Respiratory Assessment 1: Why do it and how to do it?

Author

Massey, Debbie, Meredith, Tara

Published

2010

Journal Title

British Journal of Cardiac Nursing

Respiratory assessment: why do it and how do it?

Abstract

The increasing demand for hospital beds, coupled with an ageing population and shorter hospital stays have resulted in increased patient acuity. These patients are at risk of clinical deterioration, which can have life threatening consequences. Patients with cardiac disease are perhaps even more vulnerable, and more at risk of acute deterioration, they are often older and have multiple co-morbidities. Changes in respiratory function are increasingly recognised as the most sensitive indicator of patient deterioration. However there is clear evidence that nurses may lack the required skills and knowledge to undertake a comprehensive respiratory assessment.

This paper offers practitioners an opportunity to develop and augment their knowledge and understanding of respiratory assessment. It suggests a systematic model that may be used in clinical practice. By incorporating this model into every day practice patient outcomes can be improved.

Key words

Respiratory assessment, clinical assessment, deteriorating ward patient.

Introduction

Technological developments, an increasing aging population and economic rationalisation are all factors responsible for increasing cardiac patient acuity in hospital wards. Acute hospitals now have an increasing proportion of cardiac patients with complex care needs. These patients are likely to become seriously ill during their hospital stay or may suffer serious physiological deterioration that may be recognised but not acted on by clinical staff caring for these patients (McQuillan, Pilkington et al. 1998; Jacques, Harrison et al. 2006; Massey, Aitken et al. 2008).

The increase in patient acuity impacts on clinical practice in a number of ways. Firstly clinical staff may not have the knowledge and skills to safely identify acutely ill ward patients at risk of serious deterioration (Daffurn, Lee et al. 1994; Franklin and Mathew 1994). Secondly, clinical staff may lack the knowledge and skills to safely care for these patients (Smith and Poplett 2002). Thirdly, major adverse events (MAE) including, cardiac arrest, unplanned admissions to the intensive care unit (ICU), and death occur more frequently in the acutely ill ward patient. Arguably, patients with cardiac disease are at increased risk of life threatening deterioration, these patients are often older and have multiple co-morbities. Studies have established that many of these events are preceded by warning signs in the form of physiologic instability (e.g., tachypnea, tachycardia, hypotension, decreased oxygen saturation, and changes in conscious state) (Franklin and Mathew 1994; Harrison, Jacques et al. 2006; Jacques, Harrison et al. 2006. An international study (Kause, Smith et al. 2004) examined the physiological abnormalities preceding cardiac arrests, deaths and unanticipated ICU admissions in participating hospitals in the UK, Australia and New Zealand. Serious physiological abnormalities were documented to be present in 60% of all ward patients. Twenty-nine patients studied had physiological abnormalities that were recorded continuously for periods of up to twenty-four hours prior to the primary event. In Australia, Hillman and

colleagues (2001) also found a high incidence of serious vital sign abnormalities in the period before potentially preventable hospital deaths. In theory, if abnormal physiology is identified early and corrected effectively, outcomes may improve.

Rapid Response Systems (RRS) have been developed to improve the morbidity and mortality in acutely ill ward patients who experience acute physiological deterioration .These systems have been developed in Australia , USA and Europe . RRS are hospital wide systems that provide a safety net for ward patients who suddenly deteriorate and develop complex care needs that may be outside the scope of clinical ward staff knowledge and skills (DeVita et al., 2006). The National Institute for Clinical Excellence recommends the introduction of RRS in acute care settings (NICE 2007).with the aim of improving the care and management of the deteriorating ward patient and reducing the incidence of major adverse events. It is imperative the patient management in the cardiac ward setting is optimised by more judicious identification of clinical deterioration of the acutely ill cardiac patient. Failure to seek and provide appropriate and timely care to patients at risk of clinical deterioration has led to the concept of 'suboptimal care'. A confidential inquiry into the quality of care before admission to ICU demonstrated that the management of airway, breathing and oxygen therapy in the acutely ill ward patient may be suboptimal and this increases patients' morbidity and mortality (McQuillan, Pilkington et al. 1998). The ability to recognise respiratory abnormalities is therefore a key factor in the prevention of an impending adverse event and prevention of deterioration in the cardiac patient. The recognition and interpretation of physiological abnormalities is primarily a nursing responsibility (Considine and Botti 2004; Duff, Gardiner et al. 2007). However there is clear evidence that nurses may lack the required skills and knowledge to undertake a comprehensive respiratory assessment (Considine 2005; West 2006; Duff, Gardiner et al. 2007; Massey, Aitken et al. 2008).

