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1 Introduction

1.1 Introduction and purpose

Welcome to the Promoting Respiratory Health practice guide. This resource was developed by Clinical Innovation and Governance, within the Department of Family and Community Services, New South Wales, Australia (FACS).

This practice guide has been developed to support physiotherapists who are working with people with disability. It outlines current principles around good practice in the provision of services by physiotherapists and has been developed to guide clinical practice and procedures for physiotherapists working within FACS in order to promote consistent and efficient good practice. This practice guide is designed to complement organisations policies and procedures, rather than replace them.

This practice guide supports FACS physiotherapists in their clinical work and can be used by them in a number of different ways:

- alongside clinical knowledge, skills and experience to guide clinical practice.
- as a basis for self directed learning
- as part of FACS core standards learning
- for reference and clarification
- for part of the induction of new staff
- in conjunction with professional supervision
- with student physiotherapists in FACS placements

Although not specifically designed for other practitioners, sections of this practice guide may be of interest to other practitioners; for example occupational therapists, speech pathologists, nurses and dieticians. It should be read in the context of the practitioner’s scope of practice, their organisational policies and procedures, and their professional obligations.

This practice guide forms part of a number of documents, which are supports for physiotherapists and other staff; for example occupational therapists, psychologists, speech pathologists, dieticians, therapy assistants and nurses, working in FACS. There are a number of other practice guides available on our website that could be read in conjunction with this practice guide. Some of these packages provide more general information to guide practice. They also provide a context for practice; for example implementation of evidence based practice, supervision and underpinning philosophies, values and beliefs.

This practice guide forms part of the supporting resource material for the Core Standards Program developed by Clinical Innovation and Governance. Please note that some of the information contained in this package is specific to practitioners working with people with disability in New South Wales, Australia.
Feedback on this practice guide is welcomed by Email at CIGWebinars@facs.nsw.gov.au. Please include the title of the Core Standard in the 'Subject' box.

1.2 Copyright

The content of this package has been developed by drawing from a range of resources and people. The developers of this package have endeavored to acknowledge the source of the information provided in this package. The package also has a number of hyperlinks to documents and internet sites. Please be mindful of copyright laws when accessing and utilising the information through hyperlinks. Some content on external websites is provided for your information only, and may not be reproduced without the author's written consent.

1.3 Disclaimer:

This resource was developed by the Clinical Innovation and Governance Directorate of Ageing, Disability and Home Care in the Department of Family and Community Services, New South Wales, Australia (FACS).

This practice guide has been developed to support practitioners\(^1\) who are working with people with disability. It has been designed to promote consistent and efficient best practice. It forms part of the supporting resource material for the Core Standards Program developed by FACS.

This resource has references to departmental guidelines, procedures and links, which may not be appropriate for practitioners working in other settings. Practitioners in other workplaces should be guided by the terms and conditions of their employment and current workplace.

Access to this document to practitioners working outside of FACS has been provided in the interests of sharing resources. Reproduction of this document is subject to copyright and permission. Please refer to the website disclaimer for more details.

The package is not considered to be the sole source of information on this topic and as such practitioners should read this document in the context of one of many possible resources to assist them in their work.

Whilst the information contained in this practice guide has been compiled and presented with all due care, FACS gives no assurance or warranty nor makes any representation as to the accuracy or completeness or legitimacy of its content. FACS does not accept any liability to any person for the information (or the use of such information) which is provided in this practice guide or incorporated into it by reference.

\(^1\) The term practitioner as used here includes dieticians, speech pathologists, occupational therapists, physiotherapists, psychologists, behaviour support practitioners and nurses.
2 The physiotherapist’s role in preventative chest care

The NSW Ombudsman's Report of Reviewable Deaths in 2010 and 2011: Deaths of people with disabilities in care (2013) provides information about, and a review of, deaths that resulted from diseases of the respiratory system. The report highlighted that many people with disability have multiple risk factors for death related to respiratory illness. These risk factors can include:

- needing help with meals
- problems with swallowing, eating and moving around
- conditions such as epilepsy, cerebral palsy and Down Syndrome
- gastrointestinal problems such as gastro-oesophageal reflux disease (GORD)
- smoking

The report outlined that the respiratory diseases that were the leading causes of death of people with disability in care were:

- aspiration pneumonia
- pneumonia
- chronic lower respiratory diseases (for example chronic obstructive pulmonary disease, emphysema and asthma)

The risk factors for aspiration were identified as:

- feeding and swallowing problems including dependence on others for feeding, the person having difficulty sitting up or holding their head up, swallowing difficulties, eating problems and a history of choking
- limited mobility
- gastrointestinal problems including GORD and repeated vomiting and regurgitation
- recurrent respiratory infections
- neurological and neuromuscular conditions, such as cerebral palsy and epilepsy
- drowsiness and reduced alertness
- poor oral hygiene, including gum disease
- medications such as antipsychotics, anticonvulsants, sedatives and muscle relaxants

The risk factors for pneumonia were identified as:
the very young, people aged 65 years or older, those with chronic health problems and people who have weak immune systems

- smoking
- swallowing difficulties
- crowded living conditions
- hospitalisation
- alcohol and drug abuse
- impaired consciousness
- intellectual disability
- limited mobility and reliance on others for meals and dental hygiene
- gastro-oesophageal reflux disease
- history of aspiration and/or previous episodes of pneumonia
- receiving enteral nutrition
- dental problems or gum disease

The report makes a call for:

- identification of people with known risk factors, and support for them to minimise those risks
- health providers recommendations to be understood and carried out
- respiratory specialist involvement
- access to chronic disease management programs
- annual influenza vaccination for those 6 months of age or older with chronic respiratory conditions, heart disease, other chronic diseases requiring regular medical follow up or hospitalisation in the previous year, chronic neurological conditions and people with impaired immunity
- pneumococcal vaccination for people aged 65 years and above, Aboriginal and Torres Strait Islander people 50 years of age and above and those 15 – 49 years who have underlying conditions placing them at risk of invasive pneumococcal disease (IPD), people aged 10 years and above who have underlying chronic illnesses predisposing them to IPD including conditions associated with impaired immunity, chronic illness (including chronic heart, renal or respiratory disease, diabetes and alcohol related problems) and tobacco smokers
- proactive support for individuals to quit smoking

Not all people with disability the physiotherapist supports will be in care. However, the principles and recommendations provided in the report should be considered for all. The physiotherapist can have a role in minimising some of the risk factors, as well as in some of the actions, the Ombudsman makes a call for above. These roles may include some of the activities referred to in the Physiotherapy Management in Respiratory Care in FACS flow chart (see Appendix 1).
The Ombudsman NSW’s website contains a number of fact sheets about preventing the deaths of people with disability in care. For example:

- Preventing Deaths of People with Disabilities in Care – Information for Staff of Disability Services
- Preventing Deaths of People with Disabilities in Care: Breathing, Swallowing and Choking Risks
- Preventing Deaths of People with Disabilities in Care: Information for General Practitioners
- Preventing Deaths of People with Disabilities in Care: Smoking, Obesity and Other Lifestyle Risks
- Preventing Deaths of People with Disabilities in Care: Information For Licensed Boarding House Staff and Services

(Ombudsman NSW, 2013)

3 Respiratory assessment and support

Physiotherapists, as part of a team (including, but not limited to, medical practitioners, respiratory and other specialists, speech pathologists, occupational therapists, dieticians and nurses), provide assessment and support to assist with maintenance of a healthy chest in people with developmental disability.

