Evaluation

A formal evaluation has been specifically developed for this module. It incorporates the objectives of the module and the perceptions of the participants about whether they have increased their understanding by working through the module. It is highly recommended that this formal evaluation be copied and completed by all participants at the completion of the module.

A range of informal evaluation tools may also be used in conjunction with this evaluation throughout the module, including those available in the Department of Human Services' *Clinical Skills Facilitators Manual* from the basic course conducted in 2007.

References

1. Akgul S. and Akyolcu N. 2002 Effects of Normal Saline on Endotracheal Suctioning. *Journal of Clinical Nursing* 11: 826–830
2. American Thoracic Society—Suctioning: [www.http://thoracic.org/sections/education](http://www.thoracic.org/sections/education), accessed 6/1/08
3. Barnett M. 2005 Tracheostomy Management and Care. *Journal of Critical Nursing* 19(1): 13–19
4. Baun M., Stone K., Rogge J. 2002 Endotracheal Suctioning: Open Versus Closed with and Without Positive End-Expiratory Pressure. *Critical Care Nursing Quarterly* 25(2): 13–26
5. Chau J. et al. (2007) An Evaluation of the Implementation of a Best Practice Guideline on Tracheal Suctioning in Intensive Care Units. *International Journal of Evidence-Based Healthcare* 5(3): 354–359
6. Clearing the Airway—EMS Responder: [www.http://publicsafety.com/article.jsp?id=2371&sitesection=16](http://publicsafety.com/article.jsp?id=2371&sitesection=16), accessed on 7/1/08
7. Day T. et al. (2002) Tracheal Suctioning: an Exploration of Nurses' Knowledge and Competence in Acute and High Dependency Ward Areas. *Journal of Advanced Nursing* 39(1): 35–45
8. Day T., Wainwright S. and Wilson-Barnett J. (2001) An Evaluation of a Teaching Intervention to Improve the Practice of Endotracheal Suctioning in Intensive Care Units. *Journal of Clinical Nursing* 10: 682–696
9. Glass C. and Grap M. (1995) Ten Tips for Safer Suctioning. *American Journal of Nursing* 5: 51–53
10. Griggs A. (1998) Tracheostomy: Suctioning and Humidification. *Nursing Standard* 13 (2): 49–56
11. Hooper M. (1996) Nursing Care of the Patient with a Tracheostomy. *Nursing Standard* 10(34): 40–43

Module 5: Airway suctioning—evaluation

Thank you for participating in this module. As part of our commitment to quality improvement the following questionnaire will be used to plan future implementation of this module. We appreciate your time completing this evaluation.

1. Overall

How would you rate this module?

poor fair good very good outstanding

2. Learning objectives

Please consider whether this module was successful in meeting the following learning objectives:

<i>Respiratory 1</i> Learning objectives of Module 5: Airway suctioning	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
Revised the most recent evidence base behind suctioning	<input type="checkbox"/>				
Identified the indications for suctioning	<input type="checkbox"/>				
Identified local/hospital policies and procedure, particularly clean compared to sterile techniques, and open compared to closed systems	<input type="checkbox"/>				
Practised the basic technique of suctioning on a manikin orally and nasally, and also through the following airways: Guedel, nasopharyngeal and tracheostomy	<input type="checkbox"/>				
Familiarity with suction canisters and troubleshooting of suction/canisters	<input type="checkbox"/>				

3. Important learning outcomes

What are the three most important things you have learned from this module?

4. Module implementation

Please indicate to what extent you agree or disagree with each of the following statements in relation to the implementation of the module.

	Strongly disagree	Disagree	Slightly agree	Agree	Strongly agree
The facilitator respected my experience	<input type="checkbox"/>				
The facilitator encouraged my participation	<input type="checkbox"/>				
I was able to ask the facilitator questions	<input type="checkbox"/>				
The facilitator was able to answer my questions	<input type="checkbox"/>				
The feedback I received was clear	<input type="checkbox"/>				
The feedback I received will assist me in my future performance	<input type="checkbox"/>				
There was adequate time for the skills stations	<input type="checkbox"/>				
There was adequate time for the facilitated discussions	<input type="checkbox"/>				
There was adequate time for the simulations	<input type="checkbox"/>				
I have increased my confidence in performing airway suctioning	<input type="checkbox"/>				
I have identified future learning needs in this topic area	<input type="checkbox"/>				

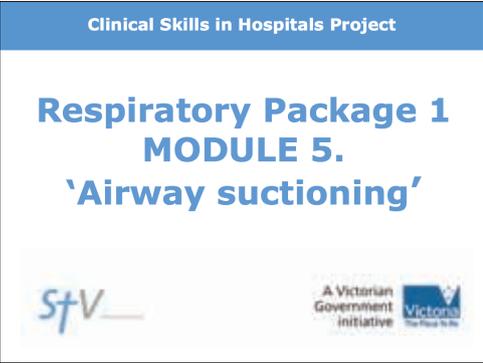
5. Future module implementation

Do you think the module should be altered in any way? yes no

If yes, what recommendations do you have?