Respiration rates are increasingly cited as one of the most sensitive and important indicators of an impending MAE (Goldhill, Worthington et al. 1999; Jacques, Harrison et al. 2006; Cretikos, Bellomo et al. 2008). Despite this there is increasing evidence that nurses do not routinely assess, record or document this important physiological parameter (Cullinane, Findlay et al. 2005; McLaughlin, Leslie et al. 2007; Chaboyer, Thalib et al. 2008; Cretikos, Bellomo et al. 2008). Accurate and timely respiratory assessment is therefore a vital component of holistic patient care and this is suboptimal when not comprehensive (West 2006). However many nurses appear to regard the skills and knowledge associated with respiratory assessment as a medical role rather than a legitimate nursing activity (Duff, Gardiner et al. 2007). Nurses who are unable to apply the theory of biological science to their practice (Clancy, McVicar et al. 2000) and communicate with other health care providers may predispose the acutely ill patient to fragmented, disjointed and even antagonistic care (Andrews and Waterman 2005). This delays the medical review of patients and predisposes them to detrimental outcomes and suboptimal care.

This paper offers practitioners an opportunity to develop and augment their knowledge and understanding of respiratory assessment. The aim of this paper is to enable practitioners caring for patients with cardiac conditions to develop a more holistic approach to clinical assessment thus improving patient care and management. This paper is the first of two articles describing respiratory assessment. This first paper discusses inspection and palpation. In the second paper the assessment techniques of percussion and auscultation are addressed.

Assessing the Respiratory System.

Assessment of the respiratory system requires a logical and objective approach. This will ensure that clinical findings can be clearly linked to diagnostic reasoning and patient care plans. A common mistake in examining the respiratory system is to rush into listening to the breath sounds before systematically examining the patient. It is important to perform the assessment with a structured and logical approach. The Jarvis Model (2009) provides practitioners with a systematic method of assessing the respiratory system. Jarvis (2009) recommends a comprehensive four-step approach to patient assessment. These four steps involve: inspection, palpation, percussion and auscultation.

Preparation for respiratory assessment

Assessment of the respiratory system is best undertaken in a quiet, well-lit environment. This may not always be easy to accomplish in a busy clinical setting. Correct patient positioning is essential for respiratory assessment. If possible the patient should be in a sitting position that allows visualisation and access to the posterior and anterior thorax. It is also important to remember to ensure and promote patient privacy during the assessment. The patient should ideally be undressed to the waist and in the sitting position on the edge of the bed or in a chair. If the patient is to unwell to sit upright then the assessment should be performed in the position the patient finds most comfortable. For example, patients with an intrapulmonary left to right shunt such as an arteriovenous malformation may find it easier to breathe when they lie flat.