As with all supports that physiotherapists provide the International Classification of Functioning, Disability and Health framework should be used when supporting people to meet their respiratory health goals (World Health Organisation, 2001). Specifically the physiotherapist should consider all three of the below areas:

- body functions and structures that may be impacting on respiratory health
- the activities the person does, or would like to do, and the life areas in which they participate, and how their respiratory health relates to these
- the factors in the person’s environment that may impact on their respiratory health, or be used to promote their respiratory health

People with developmental disability are predisposed to respiratory function problems due to:

- immobility
- neurological and physical conditions affecting the respiratory muscles and skeletal structure
- dysphagia/aspiration
Children with severe cerebral palsy are at risk of respiratory morbidity due to:

- recurrent aspiration due to poor coordination of swallowing, as well as increased incidence of gastro-oesophageal reflux
- poor cough and airway clearance
- respiratory muscle weakness
- kyphoscoliosis
- obstructive sleep apnoea

(Seddon & Khan, 2003)

Children with spastic quadriplegic cerebral palsy may also demonstrate upper airway obstruction when they are awake. This can be evidenced by laboured, noisy breathing and periods of apnoea. The cause may be central or obstructive (Wilkinson, Baikie, Berkowitz, & Reddihough, 2006).

The common respiratory problems seen in children with cerebral palsy include:

- recurrent infection
- atelectasis
- ventilation/perfusion inequality
- airway obstruction
- reduced lung compliance
- bronchiectasis

(Fitzgerald, Follett, & Van Asperen, 2009)

The assessment and management of drooling and gastro-oesophageal reflux is an essential part of respiratory management for children and adolescents with developmental disability (Marks, 2008) as is the management of apnoea (Wilkinson et al., 2006).

As discussed in Section 2 respiratory problems can be an issue across the lifespan for people with disability.

As with the broader population, other respiratory conditions are also seen in people with disability. These include, but are not limited to, chronic obstructive pulmonary disease (COPD) and asthma. For more information on COPD see http://www.lungfoundation.com.au/lung-information/copd/ . For more information on asthma see http://www.asthmaaustralia.org.au/What_is_asthma.aspx .

3.1 Assessment

After working with the person (and/or their person responsible) to identify their respiratory health goals, it is essential that a thorough assessment is conducted prior to commencing any support that targets respiratory function. This should include a history of the person’s chest health, as well as a subjective and
objective examination. The FACS Physiotherapy Chest Care Assessment (see Appendix 2) can be used to assist with assessment.

3.2 Support Options

Following completion of the FACS Physiotherapy Chest Care Assessment the Physiotherapy Management in Respiratory Care in FACS flowchart (see Appendix 1) can be used.

It is important that the person, and with their consent, their parent, guardian, carer or person responsible is involved as a key decision maker when developing supports or making any changes to the management of a person's respiratory health. With their consent the physiotherapist should also liaise with all involved in the person’s care (for example medical practitioners, respiratory or other specialists, speech pathologists, occupational therapists, dieticians, nurses etc.).

It is important to consider a person's capacity when assisting them to make choices about appropriate interventions, along with any contraindications and precautions.

3.2.1 Active Chest Physiotherapy

Active chest physiotherapy is indicated when the person cannot cough effectively or clear their secretions adequately, or if they have a lower respiratory tract infection (Fitzgerald et al., 2009). Active chest physiotherapy is not indicated for pooling of saliva in the mouth (although it is important there is a plan in place for pooled saliva to be cleared), simple upper respiratory tract infection, when secretions are sitting at the back of the throat (oral suction is required here), or as prevention.

Determine whether the person has recently been treated for their respiratory health in a hospital or other facility. If so, ascertain whether the person has an ongoing management plan, who is responsible for the implementation of the plan, and what is the review date. Also determine all practitioners (medical and allied health) who are involved.

It may not be the community physiotherapist who is delivering active chest physiotherapy. Direct provision of active chest physiotherapy and education of carers in delivery of the chest care program is usually provided by the health care team. However, a community physiotherapist should be able to:

- support carers to implement the plan
- recognise if / when a review of the program is required
- if their work setting requires, develop a program of active chest care if it is indicated

Active chest physiotherapy options are outlined below.

It is important to consider the timing of interventions and ensure that the person has an empty stomach. If the person is on PEG feeds ensure that at least one
hour has passed following feeding (some people may require longer therefore it is important to determine if there are any particular requirements for a particular person).

3.2.1.1 Postural Drainage

Until recently the 'gold standard' Airways Clearance Technique (ACT) for all respiratory problems requiring physiotherapy was considered to be postural drainage (PD) with percussion and vibrations (Society, 1950). This involves 12 positions that place the person so that gravity can assist in draining the mucus from the lungs. Many people with disability would demonstrate contraindications to head down postural drainage (see Appendix 3) and there is now increasing evidence that challenges the safety of the traditional head down PD positions.

Gastro Oesophageal Reflux (GOR) is well recognised as a common complication in children with developmental delay affecting their nutrition and growth and perhaps their gross motor development (Campanozzi, Capano, & Miele, 2007). Several studies have demonstrated an increased incidence of GOR when infants and children are tipped head down (Button, Heine, Catto-Smith, & Phelan, 1998; Button, Heine, Catto-Smith, Phelan, & Olinsky, 1997; Vandenplas, Diericx, Blecker, Lanciers, & Deneyer, 1991). It is acknowledged that the research referred to is predominantly in people with cystic fibrosis, but as children with disability have some features in common with those with cystic fibrosis, it is considered applicable.

Other documented complications of head down tip include increased dyspnoea (Cecins, Jenkins, Pengelly, & Ryan, 1999) and oxyhaemoglobin desaturation (McDonnell, McNicholas, & Fitzgerald, 1986). People with severe disability including developmental delay can also have marked skeletal deformity and corresponding muscle dysfunction and weakness. Effectively, they rely heavily on the use of the diaphragm for respiration which, in the head down tipped position, is at a mechanical disadvantage. Consequently most chest physiotherapy treatments for children with developmental delay are now performed in modified PD positions (Button et al., 1997).