Thank you

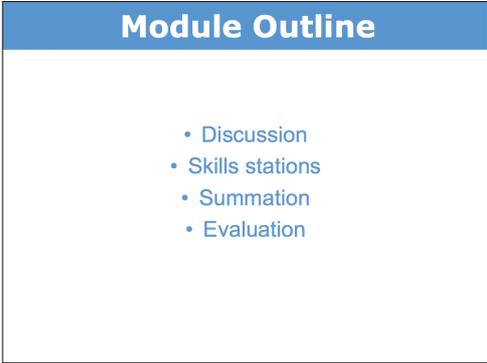
PowerPoint presentation

1. 

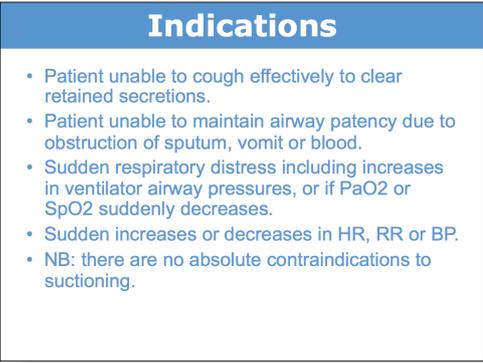
Clinical Skills in Hospitals Project

**Respiratory Package 1
MODULE 5.
'Airway suctioning'**

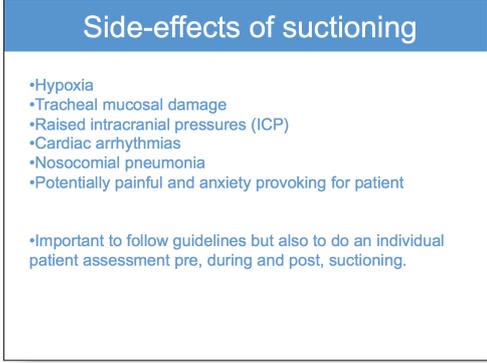
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A Victorian Government Initiative
2. 

Module Outline

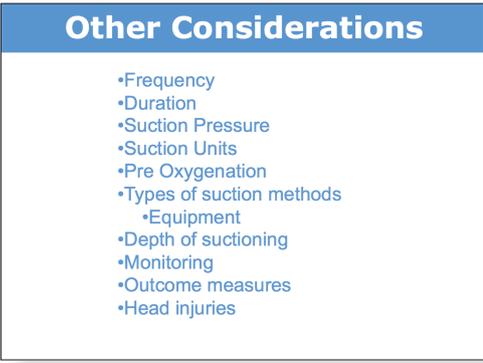
 - Discussion
 - Skills stations
 - Summation
 - Evaluation
3. 

Indications

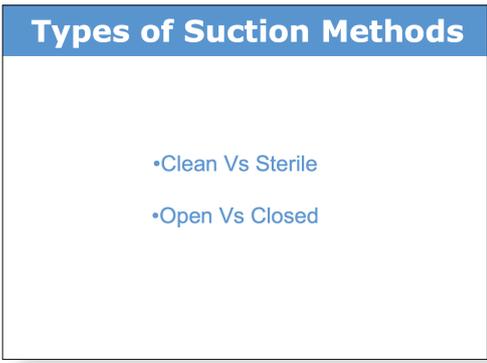
 - Patient unable to cough effectively to clear retained secretions.
 - Patient unable to maintain airway patency due to obstruction of sputum, vomit or blood.
 - Sudden respiratory distress including increases in ventilator airway pressures, or if PaO₂ or SpO₂ suddenly decreases.
 - Sudden increases or decreases in HR, RR or BP.
 - NB: there are no absolute contraindications to suctioning.
4. 

Side-effects of suctioning

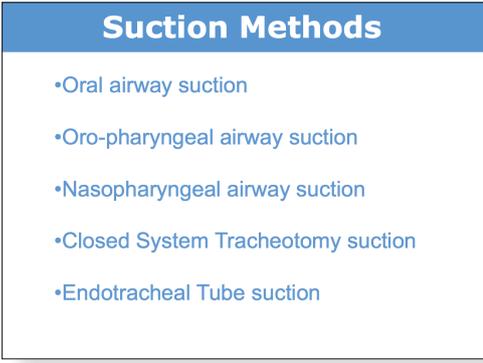
 - Hypoxia
 - Tracheal mucosal damage
 - Raised intracranial pressures (ICP)
 - Cardiac arrhythmias
 - Nosocomial pneumonia
 - Potentially painful and anxiety provoking for patient

• Important to follow guidelines but also to do an individual patient assessment pre, during and post, suctioning.
5. 

Other Considerations

 - Frequency
 - Duration
 - Suction Pressure
 - Suction Units
 - Pre Oxygenation
 - Types of suction methods
 - Equipment
 - Depth of suctioning
 - Monitoring
 - Outcome measures
 - Head injuries
6. 

Types of Suction Methods

 - Clean Vs Sterile
 - Open Vs Closed
7. 

Suction Methods

 - Oral airway suction
 - Oro-pharyngeal airway suction
 - Nasopharyngeal airway suction
 - Closed System Tracheotomy suction
 - Endotracheal Tube suction
8. 

Activity

 - Skill Stations
 - Case study
 - Summary