Inspection

Inspection is the cornerstone of a thorough and effective respiratory assessment. A common mistake in examining the respiratory system is to rush the inspection aspect of the assessment. Each stage of the assessment builds on the last and will guide you towards any abnormality so that by the time you are ready to auscultate you will have a list of differential diagnoses. Before commencing a detailed respiratory assessment you should undertake a general examination of the patient. Patients' height, build and weight should be noted. For example, is there evidence of weight loss, which may be indicative of hyperthyroidism or malignancy (Mangione 2008). Evidence of weight gain may reflect heart failure. Inspection can also reveal important information regarding skin color. The fingers may have the characteristic yellow discoloration associated with cigarette smoking. A dusky or bluish tinge to the skin indicates cyanosis (figure 1.0) and reflects a decrease in the oxygen content of the blood (Jarvis 2008). It is important to differentiate between central and peripheral cyanosis. Central cyanosis is the result of prolonged hypoxia and indicates a ventilation perfusion mismatch, implying serious heart or lung disease. Central cyanosis is best observed in the lips, oral mucosa and the tongue (Jarvis 2008; Mangione 2008). Peripheral cyanosis (figure 1.0) indicates vasoconstriction, for example a physiological response to a cold environment or may reflect a pathological response to low blood flow to peripheries such as cardiogenic shock. Be aware that increased melanin might mimic cyanosis in darker skinned individuals and make assessment for cyanosis more challenging. In dark skinned patients the best areas to assess for cyanosis is the oral mucosa and lips. Pallor may indicate hypovolaemia or anaemia with a concomitant decrease in the red blood cells' oxygen carrying capacity and this will place an increased burden on cardiac function. After you have assessed the patient for cyanosis, you should assess the fingertips and toes for clubbing (Figure 2.0). Clubbing may be seen in patients with chronic cardiac conditions, for example infective endocarditis and congenital heart disease. The soft tissues of the terminal phalanx are affected and result in an increase in the angle

between the nail plate and the nail fold. The proximal nail fold, when palpated, feels spongy, 75% of clubbing is associated with pulmonary pathology, 10% is cardiac in origin and 10% is associated with hepatic and gastrointestinal conditions (Mangione 2008).

Figure 1. 0 Peripheral cyanosis. Reproduced with permission from…

Figure 2.0 Clubbing

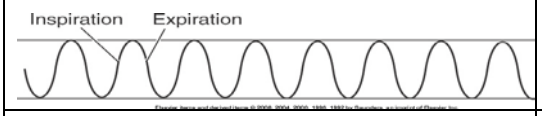
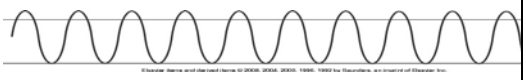
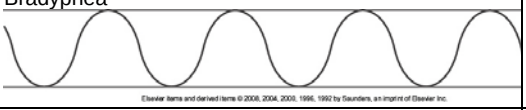
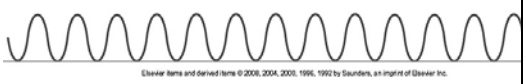
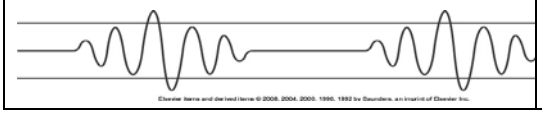
The main components of inspection are assessment of abnormalities of respiration, posture, respiratory muscles and assessment of the neck veins. The most common abnormalities of respiration are related to the vital signs of the respiratory pump and its three main components: (1) rate, (2) depth, and (3) rhythm (Mangione 2008). Each of these components may be abnormal and all are evaluated by simply inspecting the patient's respiratory rate, rhythm and depth of breathing. An abnormality in any of these factors indicates an increase in the work of breathing and signifies a cardiac or respiratory pathology. For example, the use of accessory muscles seen in patients with chronic obstructive airways disease. Normally the rate of breathing is 14-20 breaths per minute (Jarvis 2008). You should count the number of complete breaths (the sequence of inhalation and exhalation is one breath) that occur during a 60-second period this may be done by subtle observation or watching the patient's chest raise and fall. Tachypnea (table1.0) indicates a respiratory rate faster than 20 breaths a minute and is often present in cardiac failure; bradynea (table 1.0) usually indicates a rate slower than 8 breaths a minute and is most frequently seen with depression of the respiratory centre usually as a result of narcotic overdose (Jarvis 2008). From the perspective of the cardiac patient, tachypnea usually indicates moderate to severe cardiorespiratory disease and in hospitalised patients is indicative of a poor prognosis. The absence of tachypnea helps to direct practitioners away from a cardiac or respiratory diagnosis (Mangione 2008). For example tachypnea is always present in cardiac tamponade and a normal respiratory rate argues strongly against the diagnosis (Mangione 2008).