3.2.1.2 Modified Postural Drainage (MPD)

MPD positions are (Fitzgerald et al., 2009):

- supine 30° head up
- prone horizontal
- left and right horizontal side lying
- upright sitting for apical segment of upper lobe (this is done leaning against therapist/carer shoulder or sitting upright)

There is some evidence in the general population that there is no significant difference in lung function or the weight of sputum expectorated when MPD is
compared with head down tilt (Bott et al., 2009). Consequently the safer MPD positions can be substituted for effective physiotherapy treatment.

Currently the limited available evidence (Button, Heine, & Catto-Smith, 2003) and experience has shown no adverse effects when MPD is used (Fitzgerald et al., 2009). Precautions with MPD include increased intracranial pressure, hypertension, hypotension and cardiac arrhythmias amongst others (see Appendix 3). The need for side lying for respiratory health needs to be balanced with hip care for people with cerebral palsy and like conditions who due to pain or risk of subluxation / dislocation may not be able to lie on their side.

People with severe physical disability, e.g. cerebral palsy, trialling MPD positions should be clinically observed and perhaps also monitored with pulse oximetry due to the possibility that they may desaturate in some quite standard positions. This can vary across individuals.

It is important to consider the timing of positional changes in relation to when the person has eaten or been fed. Avoid laying flat for at least an hour after eating or feeding.

3.2.1.3 Percussion, Vibrations and the Active Cycle of breathing technique

These are used as an adjunct to MPD, not increasing the amount of secretions produced but assisting the secretions to loosen from the airway wall and move from peripheral to central airways also decreasing the amount of time needed to remove secretions (Pryor, Parker, & Webber, 1981).

Vibrations may change the viscosity of mucus and this may assist with the removal of secretions, as decreased viscosity may increase the ability of the cilia to move mucus (McCarren, Alison, & Herbert, 2006). A clinical practice guideline for physiotherapists treating patients with chronic obstructive airway disease advises manual percussion is likely to be ineffective as a frequency of 15 – 25 Hz is required for optimum mucus transport. This frequency cannot be achieved manually (Langer et al., 2009).

The active cycle of breathing technique can be combined with percussion and vibration if the person has the necessary cognitive ability to participate. A description of the active cycle of breathing technique is available on the Pulmonary Rehabilitation Toolkit website: Active Cycle of Breathing.

Consider the contraindications to percussion and vibrations which are haemoptysis, flail chest, severe osteoporosis, fragile ribs, low platelet count (<25), cardiac arrhythmias and over a burn (Gallon, 1992, Pryor and Prasad 2008) and acute wounds and new grafts. Care should also be taken with people who have osteopenia and those with a platelet count<50 (Gallon, 1992).
3.2.1.4 Cough & Suction

Once secretions are loosened a cough is necessary to clear them from the central airway to be expectorated or moved to the back of the throat where it can be swallowed. The airways clearance techniques outlined above can produce a cough spontaneously and if the secretions are not overwhelming then they can be swallowed without adverse effect, provided the person has a safe swallow.

Where a spontaneous cough does not occur, the person should be verbally prompted to cough. If this is unsuccessful a cough may also be stimulated using a catheter. Alternatively external tracheal stimulation can be used. This is done by applying manual pressure to the trachea in the sternal notch below the cricoid cartilage. Use this judiciously with care as there are currently no guidelines, consensus or research on this technique (Fitzgerald et al., 2009).

If the secretions are excessive or the person is having difficulty clearing them oropharyngeal (O/P) and nasopharyngeal (N/P) suction may be necessary. In children the suction catheter is only passed as far as the pharynx to stimulate a cough, and the secretions produced are suctioned out (Parker & Prasad, 1998). In adults it may be necessary to suction deeper and the catheter needs to be passed through the vocal cords and into the trachea to stimulate coughing (Webber & Pryor, 1998). However, when performing deep tracheal suction without an artificial airway in place it is very difficult to pass a suction catheter into the trachea and the catheter can pass in to the stomach. Therefore this is not typically practiced in the community setting but rather a cough is stimulated to expel secretions to the back of the throat where they can be cleared with suction.

Suction is a traumatic experience and there are necessary precautions in suctioning (see Appendix 4) that need to be followed. Physiotherapists should only be suctioning people with disability if they have maintained an appropriate level of competence to do so in accordance with the Physiotherapy Board of Australia: Physiotherapy Code of Conduct.

Most people with disability requiring this level of care will be in an acute care facility (hospital). Alternatively their parent/carer will carry out suctioning after receiving training and equipment from an acute care facility. The parent/carer should be referred back to that facility if any issues arise. Consider obtaining consent to liaise with the hospital regarding the recommended protocols for suction of a specific person if there are concerns that the techniques being employed are not appropriate.

For those interested in further information on suctioning the reference list contains some relevant material (Brooks et al., 2001; Day, Farnell, & Wilson-Barnett, 2002; Overend et al., 2009).

People with neuromuscular disorders or spinal cord injury can be supported to cough by an insufflator / exsufflator (or cough assist) machine. These are increasingly being seen in the community and the physiotherapist should
familiarise themselves with any protocols around the use of such a machine if a person they are supporting has one.

3.2.1.5 Other Airways Clearance Techniques (ACTs)

Other ACTs are available but require a degree of physical ability, cognitive ability and cooperation. An individual who has a significant developmental disability may find these techniques difficult to perform. The techniques include using positive expiratory pressure (PEP) devices, and systems such as the Flutter device, the Acapella vibratory PEP therapy system, TheraPEP and PARIPEP. These systems cause airway vibrations that loosen mucus and slightly increase pressure in the airways that aid in keeping them open. The combined vibrations and pressure progressively moves the mucus up the airways so that it can be coughed out (Fitzgerald et al., 2009).

One cohort study (Lagerkvist, Sten, Westerberg, Ericsson-sagsjo, & Bjure, 2005) looked at the use of PEP treatment in children with severe disability. The children breathed into the PEP mask for two minutes three times and rested for five minutes in between. They were then provided with cough support. The researchers found that transcutaneous oxygen tension improved after PEP in the short term but no change in respiratory rate. The long term effects or amount of secretions produced were not discussed. The children accepted the PEP treatment. Clearly further study is needed in the use of PEP in this population.

As with all interventions, contraindications and precautions to PEP would need to be considered. For information refer to AARC Clinical Practice Guidelines: Use of Positive Airway Pressure Adjuncts to Bronchial Hygiene Therapy (1993).

There is some literature emerging regarding the use of high-frequency chest wall oscillation which is administered via a “vest”. A randomised trial of a small number of children with predominately severe cerebral palsy showed trends towards fewer hospitalisations for respiratory illness and better oxygen saturation post therapy compared with those children who received standard chest physiotherapy of postural drainage, percussion and vibrations (Yuan et al., 2010). Another small uncontrolled study has shown it may reduce the number of pneumonias in children with cerebral palsy (Schechter, 2007). This literature may provide some information to physiotherapists should they be working with a person who has been prescribed this intervention.

Exercise is effective in stimulating mucus transport in individuals with chronic obstructive pulmonary disease but does not replace specific airway clearance techniques. In a single randomised controlled trial, exercise did enhance mucus clearance in patients with chronic bronchitis but it was not as effective as coughing (Langer et al., 2009).
3.2.1.6 Precautions for all ACTs

The need for active chest physiotherapy should be reassessed regularly (Fitzgerald et al., 2009). Because of the risk of pulmonary aspiration of gastric contents from gastro-oesophageal reflux as well as aspiration of saliva, physiotherapy is routinely performed when the person has an empty stomach or at least an hour after eating.

There are a list of precautions in suctioning (see Appendix 4) and contraindications and precautions to postural drainage (see Appendix 3). It is essential that physiotherapists do not immediately perform postural drainage/percussion/vibrations, without first considering the above and consulting with the person’s GP/specialist where necessary. If there is a diagnosed chest condition it is typically first treated by a GP/specialist or acute care hospital.

3.2.1.7 Adjuncts to physiotherapy

The physiotherapist should be familiar with other interventions that may be used as an adjunct to physiotherapy. These include:

- inhaled mucolytics, in particular hypertonic saline. This both loosens mucus and stimulates cough and is generally used directly before or during airways clearance techniques as it has a short acting life. The requirement for pre-medication with a bronchodilator should be considered

- Non-invasive ventilation (NIV) such as CPAP or BiPAP (if prescribed for night time use), can be utilised during airway clearance techniques to improve airway recruitment. Inhaled mucolytics can be administered through the NIV circuits to improve deposition

- the use of inhaled antibiotics as a preventative measure for those with recurrent chest infections. The timing of the inhaled antibiotic around airway clearance regimes is important to ensure the maximal benefit of the medication i.e. generally best after ACT has been performed and mucus has been removed

When considering these adjuncts physiotherapists need to work within their scope of practice and the policies and procedures of the organisation they work for. Should a physiotherapist become involved they should ensure they have the appropriate skills, knowledge and experience to do so. The physiotherapist should discuss with the person and/or their person responsible if they consider a review of these adjuncts to physiotherapy is required.
3.2.2 Tools to maintain respiratory health

3.2.2.1 Provision of Activities

One study has found that a combined exercise and swimming program of three sessions per week for 30 minutes may improve the vital capacity of children with cerebral palsy (Hutzler, Chacham, Bergman, & Szeinberg, 1998).

There is some low level evidence that children with intellectual disability (mean age 11) who are mobile demonstrate a statistically significant increase in FEV1 (forced expiratory volume in one second) and FVC (forced vital capacity) following an eight week exercise program consisting of walking, running and cycling for 30 minutes, five days of the week (Khalili & Elkins, 2009). More research is required to look at the use of exercise to prevent lung problems in this group as it is unclear if these increases were clinically significant.

There is evidence to show that pulmonary rehabilitation has benefits on exercise tolerance, dyspnoea and health related quality of life and that pulmonary rehabilitation should be offered to those with chest wall restriction with reduced exercise capacity and / or breathlessness on exertion. It should incorporate exercise training of the muscles of ambulation and strength training of the upper and lower limbs (Bott et al., 2009). For people with disability this may involve assisting incorporation of active movement (e.g. walking and arm movements) into daily functional routines. Physiotherapists may also consider low resistance aerobic exercises for example dancing, walking, running and cycling to promote increased cardiorespiratory fitness.

Deep breathing may also be encouraged through blowing bubbles, ping pong balls, streamers, wind chimes etc. Activities that involve movement of the arms, and moving in bed can be useful. A simple verbal prompt to cough can assist with clearance. Some people with intellectual disability are not able to perform traditional therapeutic exercises due to physical or comprehension limitations. Therefore it is important to work with the person and their carers to identify alternative activities that promote movement and breathing. With their consent consult with other practitioners, for example, the speech pathologist to assist with communication.

3.2.2.2 Advice on Positional Changes

Advice on positional changes to preferentially ventilate different regions of the lung may involve prescription of equipment which allows 24 hour positioning (e.g. sidelyers, standing frames, sleep systems, seating systems) built in to daily routines. Physiotherapists should collaborate with the person/family/carer and an occupational therapist where appropriate. It is important to avoid head-down positioning as well as slumped sitting as it increases gastro-oesophageal reflux and respiratory effort (Fitzgerald et al., 2009). Exactly which parts of the lung are...
preferentially ventilated in which position varies across age groups, and is
dependant upon other factors such as initial lung volume prior to inspiration,
changes in chest wall shape and obesity (Krieg, Alison, McCarren, & Cowell,
2007).

At present the evidence is inconclusive that therapeutic positioning improves
pulmonary function in children with cerebral palsy (Barks, 2004). There is some
low level evidence that an adaptive seating system has a positive effect on
pulmonary function measures such as vital capacity and FEV1 (Nwaobi & Smith,
1986). It is important to note that children with severe cerebral palsy can de-
saturate both when using, and not using, night time positioning equipment (Hill,
Parker, Allen, Paul, & Padoa, 2009). One service has observed that oxygen
saturation levels vary between individuals and thus no one position can be
recommended as optimal for all. That is, individual measurements are required to
find what is optimal for each person (de Vries, 2010). Therefore it is important
that when prescribing any positioning system the effect on that particular person
is determined. This may be through direct clinical observation (for example the
effect on their colour or respiratory rate) or be measured using pulse oximetry.

Pulse oximetry monitors respiratory function by measuring oxygen saturation in
peripheral blood vessels (SpO2). The normal SpO2 is approximately 97% and
levels over 95% are generally considered to be within the normal range (Booker,
2008). However, some people with disability may typically rest below these
levels. It is important to establish with the treating doctor what range is clinically
acceptable for that particular person.

Procedures for using pulse oximetry include (Booker, 2008):

- ensuring the probe is applied to an area that is warm and has good
circulation
- if fingertips are being used, remove nail varnish and heavy soiling
- position the probe securely but not too tightly
- check that the oximeter is recording a pulse wave that corresponds with
  the radial pulse
- allow the oximeter to “settle” for five minutes
- reposition the probe every one to two hours if oxygen saturation is being
  recorded continuously

Whilst pulse oximeters provide information on oxygen saturations and respiratory
function, they do not give information about other indicators of respiratory
function such as carbon dioxide levels or acid base balance. Physiotherapists
within FACS have observed that oxygen level measures may be inconsistent in
the same person for the same position. Therefore oximetry must be considered
in conjunction with other clinical observations and tests (Booker, 2008). Appendix
5 outlines signs of respiratory distress and normal physiological values for infants.
and children which may give the physiotherapist some indication of respiratory status.

When addressing positioning of a person, skin integrity and comfort should also be considered.