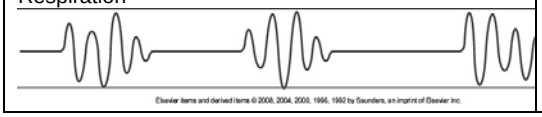
There are two main types of abnormalities associated with the depth of respiration. These are hyperpnea and hyponea. Hyperpnea (table 1.0) is characterised by rapid and deep respirations, often described as Kussmaul respirations and usually occurs in the presence of anion gap, the most common being diabetic ketoacidosis, hepatic coma or salicylate overdose (Mangione 2008). The anion gap refers to the relationship between cations and anions. Kussmals respirations are indicative of the compensatory mechanism attempting to blow off excess carbon dioxide in the blood by hyperventilating. Hypopnea (table 1.0) is shallow respirations, usually indicative of

impending respiratory failure. Bradynea (table 1.0) usually indicates a rate slower than 8 breaths a minute and is most frequently seen with depression of the respiratory centre usually as a result of opiate overdose.

There are a number of abnormalities in respiratory rhythm and these are usually the result of disruption of the neurogenic control of the respiratory centre in the brain. Thus these abnormalities are frequently seen in comatosed patients. The most common abnormality of respiratory rhythm is Cheyne-Stoke respirations (table 1.0). This is a form of periodic breathing (i.e. a regularly regular pattern that comprises a series of cycles). Each cycle has a constant respiratory rate but a variable depth and the cycle gradually increases in amplitude. This then fades into complete apnoea from which another cycle starts (Jarvis 2008). Cheyne-Stoke respirations are classically associated with congestive heart failure, where they are present in as many as one third of cases and reflect a poor prognosis. However, Cheyne-Stoke respirations are not always an ominous sign and they may be encountered normally as a result of the ageing process. Biots respiration (table 1.0) is a variant of Cheyne–Stoke but lacks the typical crescendo-decrescendo pattern, the abrupt beginning and the regularity (Jarvis 2008). Biots respiration is usually observed in patients with medullary compression and carries a poorer prognosis (Mangione 2008). Another common abnormal respiratory pattern is purse lipped breathing. This is typically seen in patients with obstructive lung disease, usually emphysema (Jarvis 2008). Patients with emphysema, have reduced lung compliance and alveolar hyperinflation and this places them at risk of expiratory airway closure and air trapping. Pursed lip breathing acts like a physiological PEEP (positive end expiratory pressure) and works to increase intra-airway pressure thereby preventing expiratory airway closure and maximising perfusion by decreasing the respiratory rate and increasing arterial oxygenation.

Table 1.0 patterns of respiration

Normal adult 	Rate-14-20 breaths a minute Depth -500-800mls. Pattern-even. Dept-air moving in out with each respiration.
Hyperventilation 	Increase in both rate and depth. Normally occurs in response to fear, exertion or exercise. Occurs in metabolic acidosis (Kussmaul's respiration).
Bradypnea 	A decrease in respiratory rate (less than 8). Rate is regular. Most commonly seen in opiate overdose when respiratory centre is depressed. May also signify raised intracranial pressure.
Tachypnea 	Rapid shallow breathing. Rate above 20 per minute. This is a normal response to exercise, fever or fear. However increase in respiratory rate is the most sensitive indicator of an impending adverse event. It also indicates respiratory insufficiency for example pneumonia or pulmonary embolism
Cheyne –Stokes Respiration 	Respirations gradually decrease and increase in a regular pattern eventually a period of apnoea ensues. The most common cause is severe heart failure although this respiratory pattern is also seen renal failure and increased intracranial

	pressure.
Biots Respiration 	Similar to Cheyne-Stokes breathing, in that there is a succession of hyperpnea and hyperventilation with apneas but it lacks the regular cycle. Carries a worse prognosis usually resulting in complete apnoea and cardiac arrest.

Abnormalities of posture can also be easily detected even before the patient undresses. These are often related to compensatory postures, designed to improve the mechanics of breathing. For example patients with chronic obstructive disease (COPD) usually sit up and lean forward, so that they can better tense their respiratory muscles and improve their contractility. Another common abnormality in posture that can be detected during inspection is orthopnea. Orthopnea is dyspnea that is aggravated by lying flat. The clinical and physiological significance of this is important for cardiac nurses because it is indicative of congestive cardiac failure. It can help to identify patients with a low ejection fraction. Often referred to a poor man's phlebotomy (Mangione 2008), orthopnea works by pooling blood in the dependent areas and thereby decreasing ventricular preload.