3.2.2.3 Inspiratory muscle training

There is a recommendation based on high level evidence to consider adding inspiratory muscle training to a general exercise program where respiratory muscle weakness is thought to be contributing to the person’s problems (Bott et al., 2009). However, it is important to remember that weakness is different to dyscoordination. One review discussed that inspiratory muscle training may improve endurance exercise capacity in those with bronchiectasis (Bradley, Moran, & Greenstone, 2009). There remains insufficient evidence to support or refute the routine addition of inspiratory muscle training to a pulmonary rehabilitation program for those with COPD. For more information on inspiratory muscle training see [http://www.sierrabiotech.com/bt_copd_imt.html](http://www.sierrabiotech.com/bt_copd_imt.html). This intervention is an emerging area of practice and would be initiated in hospital. It is more likely at present to be seen in people with disability with conditions such as high level spinal cord injuries, the subgroup of people with COPD that have weakness, motor neurone disease and Duchenne muscular dystrophy.

3.2.2.4 Educate and act on respiratory risk factors

3.2.2.4.1 Mealtime Management

Physiotherapists should work with the person and their carer, and with the speech pathologist, occupational therapist, dietician and any other people involved in the person’s mealtime management to prevent aspiration.

Upper gastrointestinal dysmotility resulting in dysphagia, oesophageal reflux and gastric emptying disorders, may lead to aspiration and pneumonia (Evenhuis, Henderson, Beange, Lennox, & Chicoine, 2000a). About 50 percent of people with neuromuscular disease are reported to aspirate, which is associated with asthma and recurrent respiratory tract disease (Beange, Lennox, & Parmenter, 1999; Evenhuis, Henderson, Beange, Lennox, & Chicoine, 2000b). Respiratory disease is the leading cause of death in those with neuromuscular disease therefore it is essential to detect and treat swallowing disorders (Beange et al., 1999; Evenhuis et al., 2000b).

One case series of eight adults with severe disability demonstrated that pulse rate increased and SpO2 decreased during feeding in most participants, and in many the measures did not return to baseline after the meal. Therefore it is important to consider customized guidelines for feeding and positioning to minimise circulatory system compromise (Tamura, Shishikura, Mukai, & Kanako, 1999). There is some low level positive evidence that positioning for feeding and the use of appropriate thickeners in children with severe cerebral palsy can improve pulmonary function (Gisel et al., 2003).
Due to the life threatening risk posed by choking and aspiration, head and neck posture is particularly important. Speech pathologists, in consultation with the person’s doctor, may recommend diagnostic tests to determine which position is optimal for a person’s swallowing e.g. modified barium swallow or Fiberoptic Endoscopic Evaluation of Swallowing (FEES).

The Interdisciplinary Mealtime Management Modules were developed in April 2003 for use by FACS therapists. They were developed following the introduction of the Nutrition and Swallowing Checklist and Manual which resulted in an increase in the number of people with nutrition and swallowing problems being referred to therapists for mealtime assistance. The aims of these training modules were to provide a framework in which therapists can investigate the topic of mealtime management to:

- increase knowledge and skills in safe mealtime management
- enhance effective team work
- identify when to call in another discipline or when to refer outside the department for specific services
- work collaboratively to understand the impact and role of own discipline on other clinicians when making recommendations for the person
- promote the development of joint goal setting and interdisciplinary mealtime management plans

FACS has recently updated the Mealtime Management Modules to an e-learning course. Designed for FACS speech pathologists, occupational therapists, physiotherapists, dieticians, nurses, behaviour support practitioners, psychologists and therapy assistants the course features videos, including personal experiences and views of families, carers and people with disability at mealtimes.

3.2.2.4.2 Address other respiratory risk factors and needs

Discuss with the person (and their person responsible where required) whether they:

- require a medical or specialist review
- need a review by another allied health professional
- need assistance with oral hygiene
- need a dental appointment
- require an influenza and / or pneumococcal vaccination
- require a review for reflux
- need assistance with saliva management
- need assistance with bowel management
- need to be referred for review of their sleep
■ need a referral to a chronic disease management program; and/or
■ need support to quit smoking

3.2.2.5 Working with a person in the community who has a tracheostomy

Community physiotherapists may provide supports to people who have a tracheostomy. The primary carer will have been trained to care for the tracheostomy by the team in the hospital who implemented the tracheostomy. Ongoing management of the tracheostomy and chest care is usually through the local doctor in collaboration with the treating physicians and hospital staff (including but not limited to tracheostomy clinical nurse consultants, speech pathologists, respiratory physicians etc.).

When a tracheostomy is seen to be in place, the community physiotherapist should, prior to working with the person, discuss with the carers the plan for managing any issues with the tracheostomy that may arise (blockages, sputum removal, dislodgement) whilst the physiotherapist is present. It is preferable if this is the same as the management of the situation should the physiotherapist not be present. Physiotherapists need to work within their scope of practice and the policies and procedures of the organisation they work for. Should a physiotherapist become involved they should ensure they have the appropriate skills, knowledge and experience to do so.

3.2.2.6 Management of chronic obstructive pulmonary disease (COPD)

People with disability may also have chronic obstructive pulmonary disease (COPD). The Lung Foundation of Australia website contains information and resources about COPD and links to the guidelines for the management of COPD (McKenzie et al., 2012) and the Pulmonary Rehabilitation Toolkit.

The physiotherapist may be involved in different parts of the COPD management outlined above depending on where they work. When promoting the respiratory health of a person with disability who also has COPD, the physiotherapist should familiarise themselves with the supports that are in place for the person in relation to their COPD.

3.2.2.7 Management of asthma

People with disability may also have asthma. For information and resources about asthma see The Asthma Australia website, the National Asthma Council Australia website and the Australian Asthma Handbook 2014. The Australian Asthma Handbook (National Asthma Council Australia, 2014) outlines:

■ diagnosis – in both adults and children
■ management in adults and children, adherence and inhaler device and technique
■ managing acute asthma – clinical management and first aid
The physiotherapist may be involved in different parts of the asthma management outlined above depending on where they work. When promoting the respiratory health of a person with disability who also has asthma, the physiotherapist should familiarise themselves with the person’s written asthma action plan.

4 Intersections between the community physiotherapist and other services in respiratory care

The role of the physiotherapist in the community can vary. Many factors can influence the role including location, their employer, the needs of the people they are providing a service to, and their proximity to health facilities.

In some community based organisations the physiotherapists do not provide active chest physiotherapy. Where the community based physiotherapist does not provide active chest physiotherapy, the local hospital or the family/carers who have been trained will continue to provide the active chest care program after discharge for a period of time. In this situation the physiotherapists located in the community may assist carers to negotiate a review with the hospital to determine if active chest care program can cease. Consequently it is important for the community physiotherapist to have a clear understanding of the techniques, their indications and contraindications. If a hospital has been involved it is important to obtain information from them, with the person’s consent, regarding the interventions utilised at the hospital, and their recommendations regarding ongoing interventions and review. In these situations the community physiotherapist may be involved in establishing programs in the home environment that encourage activity, assist 24-hour positioning, and minimise respiratory risk factors.

In some settings community physiotherapists are required to initiate active chest care programs and train carers. Other community physiotherapists may be involved in the provision of active chest physiotherapy.
When establishing a chest care program that will be carried out by paid staff who are not physiotherapists, establish with those staff (and/or their managers) who has the appropriate delegation and training within that organisation to carry out that program.

The Physiotherapy Management in Respiratory Care flow chart (Appendix 1) can be used to determine the most appropriate course of intervention.

It is important for the physiotherapist to discuss with the person and/or their person responsible what other supports they are, or can, access in relation to their respiratory care and what their goals are. In some situations, and with the person’s consent, it may be necessary to negotiate with those services, the specific roles of the therapy providers in the care of the person. It is recommended that physiotherapists seek support from a senior clinician if required.
5 Appendices

5.1 Appendix 1: Physiotherapy Management in Respiratory Care in Family and Community Services (FACS)

For more detail please refer to the Promoting Respiratory Health Practice Package.

Support the person (and their person responsible) to identify their respiratory health goals

Complete FACS Physiotherapy chest care assessment

Address Medical and specialist review, other allied health and dentist review, mealt ime management, oral hygiene, immunisation, reflux, saliva management, bowel management, chronic disease management program referral, quit smoking, if required.

Does the person have a lower respiratory tract infection, or difficulty coughing and clearing secretions?

YES

Has the person recently been treated for this at a hospital?
If so:
• Is there an ongoing chest care plan?
• If yes, who is responsible for the implementation of it and what is the review date?

ACTIVE CHEST PHYSIOTHERAPY:
NB: It may not be the community physiotherapist delivering these interventions. Direct provision of active chest physiotherapy and education of carers in delivery of chest care program is usually provided by the health care team.

The community physiotherapist must however be able to:
• Support carers to implement the program
• Recognise if / when a review of the program is required
• If their work setting requires, develop an active chest care program if it is indicated.

Consider if any of the following are indicated or contraindicated:
Deep breathing – encouraging active movement, deep breathing, blowing bubbles etc.
Cough – prompt person to cough themselves, external tracheal stimulation (judiciously), suction (by the carer who has been provided equipment by, and been trained at, the hospital)
Exercise/Movement – encourage any active movement possible e.g. upper limb movements, blowing bubbles, moving in bed, walking etc.
Modified postural drainage – monitoring O2 sats. using pulse oximetry
Percussions and vibrations – if not contraindicated
Active cycle of breathing
High frequency chest wall oscillation, PEP

REVIEW BY RETURNING TO THE TOP OF THE PAGE

NO

TOOLS TO MAINTAIN RESPIRATORY HEALTH

Encourage activity: e.g. Upper limb movements, blowing bubbles, moving in bed, breathing and coughing, aquatic physiotherapy, walking, cycling, swimming

24 hour positioning: in collaboration with OT and SP, prescribe positions using clinical observation and consider pulse oximetry as a guide (note variability)

Educate and act on respiratory risk factors: e.g. Smoking, oral hygiene, coughing/choking when eating, chronic disease management program

AND
5.2 Appendix 2: Physiotherapy Chest Care Assessment

To be used by Physiotherapists to guide the assessment of the respiratory status of a person with disability and to assist with decisions around helping to maintain a healthy chest.

Person’s name: ________________________________
Physiotherapist: ______________________________
Date of assessment: ______________________________

SECTION 1: HISTORY OF CHEST ISSUES:

1.1 Has the person recently received physiotherapy services for chest care?
Yes/No
If yes:
What interventions were recommended? __________________________
Who made these recommendations? __________________________
Have the person/carers been instructed in the program? _____________
Are they currently being implemented? __________________________
If not, why were they discontinued? __________________________
Have they been effective? __________________________
Has a review date been set? __________________________
When and where is the review to take place? __________________________

1.2 Has the person had a review of their chest by their GP in the past 3 months? Yes/No
If yes:
Who was the doctor? __________________________
When was the review? __________________________
What was the outcome of the review? __________________________

1.3 Has the person had a review by a respiratory specialist in the past 12 months?
Yes/No
If yes:
Who was the specialist? __________________________
When was the review? __________________________
What was the outcome of the review? __________________________

1.4 Does the person have a diagnosed chest condition (e.g. pneumonia, aspiration, bronchitis, bronchiectasis, asthma, emphysema, chronic obstructive pulmonary disease etc.)? Yes/No
If yes, what is it? __________________________
If the person has asthma do they have an asthma action plan? ______________
If the person has COPD do they have a management plan? ______________

1.5 Does the person have any other medical condition? Yes/No
If yes, what? ______________________________

1.6 Is the person on any medication? Yes/No
If yes:
List the medication/s and how they are administered: ______________________________

If any are administered by a puffer, does the person use it effectively? ______

Are any of these anticonvulsants, antipsychotics, sedatives or anti-anxiety medications?

Has the medication type or dosage been adjusted recently? If yes, how? ______

1.7 Does the person have a history of frequent chest infections requiring medical intervention (>2 per year)? Yes/No
If yes:
What has been the cause of these infections (e.g. aspiration, bacteria, virus etc.)?

1.8 Has the person had the influenza vaccination? Yes/No
If yes, when? ______________________________

1.9 Has the person had the pneumococcal vaccination? Yes/No
If yes, when? ______________________________

1.10 Does the person have reflux? Yes/No
If yes how is it managed? ______________________________

1.11 Does the person have other gastrointestinal problems e.g. vomiting or regurgitation? ______________________________
If yes:
Is there a medical management in place for this? ______________________________
1.12 Has the person had surgery on their chest (e.g. lobectomy, Harrington Rods for scoliosis etc. or other relevant surgery)? Yes/No
If yes:
What surgery did they have? ____________________________________________
When did they have the surgery? _______________________________________
Did they have any problems with their chest after the surgery (either immediately or in the longer term)? Yes/No
If yes what were they? _______________________________________________

1.13 Has a Nutrition and Swallowing Checklist been completed? Yes/No
If yes, when? _______________________________________________________

1.14 Has dysphagia been identified as an issue for this person? Yes/No
If yes, who is involved in managing the dysphagia? _______________________

1.15 Does the person have a Meal Time Management Plan in place? Yes/No
If yes:
What were the main recommendations? _________________________________
When was it last reviewed? ___________________________________________

1.16 How does the person get their nutrition (e.g. orally feeding self, fed orally by carers, fed via an NG tube, or fed enterally via a gastrostomy or jejunostomy)? ________________________________

1.17 Is the person being supported by a dietician? Yes/No
If yes, who is the dietician and when were the most recent recommendations made?
__________________________________________________

1.18 Does the person have any issues with oral hygiene? Yes/No
If yes:
What are the issues? ________________________________________________
How are they being managed? _________________________________________
__________________________________________________

1.19 Does the person have a Health Care Plan? Yes/No
If yes:
When was it last reviewed? ___________________________________________

1.20 Does the person have a Lifestyle Plan? Yes/No
If yes:
When was it last reviewed? ___________________________________________

1.21 Does the person have a Physical Activity Plan? Yes/No
If yes:
When was it last reviewed? ___________________________________________
SECTION 2: SUBJECTIVE ASSESSMENT:

2.1 What are the current symptoms?

2.2 What does the person/carer think has changed to cause the symptoms?

2.3 What is worrying the person most?

2.4 What is worrying the carer most?

2.5 How does the person usually display respiratory distress?

2.6 Does the person have a fever? Yes/No
   If yes, how does the person/carer know this? What is the person's temperature?