Paradoxical respiration, where there is asynchronous contraction of the diaphragm and the intercostal muscles can also be detected during respiratory inspection and is an important sign of impending respiratory failure. Inspection can also yield important information in relation to the use of accessory muscles such as the sternocleidomastoids, scalene and trapeze. If the patient is using predominantly intercostal muscles to maintain adequate ventilation, there may be something interfering with the diaphragm, for example ascites from right-sided heart failure (Mangione 2008). The anterior and posterior chest needs to be assessed separately and systematically. Any obvious chest or spine deformities should be assessed. These may arise as a result of chronic lung disease (e.g. emphysema), occur congenitally, or be otherwise acquired. In any case, they can impair a patient's ability to breathe normally. A few common variants include pectus excavatum, pectus carinatum and barrel chest. Barrel chest is commonly associated with chronic obstructive airways disease particularly emphysema and has a detrimental effect on lung function because it decreases ventilator efficiency. Abnormalities of the spine, ribs and sternum can also be detected during inspection. For example scoliosis or kyphosis can adversely affect the mechanics of breathing. In addition to inspecting the anterior and posterior chest for deformities it is also important to assess the ribs. Expiratory bulging of the intercostal spaces is typical of patients with a pneumothorax. Finally the neck veins should be inspected for abnormalities. If distension of the neck veins is seen, this can be superior vena cava syndrome, a gradual, insidious compression/obstruction of the superior vena cava, and bronchogenic carcinoma accounts for more than 80% of cases of superior vena cava syndrome and carries a very poor prognosis (Mangione 2008). Neck vein distension also occurs in right-sided ventricular failure.

Palpation

Palpation is an important component of the respiratory assessment and when performed correctly enables you to confirm, reject or supplement information previously gathered through inspection. Palpation allows you to gather new information, specifically concerning the lung and pleura. The anterior and posterior chest should be palpated for

pulsations, tenderness, bulges and paradoxical movement. The main components of palpation are assessment of the trachea, assessment of vocal tactile fremitus and assessment of thoracic expansion.

Anterior chest palapation

Palpation of the anterior chest begins with the trachea, which should be palpated to ensure it is midline. Place your index finger on the trachea between the sternal notch and slide it off each side. The space between the trachea and the sternomastoid muscle should be symmetrical on both sides. If not the patient has a tracheal shift (Jarvis 2008). There are two main causes of a tracheal shift; (1) an increase in the volume of the contralateral lung and/or the pleural space or (2) a decrease in the volume of the ipsilateral lung (Mangione 2008). The latter is usually the result of atelectasis whereas a volume increase is often the result of a pneumothorax or a large pleural effusion (Mangione 2008).

Posterior chest palpation

The posterior chest should be palpated for respiratory excursion (thoracic expansion). This is performed by standing behind the patient and placing your hands on the patient's back with thumbs pointed towards the spine (Figure 3.0). Remember to first rub your hands together so that they are not too cold prior to touching the patient. Your hands should lift symmetrically outward when the patient takes a deep breath. A unilateral lag on palpation is usually seen in either consolidation or effusion (Jarvis 2008), whereas bilateral reduction of excursion is more indicative of airflow obstruction.

Figure 3.0. Assessment of Respiratory Excursion. Reproduces with permission from

The final compotent of palpation is to assess for tactile fremitus (Figure 4.0). Fremitus is the palpable thrill produced by the patient’s voice and can be detected by placing the ulnar aspects of both hands firmly against either side of the chest while the patient says the words "Ninety-Nine"(Jarvis 2008; Mangione 2008). This manoeuvre is repeated until the entire posterior thorax is covered. The bony aspects of the hands are used, as they are particularly sensitive for detecting these vibrations or the ball of the palm. If fremitus is faint you could ask the patient to speak louder. Fremitus provides useful information on sound transmission and a number of disease processes can alter fremitus. For example, in the presence of consolidation, fremitus becomes more pronounced. Consolidation occurs when the normally air filled lung parenchyma becomes engorged with fluid or tissue, most commonly in the setting of pneumonia. If a large enough segment of parenchyma is involved, it can alter the transmission of air and sound. The hallmark of abnormal fremitus is however asymmetry. Thus each side of the thorax needs to be compared systematically and carefully.


Figure 4.0 Assessment of Tactile Fremitus.

Discussion

Nurses' close and continued monitoring of patients means that they are often the first to detect the early signs of physiological derangements and deterioration (Clarke and Aiken 2003; Clarke 2004). Early identification of respiratory dysfunction plays an important role in preventing adverse events, promoting positive patient outcomes and improving patient care (Hillman, Bristow et al. 2001; Coombs and Moorse 2002; Duff, Gardiner et al. 2007). The inclusion of a systematic respiratory assessment will improve patient outcomes. Early identification of respiratory dysfunction will reduce the incidence of major adverse events.

Conculsion

Increasingly, developing complex assessment skills is seen as an imperative for practitioners located within the cardiac care environment. This paper has presented a systematic model that practitioners may find useful to adopt within their clinical practice. A thorough and detailed respiratory assessment of patients is essential to ensuring a holistic and comprehensive model of care is delivered. Part two of the article will discuss and describe percussion and auscultation.

Key Points

- Patients acuity is increasing
- Patients are more likely to deteriorate on wards and suffer a major adverse event. Major adverse events have been defined as; unplanned admission to intensive care, in-hospital cardiac arrest or death.
- Changes in respiratory function are the most sensitive indicator of an impending major adverse event.
- Nurses are increasingly developing complex and advanced roles
- Respiratory assessment is now considered integral to the scope of practice of the cardiac practitioner

References

Andrews, T. & Waterman,H (2005). "Packaging: a grounded theory of how to report physiological deterioration effectively." J Adv Nurs **52**(5): 473-481.

Buist M., Moore G., Bernard S., Waxman B., Anderson J. & Nguyen T. (2002): Effects of a medical emergency team on reduction of incidence of and mortality from unexpected cardiac arrests in hospital: preliminary study. BMJ **324**, 387-90.

Chaboyer, W., Thalib, L., Foster, M., Ball, C., & Richards, B. (2008). Predictors of Adverse Events in Patients After Discharge From the Intensive Care Unit. *Am* J Crit Care*, 17*(3), 255-263.

Clancy, J., McVicar, A., & Bird, D. (2000). Getting it right? An exploration of issues relating to the biological sciences in nurse education and nursing practice. J Adv Nurs*, 32*(6), 1522-1532.

Clarke, S. P. (2004). "Failure to rescue: lessons from missed opportunities in care." Nurs Inq **11**(2): 67-71.

Clarke, S. P., & Aiken, L. H. (2003). Failure to rescue. Am J Nurs, *103*(1), 42-47.

Considine, J. (2005). The role of nurses in preventing adverse events related to respiratory dysfunction: literature review. J Adv Nurs*, 49*(6), 624-633.

Considine, J., & Botti, M. (2004). Who, when and where? Identification of patients at risk of an in-hospital adverse event: implications for nursing practice. Int J Nurs Pract, *10*(1), 21-31

Coombs, M. A., & Moorse, S. E. (2002). Physical assessment skills: a developing dimension of clinical nursing practice. Intensive Crit Care Nurs*, 18*(4), 200-210.

Coombs, M. A. and S. E. Moorse (2002). "Physical assessment skills: a developing dimension of clinical nursing practice." Intensive Crit Care Nurs **18**(4): 200-210.

Cretikos M.A., Bellomo R., Hillman K., Chen J., Finfer S. & Flabouris A. (2008): Respiratory rate: the neglected vital sign. Med J Aust **188**, 657-9.

Cretikos M.A., Chen J., Hillman K.M., Bellomo R., Finfer S.R. & Flabouris A. (2007): The effectiveness of implementation of the medical emergency team (MET) system and factors associated with use during the MERIT study. Critical Care Resus **9**, 206-12.

Cullinane M., Findlay G., Hargraves C. & Lucas S. (2005) An Acute Problem? NCEPOD 2005 Report HMSO London

Daffurn, K., Lee, A., Hillman, K. M., Bishop, G. F., & Bauman, A. (1994). Do nurses know when to summon emergency assistance? Intensive Crit Care Nurs, *10*(2), 115-120.