2.7 Has the person been experiencing shortness of breath? Yes/No
   If yes:
   Is it a rest, after exertion, or both? How long does it take to settle?

2.8 Is the person able to cough? Yes/No
   If yes:
   When does the cough occur (e.g. after a change in position, after exertion, after eating or drinking, when prompted to cough etc.)?
   Is it effective?

2.9 Is the person currently producing sputum? Yes/No
   If yes:
   How much are they producing?
   Is it the same amount, more, or less than normal?
   What colour is it?
   How thick is it?
   What time of the day are they producing it?

2.10 Is the person’s breathing noisy? Yes/No
   If yes:
   Is this typical for this person?
   Is the sound heard on inspiration, expiration or both?
   How can this be relieved?
2.11 Does the person appear drowsy or have a decreased level of alertness?

If yes:
Is this typical for this person? _______________________________
Has this been reviewed by the person’s GP? ____________________

2.12 Is the person in pain? Yes/No
If yes:
Where is the pain? _________________________________________
What makes it worse? ________________________________________
What makes it better? ________________________________
How is the pain being managed? _____________________________

2.13 Is the person waking during the night due to coughing or breathlessness or both?

2.14 What position/s does the person sleep in? ________________________

If they are elevated in bed:
How many pillows are they using? ___________________________
Is the head of the bed elevated? ______________________________

2.15 Does the person snore? Yes/No
If yes:
Has this been investigated? _________________________________
By who? _________________________________________________
What was the outcome? ____________________________________

2.16 Does the person have sleep apnoea? Yes/No
If yes, do they require non-invasive ventilation (e.g. CPAP) and what time of the day is it used? _______________________________

2.17 Is the person able to walk? Yes/No
If yes:
Do they walk on their own, with an aid, or supported by a carer? ____________
How far can they walk? ______________________________________
Is this usual for this person? _________________________________

2.18 Does the person use a wheelchair for mobility? Yes/No
If yes:
Do they use it in the home? _________________________________
Do they use it in the community? ____________________________

2.19 If the person is not mobile, what positional changes are occurring throughout the day and night?

__________________________________________________________________

Promoting Respiratory Health Practice Guide Version 1.1 December 2014
2.20 Does the person have a tracheostomy?  Yes / No
If yes:
When was it inserted? ________________________________
Who has been trained in the management of it? ________________
Who provided the training? ________________________________
Who is monitoring it? ________________________________
How often is the person suctioned via the tracheostomy? ________________
What is the amount, colour and consistency of their secretions and has this recently changed? ________________________________

2.21 Can the person tolerate:
Supine?  Y/N
Prone?  Y/N
Left side lying?  Y/N
Right side lying?  Y/N

2.22 Does the person have any problems with pressure areas? __________

2.23 Does the person smoke? Yes/No
If yes:
How many cigarettes do they smoke each day? ________________________________
How long have they smoked for? ________________________________
Have any actions been taken to encourage the person to stop smoking?  Yes/No
If yes: what are they? ________________________________

2.24 Is the person being exposed to any passive tobacco smoke? Yes/No
If yes, where are they being exposed to the smoke? ________________________________

2.25 What is the person's body mass index (or what is their height and weight for calculation)? ________________________________

SECTION 3: OBJECTIVE ASSESSMENT:

3.1 Respiratory rate ___________ breaths per minute

3.2 Pulse rate _________________ beats per minute

3.3 O₂ sats (pulse oximetry):
• At rest _____ % (Person's position when measured ________________
• After exertion (if applicable) _____ %
• After coughing (if applicable) _____ %
Are the saturation levels consistent across trials or variable? ________________
Are the saturation levels affected by the person's position? ________________________________
If yes, how? ________________________________
Are these levels typical for this person? ________________________________
3.4 Are there signs of cyanosis (bluish colour)? ______________________
If yes:
Is it central? (tongue, lips etc.)? ______________________
Is it peripheral? (e.g. finger tips, ear lobes, toes etc.) ______________________

3.5 Is there clubbing of the person's fingertips? ______________________

3.6 Auscultation:

<table>
<thead>
<tr>
<th></th>
<th>Left upper</th>
<th>Left lower</th>
<th>Right upper</th>
<th>Right mid</th>
<th>Right lower</th>
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<tbody>
<tr>
<td>Breath sounds</td>
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<tr>
<td>(normal, increased,</td>
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<td>decreased or absent)</td>
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<td>(Y/N)</td>
<td></td>
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<tr>
<td>Wheeze</td>
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<td>(Y/N)</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Pleural rub</td>
<td></td>
<td></td>
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</tbody>
</table>

3.7 Has the person had a chest X-ray? ______________________
If yes:
What does the PT see on the X-ray? ______________________
What does the report say? ______________________

3.8 Are there any deformities/abnormalities in the person's chest wall/spine?
Yes/No:
If yes:
What are they (e.g. scoliosis, funnel chested, pigeon chested etc.)? ________

Is their seating and positioning modified to accommodate these deformities/abnormalities? ______________________
If they have a scoliosis what is the concave side? ______________________
SECTION 4: ASSESSMENT IMPLICATIONS:

4.1 Does the person require active chest physiotherapy? (Refer to sections 1 to 3 above, the Physiotherapy Management in Respiratory Care in FACS flow chart and the Promoting Respiratory Health Practice guide)

4.2 If an active chest care program is already in place:
Are the person/carers having any issues with carrying it out? ________________
Does a review need to be arranged? ______________________________________

4.3 Does the person require a program to maintain their respiratory health?
(Refer to sections 1 -3 above, the Physiotherapy Management in Respiratory Care in FACS flow chart and the Promoting Respiratory Health Practice guide) ________

4.4 If the person has a program to maintain their respiratory health:
Are the person/carers having any issues with carrying it out? ________________
Does it need to be reviewed? ____________________________________________

4.5 Does the person require a referral to a doctor, respiratory physician, sleep physician, speech pathologist, occupational therapist, dietician, chronic disease management program, quit smoking program, dentist or another professional based on any of the assessment findings? ________________
If yes: Have you obtained consent to refer them or provided them/ or their carers with information on them? (note some of the above require referral through the GP)