.

DeVita M.A., Bellomo R., Hillman K., Kellum J., Rotondi A., Teres D., Auerbach A., Chen W., Duncan K., Kenward G., Bell M., Buist M., Chen J., Bion J., Kirby A., Lighthall G., Ovreveit J., Braithwaite R.S., Gosbee J., Milbrandt E., Peberdy M., Savitz L., Young L., Harvey M. & Galhotra S. (2006): Findings of the first consensus conference on medical emergency teams Crit Care Med **34**, 2463-2478.

Duff, B., G. Gardiner, Barnes, M (2007). "The impact of surgical ward nurses practising respiratory assessment on postive patient patient outcomes." Aust J Adv Nurs **24**(4): 52.-55

Franklin, C., & Mathew, J. (1994). Developing strategies to prevent in hospital cardiac arrest: analysing responses of physicians and nurses in the hours before the event. Crit Care Med*, 22*, 244 - 247.

Goldhill, D. R., Worthington, L., Mulcahy, A., Tarling, M., & Sumner, A. (1999b). The patient-at-risk team: identifying and managing seriously ill ward patients. Anaesthesia, 54(9), 853-860.

Harrison, G. A., Jacques, T., McLaws, M. L., & Kilborn, G. (2006). Combinations of early signs of critical illness predict in-hospital death-the SOCCER study (signs of critical conditions and emergency responses). Resuscitation, 71(3), 327-334.

Hillman K., Chen J., Cretikos M., Bellomo R., Brown D., Doig G., Finfer S. & Flabouris A. (2005): Introduction of the medical emergency team (MET) system: a cluster-randomised controlled trial. The Lancet 365, 2091-7.

Hillman, K., Parr, M., Flabouris, A., Bishop, G., & Stewart, A. (2001). Redefining in-hospital resuscitation: the concept of the medical emergency team.

Jacques, T., Harrison, G. A., McLaws, M. L., & Kilborn, G. (2006). Signs of critical conditions and emergency responses (SOCCER): a model for predicting adverse events in the inpatient setting. Resuscitation*,* 69(2), 175-183.

Jarvis, C. (2008). Physical Examination and Health Assessment. St. Louis, Saunders Elsevier.

Kause, J., Smith, G., Prytherch, D., Parr, M., Flabouris, A., & Hillman, K. (2004). A comparison of antecedents to cardiac arrests, deaths and emergency intensive care admissions in Australia and New Zealand, and the United Kingdom - the ACADEMIA study. Resuscitation, 62, 275 - 282

Mangione, S. (2008). Physical Diagnosis Secrets. Philadelphia, Mosby,Elsevier.

Massey D., Aitken L.M. & Chaboyer., W. (2008): What factors influence suboptimal ward care in the acutely ill ward patient? Australian Critical Care 21, 127-40.

McLaughlin, N., Leslie, G. D., Williams, T. A., & Dobb, G. J. (2007). Examining the occurrence of adverse events within 72 hours of discharge from the intensive care unit. Anaesth Intensive Care*, 35*(4), 486-493.

McQuillan, P., Pilkington, S., Allan, A., Taylor, B., Short, A., Morgan, G., et al. (1998). Confidential inquiry into quality of care before admission to intensive care. BMJ*, 316*(7148), 1853-1858.

NICE (2007) Acutely ill patients in hospital (NHS, ed). National Institute for Health and Clinical Excellence, London

Priestley G., Watson W., Rashidian A., Mozley C., Russell D., Wilson J., Cope J., Hart D., Kay D., Cowley K. & Pateraki J. (2004): Introducing Critical Care Outreach: a ward-randomised trial of phased introduction in a general hospital. Intensive Care Medicine **30**, 1398-404

Smith, G. B., & Poplett, N. (2002). Knowledge of aspects of acute care in trainee doctors. Postgrad Med J*, 78*(920), 335-338.

West, S. L. (2006). "Physical assessment: whose role is it anyway?" Nurs Crit Care **11**(4): 161-167.