Signed by physiotherapist: ________________________________
5.3 Appendix 3: Contraindications and precautions for postural drainage

CONTRAINDICATIONS TO HEAD DOWN TIP POSTURAL DRAINAGE
Precautions for all postural drainage positions¹,²

Head:

- head injury – raised intra-cranial pressure
- neck or head swelling / surgery / burns
- facial fractures
- oesophageal surgery / tracheoesophageal fistula
- recent eye surgery
- recent CVA - (cerebral vascular accident / stroke)
- cerebral oedema
- cerebral aneurysm

Cardio Vascular System:

- cardiac instability
  - arrhythmia – (absence of rhythm/abnormal rhythm)
  - bradycardia – (slowness of heart usually manifested in pulse rate)
  - congestive cardiac failure
  - acute myocardial infarction
- hypertension
- ionotropic drugs
- aortic aneurysm

Respiratory:

- frank pulmonary oedema
- pulmonary emboli
- orthopnea (need to sit up to breathe more easily)
- severe bronchospasm
- emphysema
- chronic obstructive airways (pulmonary) disease
- idiopathic dyspnoea (difficult or laboured breathing)
- hypoxia (deficiency of oxygen)
- acute respiratory failure
- haemoptysis (coughing up blood)
Abdominal:
- gastro-oesophageal reflux
- hiatus hernia
- gross ascites – (accumulation of fluid)
- haematemesis – (vomiting of blood)
- late pregnancy
- recent feeds or current naso-gastric tube feed
- peritoneal dialysis

Other:
- any child under 2 years of age
- recent surgery
- trauma to the head or neck

5.4 Appendix 4: Precautions when Suctioning

Routine suction following chest physiotherapy should be performed when the person has an empty stomach or at least 1 hour after eating.

- Hands should be washed and gloved.
- There is a risk of vomiting with suction so the person should be positioned on their side if able (consider comfort, reflux etc.)
- The suction pressure (vacuum pressure) should be sufficient to draw the secretions up the catheter but no greater than 8.0-20kPa (60-150mmHg). Remember suction only to the back of the throat to facilitate a cough in children.
- Suction pressure should only be applied on extraction of the catheter.
- The catheter should not be too large.
- Suction can cause adverse effects which include mucosal trauma, hypoxia, tachycardia or bradycardia and bronchospasm so close monitoring of the person is required.
- It is also very easy to make the nose bleed so nasopharyngeal suction should be done with care. Nasopharyngeal suction may be contraindicated for those with coagulopathy or on anti-coagulant medication.

NB: FACS physiotherapists are not generally involved in providing suction except in some settings. This information is provided to enable physiotherapists who are monitoring respiratory programs to determine if techniques are being performed correctly and if a referral back to the prescribing facility is required. Those who are providing suction should consult with the prescribing clinician regarding technique and equipment for that particular person.
References for Appendix 4:


Additional resources for Appendix 4:


5.5 Appendix 5: Signs of respiratory distress and normal values

Signs of respiratory distress & Normal Values

### Tachypnoea – RR > 60

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<thead>
<tr>
<th>Age</th>
<th>Breath per minute</th>
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<tbody>
<tr>
<td>Newborn</td>
<td>30 - 50</td>
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<tr>
<td>&lt; 2 years</td>
<td>20 - 40</td>
</tr>
<tr>
<td>2 - 6</td>
<td>20 - 40</td>
</tr>
<tr>
<td>&gt; 6 years</td>
<td>15 - 30</td>
</tr>
</tbody>
</table>

### Tachycardia – increased HR / Bradycardia – decreased HR

<table>
<thead>
<tr>
<th>Age</th>
<th>HR (range)</th>
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</thead>
<tbody>
<tr>
<td>Newborn</td>
<td>140 (100 - 200)</td>
</tr>
<tr>
<td>&lt; 2 years</td>
<td>130 (100 – 190)</td>
</tr>
<tr>
<td>2 - 6</td>
<td>80 (60 – 140)</td>
</tr>
<tr>
<td>&gt; 6 years</td>
<td>75 (60 – 90)</td>
</tr>
</tbody>
</table>

**Infants and children**

Breathing pattern of recession.
The compliant chest wall is pulled inward during inspiration due to the high negative intrathoracic pressure. It can be intercostal, subcostal, and substernal.

Tracheal Tug (suprasternal) – the increased pull of the diaphragm is transmitted as a downwards tug on the trachea during inspiration.

Pallor / grey / mottled / dusky / cyanosis – Infants are slow to appear cyanosed so this is an unreliable sign. Instead look for a child going pale, mottled or grey

Accessory muscle use. The muscles of the neck appear to be moving when the child breathes in.
Sweating - There may be increased sweat on the head, but the skin does not feel warm to the touch. More often, the skin may feel cool or clammy.

Reduced activity / floppy / inability to feed or cry
These are signs that the child or baby is using all their energy for breathing. When feeding it may be difficult as they need to take frequent pauses due to their tachypnoea.

Agitation, irritability or confusion can be a sign of increasing CO2 retention or hypoxia

Infants
Nasal Flaring – in infants this is a flaring of the nostrils in an effort to increase the diameter of the airway decreasing airway resistance.

Expiratory grunting – occurs in infants when due to an automatic response they actively adduct the laryngeal muscles so they are expiring against a partially closed glottis to increase the auto PEEP to increase functional residual capacity to improve ventilation.

Head bobbing – seen in infants as they attempt to use the accessory muscle of respiration (sternocleidomastoid & scalenes) which are under developed against neck extensions which are also under developed so the head isn’t stabilised so the head bobs.

Neck extension – in infants this is an attempt to decrease airways resistance

<table>
<thead>
<tr>
<th>Age</th>
<th>Systolic / diastolic</th>
</tr>
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<tbody>
<tr>
<td>Newborn</td>
<td>50 - 70 / 25 – 45</td>
</tr>
<tr>
<td>&lt; 2 years</td>
<td>87 – 105 / 53 - 66</td>
</tr>
<tr>
<td>2 – 6 years</td>
<td>95 – 105 / 53 - 66</td>
</tr>
<tr>
<td>&gt; 6 years</td>
<td>97 – 112 / 57 - 71</td>
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</tbody>
</table>
ABGs and O2 saturations are the same as for adults

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
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<td>80 - 100 mmHg</td>
</tr>
<tr>
<td>PaCO2</td>
<td>35 – 45 mmHg</td>
</tr>
<tr>
<td>pH</td>
<td>7.38 – 7.42</td>
</tr>
<tr>
<td>HCO2</td>
<td>22 - 26 mmol/L</td>
</tr>
<tr>
<td>BE</td>
<td>+ or – 2</td>
</tr>
<tr>
<td>SaO2</td>
<td>95 – 100%</td>
</tr>
</tbody>
</table>
6 References:


