Advancing Practice in Critical Care Nursing

Martin Christensen

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Abstract

This thesis presents a body of publications in the area of critical care nursing, for the consideration of the award Doctor of Philosophy by publication. The publications and their dissemination herein contribute to a new and original body of knowledge within critical care nursing practice.

This thesis aims to demonstrate how an original contribution to the advancement of critical care practice has developed through an on-going integration of academic and practice work and has led to the development of a model for advancing practice. Based on the know-that and know-how framework of advanced knowledge, consideration is given how this approach could be better developed to incorporate other dimensions attributed to experiential learning, namely pattern recognition and an exemplar of the knowing-how knowing-that framework is offered. However, it emerged that there are problems with advancing practice because it is considered the work of the advanced practitioner, yet it is contended that there needs to be a process which allows individuals to advance their own practice. Therefore, it was necessary to develop a working definition of advancing practice not only to map professional advancement of critical care nursing practice and how published works illustrate this, but to offer model of knowledge integration based around theoretical, practical, reflective and reflexive practice and supervisory support to enable individual practitioners the framework to advance practice.

This thesis is presented in three chapters: Introduction, Body of Work and The Way Forward. In the first chapter, an overview of the origins and trends of advanced nursing practice and the emergence of advancing nursing practice in critical care. The purpose of this first section, however, is not to engage in the politico-professional debate on the meaning of advanced practice, because this is well developed within the literature, but is to set the scene in the context of published work. By using a narrative approach as a journey of personal discovery, a description of how published works illustrate progress in this respect and show the advancing of critical care practice.

The second chapter not only comprises publications with regard to critical care nursing practice but also presents a detailed critique of these publications and their contribution to advancing critical care nursing practice and knowledge. Moreover this discussion identifies three themes which are further developed into the classification of knowledge attributable to advancing practice.

In the concluding chapter, recommendations for the way forward are discussed with the development of a critical care nursing knowledge integration model. An exemplar of the model demonstrates that advancing practice in critical care is a continual process of development, analysis and practice that advances the knowledge and skill of critical care nursing. More importantly, it is the integration of all these facets that allows for the growth of the individual to become an advanced practitioner.

In summary, this thesis represents a portfolio of work that makes an original contribution to critical care nursing knowledge. The product of this thesis is the development of a knowledge integration model as the basis for advancing practice.

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Acknowledgements

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I would also like to thank my wife Teresa for her undying admiration and support during the writing of this thesis. Her understanding and contribution were greatly appreciated.

Author's Declaration

I declare that, with the exception of joint publications within my body of work, all work presented in this thesis is my own.

Where joint publications are included, my contribution is clearly outlined in Appendix 1.

Martin Christensen

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CHAPTER ONE

INTRODUCTION

CHAPTER 1

Introduction

The central tenet of this PhD is to challenge the current concept of advancing practice in critical care, with the argument that its context is too narrow and does not readily account for the varying degrees of knowledge and experience that nurses use when caring for critically ill patients. In utilising my own publications, I will demonstrate how the advancement of critical care nursing practice is the culmination of experience and on-going professional, academic and theoretical development, which are necessary for developing advanced nursing practice and are not necessarily confined to experiential learning.

Therefore the aims of this thesis are to:

- Define advancing practice within the context of advanced practice;
- Review previously published work in light of advancing practice;
- Synthesise the underlying themes to produce a model of knowledge integration relevant to advancing practice.

My work will be presented in three chapters: introduction, body of work and conclusions.

In the first chapter I will discuss the emergence of advancing nursing practice in health care and how this has progressed to the critical care environment. In the first instance, I will provide an overview of the origins and trends of advancing nursing practice. The purpose of this first section, however, is not to engage in the politico-professional debate on the meaning of advanced practice, because this is well developed within the literature (for example, by Albarran & Fulbrook, 1998; Woods, 1999; McGee & Castledine, 2004), but is to set the scene in the context of my published work. I will use a narrative approach as a journey of personal discovery in which I describe my own professional advancement of critical care nursing practice, using my

variety of different forms, it is the written narrative that will establish the context in which I shall locate my published work.

I have been working in critical care for the past 18 years, either as a staff nurse/charge nurse, a practice development facilitator or in my current role as a senior lecturer with a remit in critical care. The basis of many of my publications is critical care nursing practice, whether they are research papers or subject reviews relevant to the changing pace of critical care nursing. Focusing on critical care, the aim of this section is to chart the trends in advancing critical care nursing practice. My publications demonstrate that advancing practice means more than task acquisition or competency and requires a number of different approaches to inform nursing knowledge.

My interest in the nature of advancing nursing practice stemmed from an early stage in my intensive care unit (ICU) career as I became frustrated at not knowing the intricacies of the care that I was asked to provide and just accepted instructions without question – the very essence of the task-orientated care provider because I simply didn't know. In some ways I was socialised into the perceived ICU nurse mould: identify a problem and then report it to a higher authority without really understanding how the situation arose in the first place; for example, an unexplained arrhythmia or a sudden drop in blood pressure. As I gained experienced, I became more *skilled* and *competent* at assessing situations and being able to act accordingly. What I discovered, however, was that this was merely applying learned experiential knowledge; I had become a tasked systems expert – I knew 'how' but not 'why' in any great depth. My early experiences of competent critical care nursing were often linked with task performance that appeared to concentrate on outcome only rather than on the process of learning. As a result, this approach was reductionist in nature and may have failed to include the crucial elements of learning; namely, the acquisition and integration of new knowledge and skills. Certainly, advancing practice requires these abilities to integrate the underpinning of theoretical knowledge with practical skills.

However, at the time, the integration of theoretical and practical knowledge did not occur in my own practice and, therefore, advancing my own practice

was little more than a collection of experiences with limited understanding. It was not until I started my first degree that things started to make sense. By learning to critically analyse and evaluate, I could gradually integrate new information with existing knowledge into a coherent theoretical framework of critical care nursing. From then on I sought news ways of developing my knowledge base both old and new and attempted to assimilate the theory and practice seamlessly. Whilst recognising that theory and practice were moving away from tradition and ritual, I began to consider the role of the advanced expert clinician, especially in critical care, and, more importantly, what was needed to achieve this advanced status. I was cognisant of the suggestion that it was a mixture of higher academic awards and reflection (Rolfe & Fulbrook, 1998; Borbasi, 1999; Wilson-Barnett et al., 2000; Furlong & Smith, 2005). However, for me it was something more: it was not only about the acquisition of knowledge and experience but about having the ability to relate this in a practical sense. It was about witnessing a scene evolving and understanding fully the entire cycle of events that led up to and contributed to that incident. Crucially, it was about being able to learn and advance from that experience.

Yet, I continually reflected as to what knowledge was important to advance my practice: was it the technical–rational, deductive knowledge of medicine, the holistic, judgement-based knowledge of nursing, or a mixture of both (Polkinghorne, 2004)? Or was it the process that I needed to progress through for knowledge and practice to make sense? For me, it was about uncovering those subconscious thoughts and translating them into a meaningful experience of development. The problem is that the work of the ICU fits into the technical–rational paradigm due to the illness acuity of the patients cared for there and the need for absolute physical care. Therefore, the question for me was about the nature of advanced and advancing practice within the context of critical care nursing.

The Difference between Advancing Practice and Advanced Practice

The concept of advancing practice is central to the development of nursing practice and has been seen to take on many different forms depending on its

use in context. To many it has become synonymous with the work of the advanced or expert practitioner (Rolfe & Fulbrook, 1998); others have viewed it as a process of continuing professional development and skills acquisition (Wilson-Barnett et al., 2000; Por, 2008). Moreover, it is becoming closely linked with practice development (Jenkins & White, 2001; Jackson, 2003). This is where the concept of advancing nursing practice may be ambiguous and confusing, and some of the ambiguity perhaps derives from the inability to effectively define advancing and advanced practice.

It is difficult to discuss advanced practice without reference to the advanced practitioner because the concept and the individual are inextricably linked by the common theme of advanced knowledge and skills. In defining the advanced practitioner and giving an indication of the underlying foundation of advanced practice, the International Council of Nurses (2006, p.12) suggested that the advanced practitioner is:

> *...a registered nurse who has acquired the expert knowledge base, complex decision making skills and clinical competencies for expanded practice.*

In an earlier mission statement, the United Kingdom Central Council (1996) intimated that advanced practitioners have an eclectic knowledge base, are grounded in practice and support education and research. McGee & Castledine (2004) have further suggested that advanced nursing practice is a state of professional maturity, one in which practitioners are pioneering innovators and developers of health care. Others give differing accounts of advanced practice and the advanced practitioner but, in essence, the qualities that are inherent within this role revolve around developing professional leadership, higher levels of scholarly enquiry, research, consultation, higher levels of autonomous practice, interprofessional team working and an acknowledgement of the wider political agenda (Dunn, 1997; Fulbrook, 1998; Woods, 1999; Atkins & Ersser, 2000; Davis & Hughes, 2002; Royal College of Nursing, 2003; Thompson & Watson, 2003; Castledine, 2004; Por, 2008). Whilst this list is not exhaustive, it would seem, however, that these qualities have been further redefined within a role context, such as

the clinical nurse specialist, the nurse practitioner and recently the nurse consultant. There has been much debate to identify the differences between the roles and these differences depend on the patient group being attended to by these individuals. The clinical nurse specialist, for instance, tends to focus on content and the application of specific knowledge to improve patient care through specialist areas of nursing practice such as diabetes, stoma care or tissue viability (Hamric et al., 2000). Nurse practitioners are more concerned with process and how they practise in providing direct patient care to specific patient groups; in other words, they are specialist generalists, such as the nurse practitioner in accident and emergency or general practitioner surgeries (Cronenwett, 1995).

Arguably there are some differences in the roles as they apply to advanced nursing practice and perhaps this is more to do with job title than advanced knowledge and skills (Albarran & Fulbrook, 1998; Woods, 1999; McGee & Castledine, 2004). Castledine (2004) points out that nurses have long been conditioned into believing that a title will convey their level of authority within the organisation and not necessarily the level of competence inherent in that role. Davis & Hughes (2002) further note that advanced practice goes beyond the labelling of roles and instead considers practice to be based on clinical knowledge. That aside, there is some commonality between advanced practice and many of the attributes considered to be expert practice. The expert's performance is a fluid, flexible, proficient behaviour in which they are no longer aware of features and rules. As a result, they are able to accurately focus on the problem without wasteful consideration of alternative, unfruitful diagnoses and solutions (Benner, 1984; **Christensen** & Hewitt-Taylor, 2006b; Scholes, 2006).

Know-How, Know-What, Know-Why and Know-That Knowledge

Where the advanced practitioner role is defined more in line with the personal attributes and abilities of individuals in providing expert care, the essence of advancing practice appears to centre on the continual acquisition of 'new' knowledge and skills to enhance and complement previous theoretical and practical knowing. Some authors have termed advancing practice as being

the domain of the advanced practitioner in progressing nursing care but in order to achieve this they must first attain advanced level status (Rolfe & Fulbrook, 1998; Holyoake, 1998, Elliot, 1998). This may suggest that advancing practice is part of a continuum of advanced and advancing development as described by Jamieson et al., (2002) and; Scholes, (2006). Thus, it focuses on the macro or global context of developing practice: the development of practice for the whole of nursing instead of the individual nurse although there may be some advance or growth on an individual level. I would, however, suggest that advancing practice is more individualistic and relates to the micro context. Advanced practice suggests an end-point of development, while advancing practice is a continual developmental process and refinement of knowledge and skills to a level which improves analysis of complex clinical situations and has more meaning to the individual practitioner. In some cases it may well be the precursor to advanced level practice in a step-wise progression of individual professional and personal development. For critical care nursing practice, the complexities of patient conditions lend themselves to advancing practice because of the intricacies of manipulating physiologic parameters each of which are inter-linked at varying levels. Knowledge, skill and understanding in this environment are, therefore, an integral process of ongoing experience, learning and education. However, the problem with the epistemology that defines advanced practice is that it is either heavily focused on a scientific research base or is deeply embedded in practice (Rolfe, 1998); ideally it should encompass and enhance both. In attempting to quantify the knowledge necessary for advanced practice, Rolfe (1998) constructed a typology of nursing knowledge (see Table 1) that incorporates scientific, experiential and personal domains, and further characterised these into either theoretical (knowing-that) or practical knowledge (knowing-how). Firstly, in considering practical knowledge, Rolfe (1998) saw this as the ability to 'do' based on learning gleaned from these scientific, experiential and personal domains. Ryle (2000) viewed this as 'knowing-how' while Schon (1983) called this 'knowing-in-action' which, when taken into account here, is steeped in the practical knowing of the here and now. An example is the critical care nurse recalibrating invasive monitoring devices or changing a tracheostomy dressing; the knowing is in the spontaneity and the function of the action. The

major emphasis here is the ability to recognise patterns and simply perform an act automatically, and yet being completely unaware of the knowledge or the learning associated with that action.

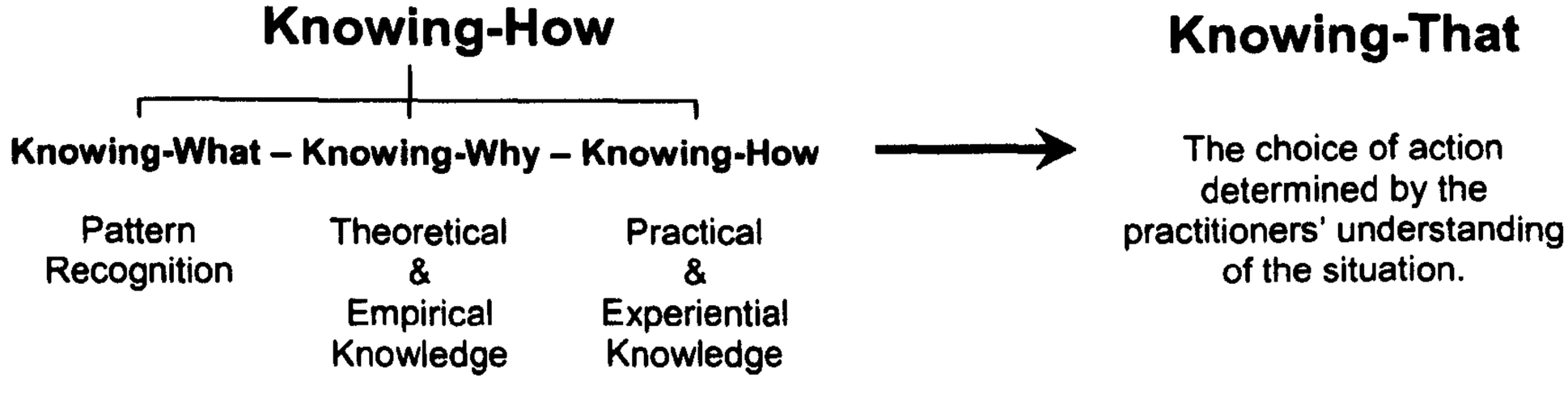
Table 1: Typology of advanced nursing practice (taken from Rolfe, 1998, p.221).

Knowledge domain	Theoretical knowledge (knowing-that)	Practical knowledge (knowing-how)
Scientific knowledge	Things that are known discovered from books, journals or lectures.	Things that can be done learnt from books, journals, guidelines or protocols of care.
Experiential knowledge	Things that are known discovered through own experience.	Things that can be done based on experience.
Personal knowledge	Things that are known which relate to specific situations or particular people, discovered through own experience.	Things that can be done which relate to specific situations or particular people.

This is where the distinction between knowing-how and knowing-that has to be brought into context to provide an indication as to the requisite knowledge appropriate for advancing practice. Ryle (2000) originally put forward the notion that propositional knowledge (knowing-that) was based on empirical and theoretical referents, such as 'I know what pressure support ventilation is'. In Rolfe's (1998) typology, he also makes the observation that knowing-that is the culmination of theoretical and empirical knowledge based on scientific, experiential and personal knowledge; in other words, content knowledge or *what is known* about a subject. Conversely, knowing-how seems more in line with practical knowing and the process of care; namely, the ability to undertake tasks and skills, such as 'I know how to suction a tracheostomy tube'. Whilst Rolfe's !998) typology makes two very distinctive portrayals of the knowledge necessary for advanced practice it is also problematic as it does not immediately identify the linkage necessary for practice to advance. For example, when viewing the scientific knowing-that, which can be more concerned with content knowledge, in comparison with process knowledge (the scientific knowing-how) there is an assumption that learnt content can somehow be reproduced in practice. This can be difficult to assimilate at times; although practitioners may have extensive theoretical

knowledge they may be unable to detect or infer this knowledge in a practical setting. A good example would be a practitioner who has substantive knowledge of diabetes but fails to recognise when their patient is becoming hypoglycaemic. Rolfe's (1998) typology seems overly simplified when he attempts to define or put into context advanced and advancing practice because there are variables that contribute to or overlap these two knowledge strands. When I analysed my publications to identify these two knowledge strands (see table 2), there appeared to be a well-defined, underlying theme of pattern recognition (see for example **Christensen**, 2002b; **Christensen** & Mattison 2006; **Christensen** & Hewitt-Taylor 2006b; **Christensen** & Pinder, 2008) intertwined with the theoretical and practical knowledge, which is not wholly consistent with Rolfe's (1998) model. Therefore, my suggestion is that knowing-how knowledge consists of three distinct variables that portray the knowledge inherent in advancing practice and contain both content and process knowledge. These include knowing-how, which incorporates the practical and experiential knowledge; knowing-why, the theoretical and empirical knowledge; and knowing-what, which is pattern recognition knowledge reminiscent of Benner's (1984) expert model. Taking the example above, if the knowing-what was taken into account in this situation, practitioners would be better prepared to observe and assess their patient for signs of hypoglycaemia and as a result make a more concise acknowledgement of knowing-how and less about task performance. Therefore reproducing these into a framework of knowledge acquisition, knowing-that could actually be the action undertaken by the practitioner based on a full and comprehensive understanding of the situation (Figure 1), which can only be achieved through a culmination of knowing-how, what and why.

Figure 1: An alternative knowing-how and knowing-that knowledge framework.



It is less apparent what constitutes the difference between knowing-how and knowing-how within this framework. Ideally an alternative word would make this distinction clearer. The how (knowing-how as the practical and experiential knowledge) is more focused on task, procedure and description at a behavioural level and is demonstrable by practitioners' ability to perform the practice and generate its products as opposed to an understanding of process (Leinhardt et al, 1995). The knowing-how is a culmination and integration of those components (what, how & why) in order for practitioners to make the right choice of action. What is offered in the following exemplar is a demonstration of this knowing-how knowledge from an experienced critical care Outreach nurse in her assessment of a patient she has been asked to review. What will be noticeable is the interplay between theoretical and practical knowledge, but just as important is the knowing-what knowledge that then allows her to develop a treatment plan which evolved from her ability to transform the elements of knowing-how and knowing-that process of action

Exemplar 1

Olive was an 87 year old woman who had been admitted to the surgical ward for routine laparoscopic removal of her gallbladder due to chronic cholecystitis. Intra-operatively the procedure was unremarkable with minimal blood loss. However, two days post operation Olive's MEWS (Modified Early Warning Score) was slowly worsening (score 2-3) which necessitated medical intervention. Unable to contact the appropriate surgical team the

nurse caring for Olive then referred her to Karen from the Outreach team for help.

On her initial examination Karen found Olive sat out in a chair awake and alert, orientated to time and place but appearing to be a little short of breath. In reviewing her MEWS chart to find the reason for her score being high Karen noted that Olive had been hypotensive for at least 12 hours (average BP 88/35mmHg, MAP-53mmHg). As a result this had also initiated the compensatory mechanisms to maintain tissue oxygenation and perfusion, that is to say, tachycardia (HR-122bpm), and tachypneoa (RR-28bpm); oxygen saturations (SaO_2) were also low at around 91% on room air. Karen immediately gave her some oxygen at 3 litres via nasal specs which brought her SaO_2 up to 96%. Continuing with her preliminary examination she noted Olive was peripherally warm to touch, her temperature was only 36.9°C, and her skin was tenting indicating she had poor skin turgor yet she had a normal capillary refill time. Inspection, auscultation, percussion and gentle palpation of her abdomen revealed slight bruising around the laparoscope insertion sites with no evidence of underlying haematomas, tympani in all four quadrants and sluggish bowel sounds over the ilieo-cecal junction. Karen's initial thoughts were the fact the nursing staff had just sat her out and this could be related to postural hypotension, volume depletion from being 'nil by mouth' for at least two days or the beginnings of sepsis, though she wasn't convinced of the latter only because of her temperature.

The morning blood results revealed nothing much out of the ordinary although Karen did notice that her haemoglobin was 8.6 g/dl and haematocrit 29% (packed cell volume); all other laboratory results (Urea & Electrolytes, LFT's, White Cell Count) were within normal limits. It transpired on discussion with Olive's nurse that she had sped-up Olive's IV fluids having noticed that she was hypotensive and this was clearly illustrated in the above results – the low haemoglobin and haematocrit could be the result of haemodilution. However, Karen surmised that Olive would have had to have received a considerable amount of fluid to reduce her haemoglobin this significantly, in which case she would be hypervolemic and showing signs and symptoms of fluid overload and in view of her age signs of congestive heart failure. What

Karen did have to consider was that haemoglobin and haematocrit are measures of red blood cell concentration within the total plasma volume. Therefore, any changes to the total plasma volume will change the overall concentration despite the amount of haemoglobin remaining unchanged (Higgins, 2000). This wasn't the case and yet this didn't readily explain the cause of the hypotension in the first place.

As it transpired, preliminary indications were that Olive might have had long standing anaemia and not dilutional anaemia as Karen had first thought. Karen had read that there was research which suggested chronic anaemia can reduce systemic vascular resistance and therefore arterial blood pressure. The exact cause is unknown; however, it had been suggested that haemoglobin has an inhibitory effect on endothelium-derived relaxing factor (EDRF) and as such regulates EDRF activity thereby maintaining vascular tone. It was thought that the low haemoglobin, as seen in anaemic states, is less inhibitory and therefore the vasodilatory effects of EDRF are more noticeable. In order to confirm this Karen asked the laboratory to check mean cell volume, iron, vitamin B12 and folate levels from the morning's blood sample. If she was correct in her differential diagnosis she might see from these results a decrease in serum iron and mean cell volume which would indicate iron deficiency anaemia, or alternatively a decrease in vitamin B12 and folate levels with a raised mean cell volume which could indicate pernicious anaemia (vitamin B12 deficiency). Karen also put in place a preliminary treatment plan that would help correct Olive's hypotension if the cause was something other than anaemia.

Treatment Plan:

- *Perform a complete CVS & Respiratory assessment.*
- *Perform an ECG to ensure no myocardial ischemia.*
- *Request mean cell volume, iron, vitamin B12 and folate levels.*
- *If necessary, infuse 250mls of Gelofusine IV over 30 minutes via a Patient Group Directive (PGD).*
- *Reassess cardiovascular status once Gelofusine infused with the option to re-infuse another 250mls if need be, as per PGD policy.*

- *Liaise with surgical and nursing team.*
- *Reassess in 3 hours or sooner if called.*

Relaying this information back to Olive, Karen said ... "your blood pressure is a little low which is making you feel dizzy and short of breath at times. But I think you are also anaemic and I suspect you have been for a while and this is probably making you tired as well. So I'm running some blood tests to firstly see what kind of anaemia you may have which will give me a better idea how we can treat it more effectively for you."

Therefore, reframing knowing-how into a contextual pattern of knowledge acquisition may make it easier to develop a model of knowledge integration based on content and process-knowing. One area of particular note is the knowing-what (pattern recognition) element of knowing-how knowledge. It is this ability to recognise patterns which is the hallmark of Benner's (1984) expert model in that practitioners form and develop paradigm cases from different patient episodes and approach patient care using previous concrete experiences. As practitioners build up this repertoire of paradigm cases, they reach the expert level.

However, this transition appears to be based on the application of previous experiences gained over a lengthy period of time, the key feature being the change in performance; in other words, task performance. The issue here is that many of the vignettes portrayed within Benner's (1984) work are little more than reflections on 'knowing-how' knowledge and the application of differing tasks based on practical experience (Jamieson et al., 2002); there is little offered in the way of a deeper portrayal of knowledge or, more importantly, the identification of new knowledge. Yet, Benner et al. (1992) would argue that this is the very nature of the intuitive expert practitioner because the requisite knowledge is so deeply imbedded in practice that it is often difficult to verbalise as to how decisions are reached and care prescribed. Although this does not readily pose an issue for the practising expert in terms of the doing, for the advanced practitioner whose role is one of education the problem is in the telling of the doing (Rolfe, 1998).

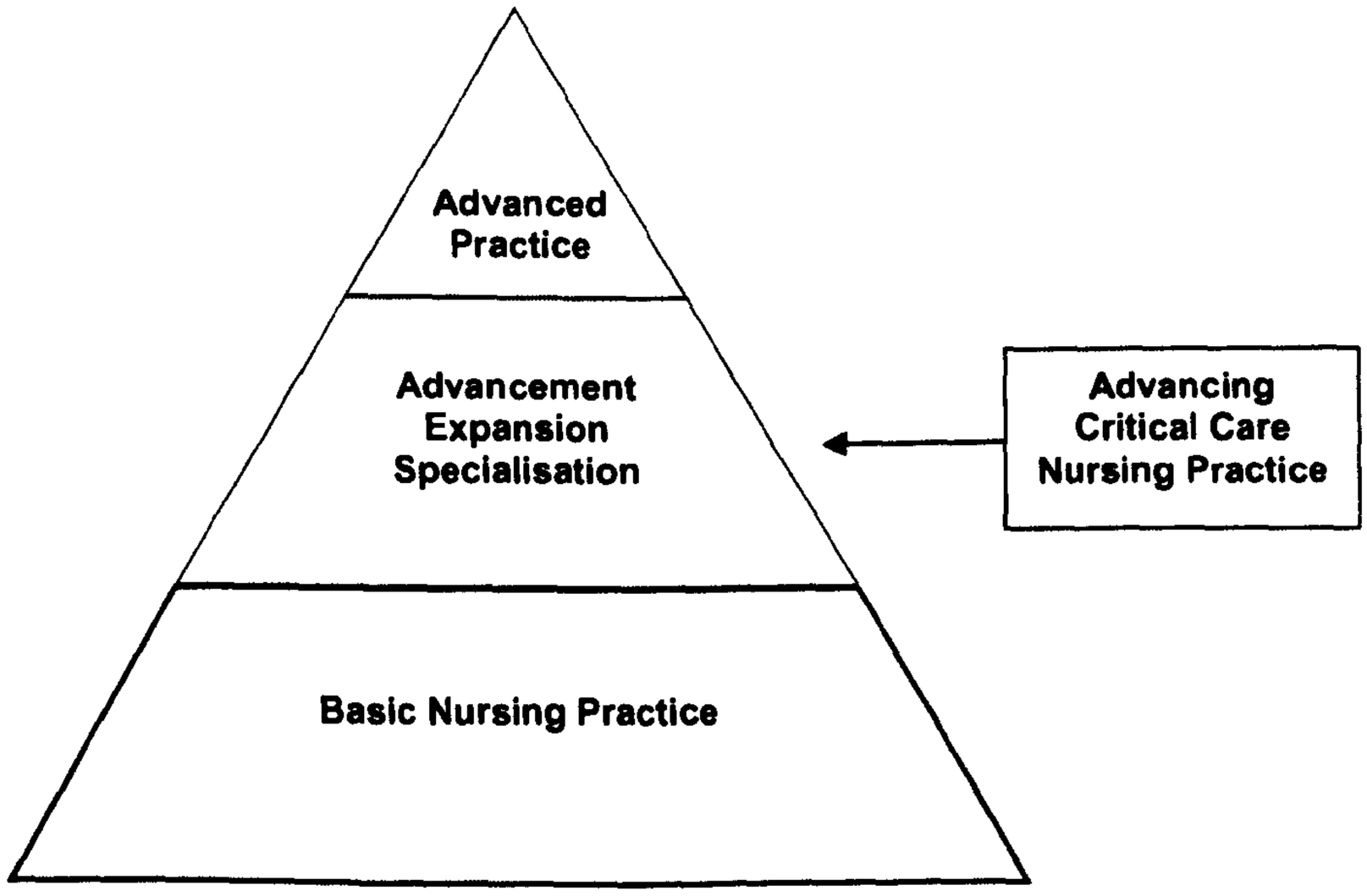
The importance of the 'knowing-that' (Ryle, 2000) element of knowledge therefore takes on greater emphasis, particularly within the advanced practice debate, and yet knowing-that is not simply reading a textbook. For Rolfe (1998), there is an element of reflection especially in the experiential and personal domains of his typology. For Schon (1983), this form of reflection takes into account the lived moment. Unlike knowing-in-action, reflection-in-action *has a critical function in questioning the assumptional structure of knowing-in-action* [knowing-how] (Schon, 1987, p.28). Reflection-in-action, as its name implies, is seated in practice, but its difference from reflection-on-action is that it occurs in 'real-time' as practice is taking place and evolving. However, this is not simply thinking in action; it involves two separate processes, which requires a reanalysis of the action and the knowing implicit in that action (Rolfe et al., 2001), hence the subtle difference from simply 'knowing-how'. It is the notion of knowing-in-action and knowledge-for-action which sets the basis for reflection-in-action because the former is a type of knowledge considered to be more in tune with practical, experiential and common-sense knowledge, while the latter is the theoretical knowledge taken from textbooks, units of study or from colleagues. This is similar in many respects to Rolfe's (1998) typology of knowledge for advanced practice.

Advancing Practice

Therefore, it would appear that the nature of advancing practice lies in the integration of knowing-how-why-what and knowing-that, and the advanced practitioner is the practical exemplar of this transition (Rolfe & Fulbrook, 1998). However, this does not readily identify what is needed for an individual practitioner to advance their practice. It would seem reasonable to suggest that, within the context of advancing practice in critical care nursing, the most appropriate model may consist of a process in which specialisation, expansion and advancement form the elements necessary to meet the requirements of advanced practice (American Nurses Association, 1995; Hamric et al., 2000). Originally conceived as a model for merging the Clinical Nurse Specialist and the Nurse Practitioner role, the advanced practice model (Figure 2) attempted to describe advanced practice in terms of

personal characteristics as opposed to role definition. Competence in achieving the stages of progression, (specialisation-expansion-advancement) was demonstrable along a continuum from novice to expert and as such the emphasis focused on education and professional certification programmes which were able to prepare nurses for a variety of roles within the health-care system (Cronenwett, 1995). Its similarity with advancing practice is because advancing practice is closely linked with the personal development of the individual (Fulbrook, 1998) and is more focused on the 'how' of practice as opposed to the 'what' of practice (Rolfe, 1998); the what is considered to be more aligned with advanced practice. This highlights the differences between advanced practice and advancing practice as well as basic nursing practice. Therefore, if this model is viewed as a pyramid of development, at its foundation is basic nursing practice and advanced practice at the apex, with the progressional elements being specialisation, expansion and advancement (Figure 2).

Figure 2: An advancing practice model of development.



When used in the context of critical care nursing, specialisation allows individual practitioners to concentrate on one specific field of nursing practice, such as intensive care, which then allows for levels of practice and educational programmes to be specifically identified and mapped against predetermined competencies and emerging roles. As development and transformation occurs, the acquisition of new knowledge and skills results in

the expansion of the existing knowledge and skills base and further legitimises the knowledge and skills that overlap existing medical and nursing boundaries. Whilst including elements of both specialisation and expansion, advancement is further characterised by the integration of postgraduate education which amalgamates experiential–practical knowledge together with theoretical and research-based knowledge (American Nurses Association, 1995; Hamric et al., 2000).

However, there is an increasing expectation that higher level degrees such as Master's degrees are needed to explore and critically analyse the finer aspects of clinical practice and therefore advance practice (Rolfe & Fulbrook, 1998; Borbasi, 1999; Wilson-Barnett et al., 2000; Furlong & Smith, 2005; Coombs et al., 2007). However, the concern is that advanced practice has not been defined adequately for specific content within these programmes to be agreed on (Hravnak & Rosenzweig, 1996; Rolfe, 1998; Jamieson et al., 2002; Brookes, 2005). There is agreement, though, that the development of advanced practice is seen as a process of integration as opposed to being solely reliant on content. Therefore, when viewed in this context, advancing practice may be regarded as the process that individual practitioners undertake to achieve advanced practice status. This is overly simplistic because there may be any number of elements that form the progression of advancing practice, in addition to the variety of models that profess to meet the requirements for advanced practice.

One of the earlier, more notable models of advancing practice was Benner's (1984) novice to expert model where practitioners develop and progress through five well-defined steps: Novice, Advanced Beginner, Competent, Proficient and Expert. The strength of Benner's (1984) model was the emphasis it placed on clinical practice, promoting holistic nursing as more significant than task allocation (**Christensen** & Hewitt-Taylor, 2007). Furthermore, Benner et al. (1992) suggested that the transition to expert involves four changes of general performance: movement from reliance on abstract principles, a shift from reliance on rule-based thinking, movement from the perception that a situation is a compilation of relevant bits, and the passage from detached observer to full involvement in the situation.

More recently, the Department of Health developed frameworks which allow service user needs to be met and which also encourage the continual professional development of National Health Service (NHS) staff. Examples include the Knowledge and Skills Framework (Department of Health, 2004) and the Skills Elevator (Department of Health, 2001). Both describe and define the knowledge and skills required of NHS staff for them to deliver high-quality, evidence-based patient care to meet employer requirements (Munro et al., 2004) as well as outlining a stepladder for career progression. Whilst both are concerned with the application of knowledge and levels of proficiency, there is little detail of what knowledge is specific in developing practitioners (Jasper, 2006). The overall theme, it would appear, is concerned more with meeting patient service expectation than professional development. Other more practical, outcome-based frameworks such as the advanced nurse practitioner model are more focused on the acquisition and application of advanced knowledge and skills necessary to complement medical practitioners (for example, Calkin, 1984; Fenton 1985; Brykczynski, 1989; Schuler & Davis, 1993a, 1993b). As a result, these models tend to have more commonality with advancing critical care nursing practice because of the overlapping of medical roles and the professionally autonomous decision making within this area of nursing.

Nevertheless, it is easy to draw parallels between individual and general nursing practice in terms of advancement because the overall aim in practice development is to advance service user expectation; in doing so it also enhances the practice of nursing on an individual level (Mallet et al., 1997). Therefore, for me, advancing practice is a continual developmental process involving the refinement of knowledge and skills and is the precursor to advanced level practice in a systematic progression of individual professional and personal development. But advancing practice is more than simply acquiring experiential knowledge or academic qualifications at the behest of organisational or professional need. Advancing practice is also a process of continuing professional development utilising research, further education, leadership and clinical practice (Sams, 1996; Wilson-Barnett et al., 2000), all of which culminate in a practitioner who is able to challenge and change

professional boundaries, attain professional maturity and achieve higher levels of autonomy.

A Review of Published Work

This section is a re-analysis of my published work, particularly the content, to identify its contribution to advancing practice within critical care nursing. My publications employ a variety of methods, each exploring a different aspect of critical nursing practice, from clinical research, practice development initiatives to clinical reviews. Their instigation was as a result of significant events that required a deeper investigation into the causes, omissions or ways of improving the overall delivery of nursing care. Therefore, it may be appropriate to group these publications into a thematic framework of specialisation, expansion and advancement to put their contribution into the context of advancing practice in critical care (Table 2).

Specialisation

Specialisation can have a variety of definitions such as those already seen with clinical nurse specialists. In this context I use specialisation to refer to the acquisition of content (knowing-why) and process (knowing-how) knowledge specific to the confines of a specialist field of nursing practice (American Nurses Association, 1995; Hamric et al., 2000), in this case critical care, as opposed to that seen with specialist nurses who are more focused on specified disease management. At first glance, some of the topics I present could easily be transferable to other fields of nursing practice, for example those concerned with naso-gastric tube placement (Christensen, 2001), emphysema (**Christensen** & Mattison, 2006), expertise (**Christensen** & Hewitt-Taylor, 2006b, 2006c) and empowerment (**Christensen** & Hewitt-Taylor, 2006a).

Table 2: Thematic representation of published works within an advancing practice framework.

	Theoretical knowledge (knowing-why)	Practical knowledge (knowing-how)
Specialisation	• Physiological effects of noise exposure • Pathophysiology of emphysema • Sedation breaks	• Naso-gastric tube placement • Quarts project
Expansion	• Expert to tasks • Empowerment In nursing	• Expert ICU nurse • Homophobia in nursing • Patient empowerment in the ICU • Sengstaken-Blakemore tube guideline • Chest drain removal
Advancement	• Noise levels in an ICU • Noise levels on a general surgical ward • Do hospital personnel influence the noise levels in an OR and PACU?	• ICU nurses knowledge of noise exposure

What makes these topics specialist in nature is the context in which the information provided is used. For me, this was an important consideration because the differences in patient care between ward environments and critical care are vastly different, such as the severity of illness acuity, the higher levels of patient dependence and advanced treatment modalities not commonly seen on the wards. Consequently, the expectation is that knowledge and skill within this area will be cognisant with this increased illness acuity (see **Christensen**, 2002b; **Christensen** & Pinder, 2008). Therefore, I wanted to challenge the existing basic premise of nursing care, see beyond the simple meaning and relate the provision of care in a critical care context because many novice nurses new to critical care have preconceived ideas about the care that certain patient groups require during their hospitalisation. However, the type of care required on an ICU requires many more variables to be considered. In terms of advancing critical care practice, some of the work presented demonstrates both elements of 'knowing-how' and 'knowing-why' (see, for example, **Christensen** & Mattison, 2006; **Christensen** & Pinder, 2008). The ability to integrate this knowledge into practice is dependent on the level of understanding and

experience of individual practitioners. In the specialism sense, the idea is to focus more on the 'knowing-how' in order to provide safe, effective care.

Expansion

Hamric et al. (2000) suggested that expansion legitimises the medical–nursing boundary and that this could only be accomplished with the acquisition of new knowledge and skills. But I also believe that this can be attained through a process of language development in terms of being able to converse in the same technical–rational language that Schon (1983) spoke of. There is evidence of this new knowledge acquisition/expansion and being able to speak the language of medicine in **Christensen** (2002a) and **Christensen** & Mattison (2006) where the discussion revolves around the physiological effects of noise exposure, dynamic hyperinflation and failing to wean from ventilation. The information is highly technical and could be considered solely within the realms of medicine (knowing-why). But what is important from a nursing perspective is the deeper level understanding of the complexities involved in caring for critically ill patients which go beyond those experienced previously or identified in the specialism realm. Furthermore, it is the ability to translate this language back into meaningful nursing care and identify the impact that both technical–rational (Schon, 1983) and judgement-based knowledge (Polkinghorne, 2004) will have on patient outcome. However, whilst these examples demonstrate that critical care knowledge is more expansive because of patient need, expansion also allows for cross-boundary interprofessional collaboration. This can be viewed within the sphere of practice development initiatives such as those seen in **Christensen** (2002b) and **Christensen** & Christensen (2007) where a level of independence in providing care typically seen with medical decision-making transcends this process. Similar to the example above, these works exemplify the knowledge and skill required to undertake these nurse-led procedures independently. Arguably, they are protocol or guideline driven in terms of expectation. However, there is a requisite level of knowledge needed to fully appreciate the variables required in the decision-making process which can only come with continued experience and understanding.

Advancement

Advancement involves not only elements of specialisation and expansion but also the obtaining of postgraduate qualifications to enhance the learning experience by integrating experiential and practical knowledge (American Nurses Association, 1995; Hamric et al., 2000). Within the work presented, this is difficult to demonstrate because little is offered in terms of the benefits of postgraduate education to support advancement. However, if a perspective of personal advancement was considered, this could be seen in my research work that focuses on noise measurement within the hospital environment. It could be argued that this work transcends all three themes here, but if it wasn't for my own postgraduate academic development in research methods they would be less obvious in terms of advancement. What they demonstrate is a process of advancement through identifying different aspects of noise exposure within a number of clinical areas. However, it is important to note that this progression was a stepwise development as more information came to hand. For example, the initial review on the physiological effects of excessive noise exposure (**Christensen**, 2002a) led to three spin off research studies in which I was able to conduct noise measurement studies in four clinical areas (**Christensen**, 2004, 2005b, 2007). As a result, I was able to ascertain that other variables were responsible for its production, one of the major ones being whether the presence of staff in these clinical environments influenced the level of noise. This then led me to question whether nursing staff actually knew what the causes and the physiological effects of noise exposure were on patients and themselves (**Christensen**, 2005c). This enabled me to build up a picture of noise exposure within the hospital; admittedly, my later work appeared to be directed towards the critical care area.

Defining Advancing Practice

As I have developed my knowledge and skills within critical care, initially as a clinical practitioner and now as an academic and nursing clinician, it has become evident that a dichotomy exists, not only between what advancing and advanced practice are, but also within the concept of advanced practice itself. This can be explained by the very nature of what constitutes advancing

and advanced practice. The rhetoric within the literature identifies who advanced practitioners are, either by role definition or by the attributes of the individual. Not readily explained is what actually constitutes advanced practice, nor is a practical definition offered of either advancing or advanced practice. This has invariably led to the confusion as to what advancing and advanced practice are. As a result, I have developed a working definition of advancing practice for two reasons; first, to attempt to bring the nature of my published work within the realm of advancing practice and, second, to challenge the current discourse of what advancing practice is. Therefore, I would define advancing practice as:

> *The ongoing procedural development of problem-solving, analytical and synthesis skills which allow practitioners to integrate practical knowing-how, theoretical knowing-why and experiential knowing-what into a pragmatic knowing-that knowledge to improve patient care.*

Important features within this definition are the three themes which I believe are central to advancing practice: the practical/experiential and theoretical knowledge and the integration of this knowledge into a purposeful, autonomous knowing-that knowledge. There are some difficulties in defining practical/experiential knowledge because this is seen within the domain of practice and is often perceived as the hands-on, observational and social interaction knowledge that develops over time (Benner, 1984; Rolfe et al., 2001; Estabrooks et al., 2005). This type of knowledge could be likened to Carper's (1978) aesthetic knowing in which knowledge is a gathering process of scattered details and particulars of practice combined into an experienced whole, or equated with gaining knowledge through the use of paradigm cases (Benner, 1984). Others have suggested that practical knowing has been compared to an immediate knowing (Jacobs-Kramer & Chinn, 1988) or professional craft knowledge (Titchen, 2000). There are some notable similarities between these different perceptions of practical knowledge in that this could easily be compared with the work of the expert practitioner attributes which were mentioned previously. However, Fulbrook (2003) put forward the notion that knowledge to inform practice is contained within a

variety of different sources, methods and methodologies. He referred to this as pragmatic epistemology which:

> *...is about practical knowledge which incorporates all forms of knowing – it is the utilisation of knowledge within a practice setting: the value of knowledge for practice and the value of knowledge generated from practice.* (Fulbrook, 2003, p.301)

What pragmatic epistemology embraces is the view that clinical experience/expertise together with an eclectic approach to 'evidence-based practice' culminates in effective patient care and improved practice. Whilst I agree with Fulbrook (2003) in principle, for me the application of pragmatic knowledge in this context goes beyond his definition because what is important in terms of advancing practice is the *integration* of the different types of knowing and the understanding associated with this – the link between thinking and doing. I firmly believe that developing a mixture of knowing-how (practical knowing), knowing-why (theoretical knowing) and knowing-what (pattern recognition) leads to knowing-that – the choice of action determined by the practitioner's understanding of the situation.

However, when I classify my publications according to knowledge type and source, it is difficult to distinguish which type of knowledge can be considered within the realms of advancing practice for critical care (Table 3). Moreover, it could be said that the types of knowledge that I present here could merely inform practice and do so using different methods. This is where Fulbrook's (2003) pragmatic epistemological approach has its value, especially in identifying that all types of knowledge are important in providing an evidence base of care. Herein lies the problem for advancing practice in critical care. Because of the medical dominance in the prescription of care that is undertaken in this environment, the use of different forms of knowledge would certainly inform nursing practice, but the question remains: is informing practice enough to advance the practice of individual practitioners? A number of studies highlighted that nurses place a greater value on experiential knowing than on any other form of knowledge, and therefore it seems

practical in this sense to categorise my publications in terms of the different types of knowing that could advance critical care practice (Table 3).

Table 3: Publications classified according to types of knowledge.

	Knowing-how	Knowing-why	Knowing-what
Case	• Naso-gastric tube placement • Sengstaken-Blakemore tube guideline	• Physiological effects of noise exposure • Pathophysiology of emphysema • Noise in a surgical ward • Noise in an ICU • ICU nurses knowledge of noise exposure • Do hospital personnel influence the noise levels in OR and PACU?	• Sedation breaks
Patient	• Chest drain removal • Naso-gastric tube placement • Sengstaken-Blakemore tube guideline	• Quarts project	• Expert ICU nurse • Expert to tasks
Person		• Patient empowerment in the ICU • Empowerment in nursing	• Homophobia

Although, when viewed in this context, it can be seen that there is an eclectic or pragmatic approach to the way knowledge is gained and presented, it is its application that advances practice. In the next chapter I present my published works that contribute to the concept of advancing practice and a discussion of how my publications fit within the wider context of advancing practice.

CHAPTER TWO

BODY OF WORK

Publication Index to Chapter 2

CHAPTER 2

Contribution to Advancing Practice within Critical Care

My critical care experience and development, as an academic and nurse clinician, have been influential in shaping my understanding of advancing practice. Whilst I would consider my published works to have been instrumental in developing my own critical care practice, their contribution to advancing practice in critical care forms the basis of this thesis. I have been publishing within the field of critical care nursing for six years and have produced ten publications specific to critical care practice and six that are relevant to critical care and nursing practice in general, all of which form the body of my work. The work presented here demonstrates the value in employing different approaches to enhance the knowledge base and therefore advance practice, similar to Fulbrook's (2003) pragmatic epistemology. My work has been cited throughout peer-reviewed journals and books, all with national and international standing (see Appendix 1); but more importantly for me, they have been cited within professional, subject-specific journals as opposed to academic journals because of the nature of the content and the audience that I wished to influence, namely critical care. In the context of advancing practice, my work has contributed to the advancement of critical care practice in three main areas/domains:

- **Practice**
- **Theory**
- **Research**

However, to bring clarity to this, it is important to demonstrate how the body of my work fits within these paradigms. Therefore, in utilising the case–patient–person model of knowledge use developed by Liaschenko & Fisher (1999) and Fulbrook's (2003) pragmatic approach, I have identified the different methods which encompass a theoretical framework of knowledge source to inform and possibly advance practice (Table 4). The reason I have chosen this particular approach is that the model of Liaschenko & Fisher suggests a tripartite approach to the classification of knowledge, which

reflects the work of nurses. This was particularly attractive when I tried to examine which knowledge type and source would be instrumental in advancing practice. I had considered other models such as Benner's (1984) 'Novice to Expert' model, the nurse-practitioner framework, Carper's (1978) 'Ways of Knowing' and Jacobs-Kramer and Chinn's (1988) 'Perspectives of Knowing'. While they are all equally valuable in classifying knowledge for practice, it became difficult to decide which model could be seen as advancing practice and clarify distinctions between the models. Carper's (1978) model for example identified four key areas from which nursing knowledge is produced but offered little as to how this knowledge could be operationalised into a practical setting. The same could be said of Benner's (1984) model which again based novice to expert development through reflective practice but did not really identify the knowing- what, how or why knowledge, key to the advancement through these stages. Jacobs-Kramer and Chinn's (1988) model however, developed the work of Carper (1978) and Benner (1988) to include a typology of knowledge which incorporated creative, expressive and assessment knowledge. They used these categories to identify the interrelationship between the processes that create knowledge and the created product (creative), the exhibition of knowledge (expressive) and an examination of the separate knowledge forms (assessment).

It became evident to me that Jacobs-Kramer and Chinn's 1988 model was difficult to use in attempting to incorporate my published work because many of my works included different, overlapping knowledge streams and therefore it became problematic to identify particular knowledge strands important for advancing practice. When I attempted to combine the model of Jacobs-Kramer and Chinn's (1988) with Carper's (1978) ways of knowing (Table 4), this proved cumbersome and incoherent in its presentation and complex in identifying the place of practice, theory and research. Consequently, Liaschenko & Fisher (1999) suggested that the work of nursing is encapsulated within case, patient and person knowledge. However, their original conception for this model came from the work of Strauss et al (1997) where work involves a sequence of expected tasks, either routinised or unexpected. When compared with critical care nursing practice the sequence

of nursing work was aimed at managing outcome focused illness trajectories. What Liaschenko & Fisher (1999, p32) suggested is that the work of nursing (case, patient & person) describes processes and not the accomplishment of outcomes and therefore legitimises nursing work because it "links the actions of nursing to the knowledge used in the conduct of those actions". Furthermore, the nature of knowledge held by nurses encompasses not only the scientific but nurses know how to get things done in a personal and patient orientated way. Therefore, I opted for Liaschenko & Fisher's (1999) model not only for its tripartite approach to knowledge classification but because it allowed me to better refine where my published works fitted, not only advancing my practice but that of critical care nursing as well. Although there was some overlap similar to that which I experienced with Jacobs-Kramer and Chinn (1988), this was more manageable and as a result I was able to discuss my knowledge domains (practice, theory & research) more effectively. In doing so I attempted to capture those complex dimensions of nursing practice in identifying the interactions between knowledge and action.

In using Liaschenko & Fisher's (1999) model to inform the advancement of critical care practice, I utilised my knowledge domains within the case, patient and person model to categorise my publications (Table 4). Case knowledge is considered general knowledge of disease processes, therapeutic protocols, pharmacology and pathophysiology. Patient knowledge is that which defines patient responses to therapeutics, identifies the patient within the healthcare system and outlines how to get things done for patients whilst they are hospitalised. In contrast to case and patient knowledge, person knowledge is knowledge of the individual as a personal entity, such as their ethical and moral views, their experiences along the illness trajectory and their social standing. Therefore, when used in the context of critical care practice, it is helpful for identifying what knowledge may be deemed important for nurses in locating evidence to inform and advance practice.

I wish to clarify how and why my publications sit within the domains as specified in Table 4. It is apparent that there will be some overlap of the publications in terms of the information they portray, but I see these publications contributing to my knowing-how, knowing-that framework. As I

discussed previously 'knowing-how' is the culmination of theoretical, experiential and pattern recognition knowledge with the outcome being a knowing-that action. Therefore, the research domain is linked with the knowing-what, the theory with knowing-why and practice with knowing-how. Within the research domain there are four publications that span case and patient knowledge, each of which focuses on the exploration of noise exposure within the hospital environment. Whilst Liaschenko & Fisher (1999) discuss case centred knowledge in line with knowledge of the biomedical sciences; it is the most common knowledge nurses use to support patients through their illness trajectory. I use it to illustrate that case knowledge is a cue to set in place expected actions about what is necessary to reduce the incidence of noise exposure for patients and staff alike. This is then transposed through the patient domain with the publication on what knowledge nurses have about the effects of noise exposure. For example, having knowledge of the noise levels within a specific clinical environment allows nursing staff to implement actions that will reduce their occurrence. Making this link between patient and case knowledge then allows nurses to formalise the effects of noise exposure within a context of care and therefore contributes to knowing-what.

This is also evident in the theory section where again the case domain explores the theoretical knowledge in relation to the biomedical sciences such as the physiological effects of noise, the pathophysiology of emphysema and the psycho-physiological effects of sedation. What is noticeable especially within the work on noise is that there is an overlap between theory and research. Even though I saw the physiological effects of noise exposure based purely within a theoretical paradigm and the knowing-why, it would inform the research domain only because of its causal links with that topic area. It could be argued that case theory informed patient research which in turn informed case research and therefore also makes those causal links between knowing-why and knowing-what. The patient theory domain proved difficult to define when considering the characteristics assigned to this within Liaschenko & Fisher's (1999) model. The authors explain that patient knowledge is highly complex. Empowerment and expertise are concepts difficult to define because of their subjective nature. They are found within the

patient theory domain because I felt their content offered a theoretical debate about applying these principles into the critical care environment. But what can be seen within the practice domain, especially in the patient practice domain, is the application of these concepts into the knowing-how and again that overlap I discussed earlier where the link between knowing-how and knowing-why becomes more prominent. Finally, I saw the case practice domain publications advance practice either through practice development principles or as a supplement to existing practice, similar in many respects to Fulbrook's (2003) pragmatic epistemological approach to knowledge development. For me this is the knowing–how or as I explained earlier the task, procedural and behavioural aspect of care delivery.

Table 4: Publications classified according to knowledge type and source.

	Research	Theory	Practice
Case	• Noise levels in an ICU • Noise levels on a general surgical ward • Do hospital personnel influence the noise levels in an OR and PACU?	• Physiological effects of noise exposure • Pathophysiology of emphysema • Sedation breaks	• Naso-gastric tube placement • Sengstaken-Blakemore tube guideline • Chest drain removal • Quarts project
Patient	• ICU nurses knowledge of noise exposure	• Expert ICU nurse • Patient empowerment in the ICU	• Expert to tasks • Empowerment in nursing
Person			• Homophobia in nursing

Practice

Referring back to my working definition of advancing practice, which encompasses the integration of knowing-how, knowing-what and knowing-why knowledge into a practical knowing-that knowledge, the published works that contribute to this domain include those that can be located within the framework of practice development.

Indeed, when transposed into the critical care environment, the fundamental nature of practice development in increasing the effectiveness of patient-centred care means the development of nursing generally and also individually. However, it must be reiterated that practice development does more than develop nursing practice; it can help disseminate knowledge to a wider audience, facilitating effective change, establishing a sound evidence-base for clinical decision making and is responsive to a changing climate of healthcare provision both locally and nationally, all of which is based around a clinical governance framework (McSherry & Bassett, 2002). There are a number of examples within the literature, including the ones presented here, which extol the virtues of advancing practice within specific areas of nursing and are firmly embedded in the practice development idiom. Examples include the work of Jenkins & White (2001), Richardson (2002), Jackson (2003), Munro et al. (2004), **Christensen** (2002b) and Christensen & **Christensen** (2007), which illustrate advancing practice from a global perspective.

However, when mapped within the specialisation, expansion and advancement framework (see Chapter 1), it is evident that the core fundamentals of practice development correspond within the realms of advancing practice, especially within the specialisation and expansion domains. One of the main reasons to consider is that, during the early period of development within critical care, individuals are learning to critically analyse and evaluate the evidence base, not only for the betterment of patient care but also to bring about significant changes in nursing practice (Rigby, 2001). Practice development can be seen as a developmental or transformational change in knowledge and practice to the extent that any trigger that challenges past constructs will have a significant impact on nursing practice (Scholes, 2006). The refinement or the transition to advancement occurs when those skills needed to interpret the complexities of clinical scenarios are harnessed, a reappraisal of the situation has taken place and, as a result, a deeper, enhanced understanding of the nuances of practice ensues; skills that can be developed through practice development. Practice development is summarised by McCormack et al. (1999, p.256) as:

> *...a continuous process of improvement towards increased effectiveness in patient centred care. This is brought about by helping healthcare teams to develop their knowledge and skills to transform the culture and context of care. It is enabled and supported by facilitators committed to systematic, rigorous processes of emancipatory change that reflect the perspectives of service users.*

Moreover, in using concept analysis of practice development to identify a number of critical attributes, Unsworth (2000) suggested that practice development involves:

- Direct measurable improvement in care through new ways of working;
- Specific patient need or problems responded to through effective change;
- Effective services developed through change;
- The maintenance or expansion of current work.

In some cases, practice development can be seen as the driving force for the creation of guidelines or protocols of care to ensure consistency in the provision of that care. There is a danger that protocol-driven or guideline-based care may erode the very nature of advancing practice (Melling & Hewitt-Taylor, 2003; **Christensen** & Hewitt-Taylor, 2006b, 2006c). The issue here is that protocol-driven care does not readily lend itself to close scrutiny or deeper levels of analysis on an individual basis, especially at the clinical workface. This is further compounded by the repetitive nature of some aspects of care which can culminate in individuals who are using this method becoming overly embedded in the 'knowing-how'. For example, a critical care nurse who has developed professionally through the guideline/protocol route, such as a new mouth care protocol, will require a negligible level of knowledge to instruct care. The reason is that there are fewer deeper thought processes required to follow a guideline/protocol. This approach takes the need to think out of practice delivery, similar in many respects to Benner's (1984) rule-governed novice practitioner – the skilled task doer. Instead, it

could be suggested that this method of practice merely enhances an individual's task level.

Despite the negative impact that using protocols or guidelines may have in influencing advancing practice, it is the application of this practical knowledge into a meaningful source of knowledge that is important here. Two publications (**Christensen**, 2002b; **Christensen** & Christensen, 2007) do provide examples of both the advancement of practice in terms of knowledge gained and the potential problems associated with simply following a guideline of care. Both of these demonstrate the benefit for patients in terms of moving them along their prescribed care pathway; an approximation of the practice development principle (see Unsworth, 2000). However, a comparison clearly reveals the different processes undertaken to implement a change to practice. Christensen (2002b) involved a semi-autocratic approach: it was part of my remit to change and improve practice, in this case a quicker throughput of 'fast-track' coronary artery bypass graft patients (Parsonnet et al., 1989). With the introduction of this protocol, to safely remove chest drains independently after cardiac surgery, it advanced the nature of decision making and not the skill in removing the drain because nursing staff had already been deemed competent to remove chest drains in the first place. The difference here is that nursing staff were able to take the additional responsibility of making the decision themselves as to whether to remove the patient's chest drains or wait for medical advice; of course, this would be based on their level of knowledge and experience. In terms of patient benefit, it allowed for earlier discharge to the ward and a quicker recovery from heart surgery. However, organisationally:

> *...the timing of the ward round often meant delays in the discharging of patients to the ward and the unavailability of space and resources to safely accept the incoming admissions. The 'knock-on' effect of this reached not only the patient and CHDU personnel, but had a wider impact on other health care professionals within the cardiothoracic directorate, for example physiotherapists, ward-based nursing staff and those working in radiology services. Consequently,*

> *this led to ineffectual chest physiotherapy as a result of pain and discomfort due to the drains themselves, delays in taking and reporting of post chest drain removal x-rays and a breakdown in effective patient and ward management.*
> (**Christensen**, 2002b, p.67)

As a result of this, perhaps, the change process was one set against the development of a care standard (Royal College of Nursing, 1997) instead of a structured change theory, which meant the former approach remained the central focus for everything else – the decision-making algorithm, staff education and patient inclusion criteria (**Christensen**, 2002b).

The second publication, which focused on the development of a guideline for the care of patients with a Sengstaken-Blakemore tube in situ, might be seen to demonstrate a true practice change for a number of reasons. First, it used a recognised change management theory (Lewin, 1951) to guide the planning, implementation and monitoring process. Second, it identified key personnel and their impact on the change process and allowed strategies to be developed to overcome any potential problems. Third, it adopted a democratic approach instead of a semi-autocratic change to practice like in the first example. Finally, it was in response to an improvement in nursing practice pertaining to the care of a specified patient group which, at the time, appeared ad hoc and reliant on local knowledge and experience as opposed to recognised evidence of best practice (Christensen & **Christensen**, 2007).

Whilst these publications depict the process of practice advancement through practice development and the case-centred domain, the remaining two domains, patient and person, exemplify the advancement of practice from a 'practical wisdom' perspective. If practice is considered as the culmination of experiential and theoretical knowledge, practical wisdom is the embodiment of the human science that is practice (Benner, 1984) – the instrumental problem-solving by a thorough consideration of the facts of the situation (Johnson, 1996). Aristotle first coined the phrase practical wisdom or phronesis to mean the production of a universal good for human kind as well as for particular individuals. Central to this was the production of major and

minor premises that would direct the appropriate action or response to the given situation. The major premise in Aristotle's view is the very essence of practical wisdom because it entails the deliberation of the right action or rule. The minor premise is the inception of the thinker into action: practical syllogism (Hardie, 1980; Lauder, 1994). To give an example – an intensive care patient's blood pressure suddenly drops; the major premise is for the nurse then to ascertain the causes of hypotension. The ensuing deliberative analysis of the situation may involve a theoretical debate as to the possible reasons, such as the effects of anti-hypertensive medication, increased temperature or hypovolaemia. Therefore, the conscious deliberation as to the causes of low blood pressure becomes the 'good end'. The minor premise is then the call for action; in other words, the means that will result in the good end, which may involve a number of different actions to restore the patient's blood pressure back to acceptable limits. Thus, phronetic reasoning in this example produced a perceptive understanding or insight about what is called for in a particular situation (Polkinghorne, 2004) – the right rule based on deliberative analysis of the situation. Indeed, Benner (2000) suggested that phronetic practice is the embodied knowing of the expert nurse – the pattern recognition (knowing-what) of intuitive practice. As already alluded to, expert practice:

> *...has moved beyond knowledge alone and has the ability to rapidly and accurately assimilate knowledge with the salient points of the situation and act appropriately on these without consciously working through the alternatives and the rationale for their decision.* (**Christensen** & Hewitt-Taylor, 2006b, p.303)

Therefore, if consideration is given to phronetic practice (practical wisdom and practical syllogism) within the patient and person domains, the notion of embodied knowing is exemplified in defining the expert nurse within the ICU (**Christensen** & Hewitt-Taylor, 2006c) and individualised patient-centred care itself (**Christensen**, 2005a; **Christensen** & Hewitt-Taylor, 2007). The suggestion here is that the deliberative analysis of the expert ICU nurse then becomes the major premise, remembering that the major premise is more

concerned with achieving a good outcome, by acting as the catalyst for the minor premise (Benner, 2000). The implications of this on patient care especially in defining expertise are concerned with assisting individual patients along their illness trajectory towards health. Within critical care, this may only involve assisting the patient to a different level of illness acuity, for example the transition from level three to level two (Department of Health, 2000, 2001). In **Christensen** & Hewitt-Taylor (2006c), we suggested that the expert nurse is able to work outside guidelines of care because of the extensive practical and propositional knowledge (Benner, 1984) crucial for the deliberative analysis that is encompassed in practical wisdom. Therefore, the assistance afforded to patients is relative to human concerns. For example:

> *...an expert ICU nurse may decide that a patient is not ready for weaning from assisted ventilation. The guidelines on weaning may suggest that the patient's vital signs indicate that weaning should commence. However, an intuitive feeling regarding the patient may make an expert nurse either delay this or follow a more cautious reduction in ventilation than the protocol suggests.* (**Christensen** & Hewitt-Taylor, 2006c, p.303)

The embodied knowing (the major premise) within this example typifies the essence of practical wisdom to the extent that being able to assess the situation on an individual basis ensures that the practical syllogism (minor premise) results in effective weaning from mechanical ventilation. This symbiosis of expert practice and practical wisdom makes for practical syllogism and therefore advances nursing practice.

Although this may appear too simplistic in its underpinnings, the concept of expertise as a phronetic symbol in advancing practice can be demonstrated in the person domain. Here the concept of homophobia and patient empowerment can be viewed from two different perspectives across the spectrum of nursing experience. In the publication on homophobia, I attempted to identify the defining attributes associated with homophobic

feelings and behaviours exhibited by nurses caring for gay patients and then transpose these against model cases (**Christensen**, 2005a). Whilst the model cases are self-explanatory examples of the defining attributes of homophobia in nursing, it is an analysis of the model cases that allows them to be transposed into phronetic judgement. For example, the model case when seen as a distinction between novice and expert practice could be portrayed as novice behaviour simply because it suggests one of three things: a lack of practical and personal experience, life-long prejudice and a lack of self-awareness. The behaviour encountered here could be considered rule governed because it is based on abstract principles, formal models and theories – the religious abhorrence of same-sex relationships and society's depiction of strict gender roles. The novice will only focus on specific aspects of the situation, in this case the same-sex relationship. In terms of phronesis, the outcome for the patient is a negative encounter between themselves and healthcare professionals – in other words, there will be little to differentiate what aspect of the care provided resulted in a good ending. Hardie (1980) does discuss the proposition that a negative rule, as suggested here with the exhibition of anti-gay behaviour, can a have a negative end. The application of the negative rule then supposes that the nurse should consider unconditional positive regard in this situation (Rogers, 2001); whatever the patient's social background may be, any personal biases are negated for the benefit of effective patient care and therefore brings about the good end. This can be demonstrated succinctly in the borderline case. Whilst showing some of the attributes of homophobia as identified in the empirical referents, the nurse in this case was able to make reasoned decisions about the needs of the patient under his care and then act accordingly. However, as progression through the cases demonstrates practical wisdom and syllogism, it is evident that the borderline and contrary cases could also be considered within the realms of expert practice based on practical and propositional knowledge (Benner, 1984), although gained from different perspectives.

In summary, the publications presented here contribute to advancing practice in critical care from two different perspectives in keeping with Liaschenko & Fisher's (1999) knowledge model. First, the case-centred domain discusses the advancement of practice within a practice development framework and

considers the betterment of patient care through the guise of effective change management and better ways of working; for example, determining naso-gastric tube placement and the Quarts project (**Christensen**, 2001; **Christensen** et al., 2008). Second, the person and patient domains were exemplified by a discussion of expert practice and the notion of practical wisdom. Instead of attempting to discuss what an expert practitioner is or does, as this is already well established within the literature, I wanted to emphasise the importance of expert practice in the ICU against the backdrop of current driving forces in health care, such as the current climate in which quantification of value and cost containment run high on political and health agendas. The examples presented here demonstrate the very essence of expert practice in providing holistic patient-centred care as opposed to the protocol/guideline aspects of care. Whilst I have attempted to discuss expert practice from a philosophical perspective, I was also aiming to identify the deliberative reasoning that separates novice from expert practice and, in doing so, demonstrate the advancement of practice from these two practical paradigms. From a personal perspective, practical wisdom contributes to advancing practice in critical care through the expansion of the knowing-how and knowing-why knowledge encompassed within deliberative reasoning and the subsequent action that takes place in complex situations, to the extent that practical wisdom draws on all the human sensitivities in producing a universal good.

Theory

The theoretical knowledge as depicted in Table 4 is limited to the case and patient domains and, as such, they can be considered within a continuum of empiricism and abstraction similar to that described by Chinn & Kramer (2008); the nature of this work corresponds with their relatively empiric-abstract concept. I'm using this continuum in the context of categorising my theoretical work based on technical–rational knowledge (empiricism) and judgement-based knowledge (abstract) as it applies to critical care. By taking this approach, it identifies for me that the knowledge important for advancing practice can be viewed from different perspectives depending on how that knowledge is utilised; it could be argued that this may be comparable to

Fulbrook's (2003, p.304) pragmatic epistemological approach to knowledge use to the extent that this *is also about building upon foundations of knowledge and promoting a continuing conversation about the value of knowledge for practice*. Therefore, the relatively empiric concept in this instance focuses on perceptual encounters that are directly observable, such as objects and events which can be measured through standardised instruments such as the physiological effects of excessive noise exposure (**Christensen**, 2002). At the opposite end of the spectrum are those relatively abstract concepts that are formed from inferred mental constructs which encompass complex behavioural observations and offer fewer concrete definitions, for example the concepts of homophobia (**Christensen**, 2005a), wellness, empowerment (**Christensen** & Hewitt-Taylor, 2006a, 2007) or expertise (**Christensen** & Hewitt-Taylor, 2006b, 2006c; Chinn & Kramer, 2008). Whilst these may sit within the case and patient-centred domains (Table 4), they equally sit within the specialisation and expansion domains (Table 2) because they exemplify advancement of my own development and thought as well as their contribution to critical care nursing practice. To summarise, specialisation focused on the acquisition of content and process knowledge within a specific area of nursing whilst expansion then encompassed new knowledge and skills based on existing practical and propositional knowledge.

Therefore, basing the nature of these publications within the sphere of specialisation and expansion in relation to practice advancement, it becomes noticeable that there is an overlapping of content and process between specialisation and expansion. For example, when looking at the discussion on emphysema, its pathophysiology meets the requirements of specialisation in that it is focused on content knowledge – relatively empiric, because it centres on the development of disease (the case-centred domain), an identifiable and measurable event. However, within the discussion on nursing care, especially in the critical care environment, the context then becomes expansive through the application of this content knowledge into a practical framework – the development of new skills in determining nutritional status, identifying intrinsic positive end expiratory pressure and effective weaning from artificial ventilation. There is much already written about emphysema,

but this tends to be heavily medicalised and concentrates on one particular facet of emphysema, for example non-invasive ventilation (Plant et al., 2001; Conti et al., 2002; Petty, 2002). What my co-author and I were attempting to achieve was an amalgamation of known knowledge about emphysema to make a coherent construct of this condition and the specifics of care that are pertinent to critical care nurses. As we concluded:

> *Emphysemic patients especially ones experiencing an acute exacerbation of their disease process challenges the nursing care that is provided in critical care. Namely because of the different pathologies that sometimes co-exist for example malnutrition. Therefore, nursing care should have as its focus a key understanding of the pathophysiology of emphysema within a critical care context to be able to provide effective care especially with regard to the fragility of this patient group in terms of their respiratory function. Of importance within this context is an understanding of the factors that may well lead to weaning failure in these patients. That is to say the provision of adequate nutritional support to meet their high energy needs and allow for patients to normalise their pre-admission acid-base balance prior to weaning.* (**Christensen** & Mattison, 2006, p.336)

There is a similar issue that echoes through those publications depicted within the case-centred domain on noise exposure and sedation breaks inasmuch as there is an overlap between specialisation and expansion. The focus was to identify key principles or themes within the critical care environment that warranted further exploration and contributed to the existing knowledge base, albeit theoretical. The publication on noise exposure (**Christensen**, 2002a), whilst setting a theoretical precedent in terms of specialisation, its value within the expansion domain is in identifying key physiological effects that contribute to those behaviours seen in agitation and post-traumatic stress disorder (PTSD) in the acutely ill ICU patient (Samuelson et al., 2003; Capuzzo et al., 2004; Van de Leur et al., 2004). Like any stressor, constant exposure to excessive noise levels has been shown to

contribute to the condition known as ICU delirium, which is often characterised by delusions, paranoia, disorientation and slurred speech (Helton et al., 1980; Baker, 1992; Baker & Holding, 1993; **Christensen**, 2002a). To support the ICU patient through this acute illness phase they are sedated to reduce tissue metabolic demand and, if in need of mechanical ventilation, to tolerate the endotracheal tube. Of course, there are a variety of other reasons specific to certain diseases such as pneumonia where sedation is required to support gaseous exchange and secretion removal.

However, it was the context of this publication that led the way to developing further work. For example, noise level measurements within other clinical areas, hospital personnel's knowledge and influence of noise levels within clinical areas (see research section below) and the appropriateness of sedation breaks, all of which contribute to the ongoing debate concerning hospital induced stressors on patient well-being. One notable theme to emerge from the sedation breaks publication was that there appeared to be some confusion as to the differences between PTSD and agitation in terms of recognised behaviour. This may seem innocuous to the inexperienced nurse, but treatment modalities, especially within the critical care environment, can vary quite significantly, such as the use of physical (though not routinely practiced in this country) or chemical restraint. As a result of this confusion, it was easy to conclude from an anecdotal perspective that this may have led nursing staff to accept that both conditions are similar in terms of their presenting behaviours. Although often resulting in patients being unnecessarily re-sedated because they were deemed "unmanageable", this invariably meant patients were then re-exposed to the stressors which had contributed to the agitation in the first place – a vicious cycle of unintentional torture (Dyer, 1995). As I commented:

> *...the source or sources of noise pollution within the hospital are aspects that nurses consider to be 'part and parcel' of the environment and as such tend to overlook.* (**Christensen**, 1997, p.300)

Within the abstract concept of Chinn & Kramer's (2008) continuum, the publications on empowerment and expertise further develop those principles identified within the practice domain (mentioned above) more succinctly into a critical care context. For me, they typify my own advancement regarding the application of expertise and empowerment within my sphere of clinical practice. Whilst I contend that expertise can be considered within the realm of phronetic judgement, it is in the ICU where expertise is able to excel; Benner's (1984) work on expert practice is a notable example. Notwithstanding other areas of practice, such as mental health or midwifery, critical care nursing practice requires of its practitioners a high level of theoretical understanding and detail to patient care due in part to the severity of illness acuity within this area. There is also the close working partnership between medical and nursing staff that allows for effective interprofessional team working and knowledge transfer. In **Christensen** & Hewitt-Taylor (2006b), we argued that the rising need to promote and undertake evidenced-based practice established on protocolised adjuncts of care is in danger of eroding or undervaluing expertise, in some cases due to cost alone. Yet, we contend that the very basis of expert practice is the exposure individual nurses have to differing episodes of care (knowing-what) and, as such, they are able to build on previous experiences and existing knowledge to provide that individualised care (knowing-that) – the practical wisdom and syllogism that forms expert nursing practice. In the critical care context, intensive care patients do not necessarily follow a set pattern of treatment according to a guideline or a protocol of care. There are a number of different nuances as to how a patient will respond to different treatment plans which are dependent on many factors, for example, pre-existing pathologies, age, and sex. It is the ability of expert ICU nurses to assess, observe and react to the minute changes from the expected norm that distinguishes them from less experienced colleagues. We argued that this ongoing experience and ability to assess and interpret these subtleties forms the basis of advancing practice. Moreover, it builds on from 'expert to tasks' in defining expert ICU practice to going some way towards legitimising and adding to the debate about expert and advancing practice.

The same can be said of empowerment. Whilst we confirmed that empowerment is an important consideration in the ongoing improvement of healthcare provision and is central for individualised patient care, we focused the initial discussion regarding the purpose of empowerment (**Christensen** & Hewitt-Taylor, 2006a) into a context-specific exploration of empowerment in the ICU (**Christensen** & Hewitt-Taylor, 2007). Initially, there are some considerable problems with achieving true patient empowerment in this environment: first and foremost, patients are often sedated to comply with treatment modalities such as invasive ventilation. Therefore, the basis of empowerment in this situation is more in tune with assisting individuals to gain a sense of control of their lives as well as:

> *...creating an environment in which they feel valued as humans, not objects.* (**Christensen** & Hewitt-Taylor, 2006a, p.697)

However, the concept of empowerment, especially within critical care, has called into question the need to keep patients sedated for extended periods of time and the effects that this has. It is well documented that intensive care patients display feelings of powerlessness, apathy and withdrawal, agitation and PTSD-type symptoms (Oberle, 1991; **Christensen** & Hewitt-Taylor, 2007). Therefore, it can be seen that several publications follow a theme of critical care nursing and are encapsulated within the theory and research domains, and can then be transposed into the practice domain. For example, my research on noise exposure and knowledge has led to discussions about empowerment and sedation breaks in a global and critical care context to portray a rounded approach to patient care – the link between thinking and doing. In terms of expertise, I would consider this to be intertwined within the advancement of practice through all three domains; I suggested that expertise is focused on phronetic judgement because it is the ongoing culmination of both practical and propositional knowledge into a pragmatic knowing-that. Moreover, this also gives credence to my working definition of advancing practice because it demonstrates an ongoing development of analytical and critical thinking skills.

Research

In my own personal practice I'd always been socialised into the skills approach to nursing care and, at the time, skills acquisition meant experience and advancement. But I soon realised that this was not enough because nursing in the 1990s was still trying to establish itself as a profession; crucial to its place in healthcare provision was the ability to construct a widely accepted research base around itself (Hicks, 1996), similar in many respects to what had already been achieved in medicine. Indeed, it was the Briggs Report (Briggs, 1972) that brought to the forefront the notion of professionalism in nursing and that nursing research should be the driving force in establishing professionalisation. This was then seen as the way forward – nursing research was becoming the answer to professional development in nursing and to the advancement of nursing practice. Some nurse researchers suggested that nursing should establish a unique clique in nursing research and move away from positivist, scientific and medically focused research by focusing on socio-anthropological sciences to inform nursing care (Melia, 1982, Duffy, 1983; Mulhall, 1995), simply because of the social context which nursing is predominately immersed. Even though I saw my noise research as a way of informing practice, I question whether it really advanced practice because this phenomenon was well known within the confines of intensive care. It is then that I thought about the questions Akinsanya (1994) raised around the importance of nursing research for clinical practice. He suggested that:

> *...nursing research in recent years has been directed at the usefulness of, and the relevance of much of the completed research to, the practice of nursing itself. In short, practitioners sometimes wonder whether the so-called research in nursing is of any use to them in their daily clinical experiences.* (Akinsanya, 1994, p.174)

Its relevance, he argued, was more about its contribution to identifying and strengthening the current professional nursing knowledge base, whereas its usefulness was dependent on two distinct points. First, for research to be

useful, the reader or implementer must be research minded and research aware and key to this is the establishment of research education at undergraduate level. Second is the implementation of research findings by practising nurses. This latter point may appear simple in itself; but it was MacGuire (1990) and Sitzia (2002) who pointed out that there appears to be a reluctance to accept research findings into everyday practice because of the need to change the status quo. Yet, this is exactly what one of the major principles of practice development is supposed to address – the implementation of best evidence into practice for the betterment of patient care (see **Christensen**, 2002b and **Christensen** & Christensen, 2007). When nursing staff were asked their opinions about implementing research-based evidence into their own practice, 78% of respondents would act on opinions from their professional colleagues (Upton, 1999), which suggests that practical knowledge and experience still go a long way towards defining the best evidence for practice. However, this debate does not take into account that research often contradicts practical and common-sense knowledge and, as such, research is not there just to professionalise nursing but is also there to underpin practice.

Therefore, it might be appropriate to discuss my research publications in the context of their relevance and their usefulness to advancing critical care practice. As Akinsanya (1994) suggested, the relevance of research findings is their ability to contribute to and underpin the existing knowledge base around a given area, subject or topic. My research predominately centres on noise levels generated within the hospital environment. However, my first publication was a review of the physiological effects that excessive noise exposure can have on human beings (**Christensen**, 2002a), which led to my interest in measuring noise levels in clinical areas and whether hospital personnel contribute to the noise levels being measured. Two of my studies, which focused on three different clinical areas, made distinct correlations between the number of staff present and the level of noise being measured (**Christensen**, 2004; **Christensen**, 2005b), whilst the study undertaken in the ICU gave an impression of what level of noise an ICU patient may be exposed to during their admission (**Christensen**, 2007). In terms of noise measurement levels, these three publications offer nothing new apart from

reiterating the problem of excessive noise production in the hospital environment (see, for example, the work of Hilton, 1985; Baker, 1993; Kam et al., 1994). However, what they did add to the noise level discourse is that the presence of hospital personnel is instrumental in the noise levels being generated (55%), which is similar to the findings of Kahn et al. (1998). Foremost to the addition of new knowledge was the study which looked at what ICU nurses knew of the effects of excessive noise exposure within the ICU (**Christensen**, 2005c). Therefore, in terms of their relevance, the published articles mentioned here do provide an additional layer to explicit knowledge as well as reiterating and strengthening the argument that exposure to unwarranted noise can have deleterious psycho-physiological effects on patients and hospital personnel alike. Notwithstanding their contribution to existing knowledge, it is their suitability in advancing practice that needs to be taken into consideration. These publications fit within Liaschenko & Fisher's (1999) case-centred domain (Table 4) and the advancement domain (see Table 2, Chapter 1) because they have the ability to inform practice over a wide area of specialities. As some researchers have found, it is not necessarily the amount of equipment present within the vicinity of patient care areas that is the problem, it is the human element that influences the perceived level of noise (Kahn et al., 1998; **Christensen**, 2002).

It is these publications' usefulness within the global context of advancing practice that can readily be seen by the number of citations (see Appendix 2) attributed to them in that they appear to be supporting a change in practice. However, their usefulness in a practical context is not so much about the findings themselves, because these are self-explanatory, but about the implications for practice. For example, concluding from the study on what knowledge nurses have of noise exposure, I suggested that further research on measuring noise levels is questionable because much is already known. Instead, I suggested that:

> *Education through literature review or case study analysis could stimulate peer review and provide a positive medium for pin-pointing problem areas. Random sampling of noise*

> *levels could provide positive feedback, therefore consciously making staff aware of the potential for unnecessary interactions that take place near patients and as such possibly provide a positive influence on behaviour.* (**Christensen**, 2005c, p.206)

This is the very case in the behaviour modification programme of Taylor-Ford et al. (2008), which identified staff as being the major contributor to noise levels in their ICUs, and Robinson et al.'s (2005) Sh-h-h-h Project, which aimed to provide non-pharmacologic interventions to promote sleep through noise reduction education. They both concluded that effective educational strategies along with behavioural cues reduced the level of noise being generated. Therefore, in summary, the usefulness of these publications has contributed to the advancement of practice by exemplifying how research can have a positive impact on patient care even if only in an indirect way.

The contribution of the work to advancing my practice and critical care nursing

When re-considering my work, I became aware of the nature of my publications and the indirect way they influenced and advanced my own understanding of critical care nursing practice. Initially for me as a novice ICU practitioner the critical care environment was a medically dominant environment with medical colleagues dictating care provision despite nurses having a daily plan of care, which appeared to be superseded by medical goals. But as my experience grew it became apparent that nurses were showing more initiative and their opinions were becoming valued and respected. It is then that I started publishing. I feel I have contributed to the knowledge base of critical care nursing because the stepwise approach I have taken to my development and education over the years has increased the depth and understanding of critical care praxis and as a result of my own learning I am better able to disseminate a greater understanding of critical care nursing practice to a wider audience. But secondly and possibly more importantly it has advanced my understanding of issues relevant to this clinical environment. Whilst there are recurrent themes within the work (see

for example the publications on noise) a critique of their content identified for me new knowledge, learning and understanding. In the work on emphysema, for example, I had limited knowledge about the care required for these particular individuals who were experiencing an exacerbation of their condition, but the knowledge was simple and care was task orientated. During the writing of this particular article for publication it suddenly occurred to me that there were some aspects from which I had observed or read that made sense for the decisions that were being made. In doing so I had a better understanding of arterial blood gas analysis in terms permissive hypercapnia and bicarbonate retention in the face of chronic respiratory acidosis. I could, therefore, apply this knowledge in clinical practice and be able to converse with medical colleagues from a point of mutual understanding. At this point it made me realise the link between the knowing-how into an appropriate action taking, knowing-that.

How my publications have influenced critical care nursing can be seen more widely within the citations that have influenced others (see appendix 2). However, apart from the integration of new knowledge into the existing knowledge base (see for example those publications on expertise and empowerment), it is those publications that have had a direct impact on the way that nursing care is delivered and nursing advanced through practice development initiatives. It is these publications that have advanced practice because they have allowed nurses to adopt some independence from medical decision-making and increased professional autonomy. Originally, the dominant organisational culture appeared to increase efficiency for the organisation as work was structured according to expertise. In other words rules and regulations co-ordinated activity. The wish to be recognised as autonomous professionals conflicted with the fact that medical colleagues controlled much of the care and so dictated much of the nursing care which also meant that nursing treatments need to be completed in time scales dictated by this policy. The notion of professional autonomy is problematic in critical care nursing because the work requires a high level of collaboration and agreement with other healthcare professionals, particularly the medical staff.

REVIEW

Bedside methods of determining nasogastric tube placement: a literature review

Martin Christensen

Summary

- **The insertion of an enteral tube can be both distressing and dangerous for the patient especially if placement is not correctly determined**
- **It is hypothesised that techniques for determining enteral tube placement have at times been based on information that may be either outdated or otherwise inappropriate**
- **This paper is a review of the research on three traditional non-radiologic and non-endoscopic bedside techniques for determining nasogastric and naso-intestinal tube placement**
- **Hydrogen ion (pH) analysis, auscultation of insufflated air and the visual analysis of gastro-intestinal aspirate are discussed**
- **Other forms of enteral tube placement are also considered, as well as possible implications for future practice**

Key words: **Enteral tubes, Nasogastric intubation, Nasointestinal intubation**

INTRODUCTION

The aim of naso-intestinal intubation is to provide a route for diagnostic studies, the administration of medicines and nutrients, the promotion of gastro-intestinal decompression and the relief of nausea and vomiting (Delaney, 1991). It involves the insertion of a polyurethane or silicone based enteral tube through the nares into the oesophagus either to lie in the body of the stomach or to continue through the pyloric sphincter into the small intestine.

The placing and determining of the position of the nasogastric tube are not without their complications. A review of the literature identifies that the most common problem is inadvertent intubation of the tracheo-bronchial tree. Accidental misplacement of the enteral tube into the lungs may cause: pneumothoraces, haemothoraces, pneumonitis, broncho-pleural fistula, pleural effusion, pulmonary haemorrhage, empyema, pneumonia and oesophageal perforation (Metheny *et al.*, 1990b; Delaney, 1991; Eisenberg, 1991; Giunta and Malaguti, 1994; Rakel *et al.*, 1994; Gharib *et al.*, 1996). Therefore, accuracy of enteral tube placement into the gastro-intestinal tract rather than into the respiratory system is crucial for safe care (Schmeiding *et al.*, 1997).

Chest – and at times abdominal – radiology and endoscopic visualisation of tube placement are, arguably, the most precise methods for determining the position of enterally placed tubes (Metheny *et al.*, 1990a; 1990b; Zaloga, 1991; Welch *et al.*, 1994; Fater, 1995). However, the skill and expertise required to use this equipment would be considered outside the remit of many ward-based nursing staff. Therefore, nurses have traditionally relied on three basic non-radiological and non-endoscopic methods for determining enteral tube placement. These are:

- auscultation of insufflated air
- aspiration of gastro-intestinal fluid
- pH measurement of gastro-intestinal fluid (Delaney, 1991; Zaloga, 1991; Pulling, 1992; Metheny *et al.*, 1994a; Rakel *et al.*, 1994; Swiech *et al.*, 1994; Welch *et al.*, 1994; Fater, 1995; Viall, 1996; Welch, 1996).

The outcome of research studies has prompted several authors to develop protocols to minimise the complications associated with nasogastric intubation (Price, 1989; Metheny *et al.*, 1993; Rakel *et al.*, 1994; Fater, 1995; Viall, 1996; Welch, 1996). However, the methodology of nasogastric tube placement has changed little over the succeeding years.

LITERATURE SEARCH

This review, therefore, centres on research and anecdotal evidence from the last 18 years, focusing on the non-radiological and non-endoscopic positioning and estimation of enterally placed tubes in adults. The literature reviewed was obtained through CINAHL and Medline searches covering 1982 through to 2000 and consisted of human studies set both in the clinical setting and under experimental laboratory conditions. Only published studies were considered. Of the 68 studies identified 18 were excluded due to the medicalisation of the techniques, for example, the use of external magnetic guidance, sono-

M Christensen, DipN, PGC (ICU), BSc, MSc, MA, Senior Staff Nurse, General Intensive Care Unit, Southampton General Hospital
Address for correspondence: **General Intensive Care Unit, Southampton General Hospital, Tremona Road, Southampton SO16 6YD**
E-mail: **martinchristensen1@yahoo.co.uk**

graphy, capnography, electrocardiography and fluoroscopy. The articles referring to these techniques were considered to be outside the remit of the paper.

Auscultation of insufflated air

Insufflated air auscultated, with the use of a stethoscope, over the epigastrium or left hypogastric region (LHR) typically produces the characteristic 'whooshing' or 'gurgling' sound that generally signifies gastric placement (Metheny *et al.*, 1990a; Pulling, 1992; Giunta and Malaguti, 1994; Swiech *et al.*, 1994; Welch, 1996; Viall, 1996; Colagiovanni, 1999). Other investigators claim that migration of the enteral tube from the stomach into the intestinal tract produces variations in pitch and loudness at different abdominal locations during air insufflation (Thurlow, 1986; Zaloga, 1991; Ugo, 1992; Welch *et al.*, 1994). However, opinion appears to be divided as to the efficiency and reliability of auscultation for determining gastric or intestinal placement (Metheny *et al.*, 1988; Metheny *et al.*, 1990b; Metheny *et al.*, 1994b; Welch *et al.*, 1994; Gharib *et al.*, 1996; Schmieding *et al.*, 1997). Several authors have reported 'pseudoconfirmatory' gurgling when the tube was found to be positioned in the respiratory tree rather than the stomach (Muthuswamy *et al.*, 1982; Miller *et al.*, 1985; Lipman *et al.*, 1985; Biggart *et al.*, 1987; Metheny *et al.*, 1988; Metheny *et al.*, 1990b). Thurlow (1986) suggested that auscultation of insufflated air over the LHR produced loud, low-pitched, deep resonant sounds when the enteral tube was placed gastrically, whereas with proximal duodenal placement the sounds produced were louder and higher-pitched when auscultated over the right hypogastric region (RHR). This technique for distinguishing variations in pitch was then used to predict tube migration from the RHR to the LHR, ensuring placement of enteral tubes into the distal duodenum. Successful distal duodenal intubation occurred 87% of the time from 64 attempts using this technique. However, the difficulty here, the author concedes, is the ability to differentiate between distal duodenal placement and gastric placement, presumably because of their close anatomical approximation to each other.

Welch *et al.* (1994), in following the work of Thurlow (1986) and Ugo *et al.* (1992), used contingency table analysis to demonstrate an 86% positive predictive value for duodenal tube placement using auscultation in 106 observations. Tube placement (size = 10 French) required the investigators to auscultate successfully four different abdominal locations while insufflating air as the tube was advanced. When agreement was reached as to a location, for example the stomach, other non-radiologic indicators were used to confirm placement. These included the retrieval of insufflated air (the negative vacuum effect), pH analysis and the aspiration of gastro-intestinal fluid. The loudest sound auscultated was used to predict location as the researchers failed to distinguish changes in pitch with enteral tube migration into the intestinal tract, as originally suggested by Thurlow (1986).

Confirmatory abdominal X-ray taken after placement revealed 88 (83%) tube ports were located at various sites within the duodenum and 18 (16%) located in the stomach. Whilst the results signify a high success rate for tube placement, there is some difficulty in drawing conclusions from this study as to the efficiency of auscultation alone. The obstacle lies in the fact that the investigators evaluated four bedside indicators used in unison. Other studies have, however, investigated the use of auscultation alone (Metheny *et al.*, 1988; Metheny *et al.*, 1990a) as an indicator of gastro-intestinal placement. The results in these cases demonstrated considerably lower success rates.

For example, in a descriptive pilot study, Metheny *et al.* (1988) demonstrated that nurses were unable to determine the position of the enteral tube through air insufflation and auscultation despite confirmatory X-rays. Thirty-one patients cared for in a variety of nursing speciality units (two intensive care units, two rehabilitation wards, one step-down unit and an ear, nose and throat unit) had 34 X-rays performed to verify enteral tube placement. Auscultation was carried out over the epigastric region while 10 millilitres of air were injected into the tube. Nurse raters reported hearing insufflated air 100% (n = 31) of the time. However, documented X-ray placement of the tube other than in the stomach failed to be confirmed by auscultation over the epigastrium in 47% of cases. Tube verification by X-ray found the tube position to be, variously, in the stomach (n = 18), duodenum (n = 11), jejunum (n = 3) and the oesophagus (n = 2).

In a subsequent study, Metheny *et al.* (1990a), asked five skilled nurses to determine the location of enteral tubes by the pitch and the loudest produced sound when 123 tape recordings (recorded using a doppler stethoscope) of insufflated air were recorded over the epigastrium, the LHR, the RHR and the uppermost segments of the left and right lower quadrants. Enteral tubes were placed in 85 acutely ill adult patients with insertion confirmed by fluoroscopy or X-ray. The nurse raters recorded their impressions according to the location, pitch, loudness of the recorded sound and possible presence of peristaltic sound (Miller *et al.*, 1985; Giunta and Malaguti, 1994). The findings demonstrated that the nurse raters were unable to differentiate variations in pitch. However, mean loudness of sound at the five different abdominal regions was reported to be 34.2%, which is lower than predicted by Welch *et al.* (1994). Of the correctly identified sounds, 24.4% (n = 28) were later categorised as being peristaltic bowel sounds. The authors concluded that the reliability of auscultation as a means of determining enteral tube placement was not supported by this study. Furthermore, they suggested that air insufflated sound generated through enteral tubes may move freely throughout the abdomen, thus clear delineation of exact tube placement is not reliable by auscultation alone.

Metheny *et al.* (1990b) reports a study in which false reassurance of fine-bore enteral tube placement by auscultation resulted in tubes being inadvertently placed in the respiratory tract. Ten patients were studied over a two-year period in five intensive care units and two general wards. Investigators documented the clinicians' bedside test methods and results using either observations during tube insertion, or interviews afterwards. Of the 10 tube placements studied, auscultation was attempted in nine. Respiratory status in all subjects was obser-

ved during tube insertion. Five subjects were intubated with endotracheal tubes; eight subjects showed no immediate detectable changes; two subjects coughed during insertion; and two subjects were able to phonate while the tube was in the respiratory tract. Cyanosis was not present either during or after tube insertion. Confirmatory X-ray, however, reported all 10 tubes to have migrated into the right main bronchus. Four of the tubes were positioned in the tracheo-bronchial tree, while the other six tubes had perforated the lung and lay within the pleural space, resulting in five patients developing pneumothoraces requiring treatment with chest drains. Pleural effusion, a broncho-pleural fistula and inadvertent administration of antacid medication through the feeding tube were reported in three of the subjects.

Despite this, clinicians reported hearing sound at the epigastrium in eight subjects with the intensity of the sound ranging from loud (n = 5), muffled (n = 2) and soft (n = 1). Guiness (1986) believed that the muffling of sounds heard at the epigastrium should alert staff to possible respiratory placement. However, this was supported in only two subjects. The five subjects exhibiting loud sounds led clinicians to feel assured of correct placement. Therefore, based on these findings, the authors concluded that the reliability of the auscultatory method for confirming tube placement could not be supported in the majority of cases.

Biggart and colleagues (1987) discussed the dangers of inherent enteral tube placement using a case study approach. Their findings were similar to that of Metheny *et al.* (1990b) when auscultation was used in a 45-year-old intubated woman admitted to the intensive care unit following jaw-wiring. A fine-bore feeding tube was passed, post extubation, without difficulty and insufflation of air reported a clear 'gurgling' sound heard over the left hypogastric region, therefore no confirmatory chest X-ray was taken. Enteral feeding was commenced shortly afterwards. After a six-hour period the patient exhibited respiratory distress, tachycardia and pyrexia. Chest X-ray revealed the enteral tube to be positioned in the left pleural space. Following chest drain insertion, 350 millilitres of enteral feed was recovered.

Evaluation of enteral tube placement by auscultation, aspiration of fluid and ease of guide-wire removal still resulted in 14 tubes inadvertently intubating the bronchial tree in a study by Dobranowski *et al.*, 1992, who concluded that all of these techniques are unreliable indicators of enteral tube placement and that confirmatory X-ray is the only sure means for determining tube placement. Roubenoff and Ravich (1989) reported pleural intubation with fine-bore feeding tubes in four subjects even though auscultation of insufflated air indicated the placement to be gastric.

The work of Metheny *et al.* (1988; 1990a; 1990b) and others confirms that the use of auscultation as a method for determining enteral tube placement is an unreliable indicator. Nevertheless, auscultation is still recommended as a reliable indicator of tube placement within the gastro-intestinal tract (Monahan *et al.*, 1994; Black and Matassarin-Jacobs, 1993; Long and Roberts, 1995; Mallet and Baily, 1996). This recommendation is supported by the work of Schmieding *et al.* (1997) who investigated current nursing practice regarding the insertion, placement and removal of nasogastric tubes. This descriptive study, using a 62-item questionnaire sent to 350 nurses (response: n = 143, 43%), discovered differences in determining tube placement immediately after insertion and later as a matter of routine placement check (see Table 1). Analysis of the data revealed that auscultation (25%) and aspiration (22%) were more favoured by nursing staff at the completion of tube insertion than pH analysis (0.7%) and X-ray (9%).

However, later routine checking of enteral tube placement prior to the administration of medication or gastric gavage resulted in 84% of nursing staff relying on auscultation for determining correct tube position as compared with other methods. The checking of tube placement, the authors argued, was seen by nursing staff to be time-consuming, therefore auscultation was chosen as being quick and easy and perceived as a reliable method of assessing enteral tube placement.

Analysis of pH

The technique of pH analysis for verifying enteral tube placement would appear to be more accurate than that of auscultation. Fluctuations in gastro-intestinal pH have been reported to lie within the ranges of one to eight (Goldberger, 1986; Strong *et al.*, 1988; Rose, 1989; Metheny *et al.*, 1989; Guyton and Hall, 1996; Zaloga, 1991; Metheny *et al.*, 1993ab; Welch *et al.*, 1994; Metheny *et al.*, 1994; Welch *et al.*, 1996; Metheny *et al.*, 1998). According to Guyton and Hall (1996) the pH range of gastric fluid is approximately one to four whereas the pH values of oesophageal, biliary, pancreatic and small intestinal fluids are relatively higher due to their alkalinity, ranging in the range of seven to eight (Guyton and Hall, 1996; Goldberger, 1986; Rose, 1989). In a clinical study conducted by Strong *et al.* (1988), 20 aspirates from eight tube-fed patients were reported to have gastric pH values ranging from one to four and intestinal pH from six to seven. Similarly, Metheny *et al.* (1989) found that in 81% of 120 gastric aspirates the gastric pH value was less than four (mean 3.02); in 111 intestinal aspirates studied, 87% showed a pH value of greater than six (mean 6.57). Likewise, in a later study, the average gastric pH obtained from 794 observations of gastric fluid was proven to be significantly lower than

Table 1. Nurses' selected methods for checking placement (Schmieding *et al.*, 1997)

Method	No. of Subjects
Initial placement check	
X-ray	14
Auscultation	39
Aspiration	34
pH	1
Other	5
Routine placement check	
Auscultation	129
Aspiration	73
pH	8
Other	4

intestinal pH (3.52 versus 7.05 using a pH meter) in more than 90% of aspirates collected (Metheny *et al.*, 1993a).

However, the use of acid blocking agents, for example ranitidine and cimetidine, have been shown to increase gastric pH; Metheny *et al.* (1993a) noted an 18.2% increase in gastric pH (pH = 3.12–3.84) with the use of acid inhibitors (see Table 2).

In a large scale follow-up study (n = 794), Metheny *et al.* (1994a) reported that 89.2% of gastric aspirates obtained (n = 405) had a pH of less than six. In the absence of acid inhibitors, 73.5% of nasogastric aspirates had pH readings of less than four, whereas in the presence of acid inhibitors gastric pH rose by 7% with only 55.3% of aspirates having a pH of less than four. Both studies highlighted that intestinal pH showed no significant effects from the presence or absence of acid inhibitors ($p > 0.05$).

The analysis of pH is used ideally as a technique to determine gastric placement (Zaloga, 1991; Welch *et al.*, 1994; Metheny *et al.*, 1993a; Metheny *et al.*, 1993b; Metheny *et al.*, 1994; Welch *et al.*, 1996; Colagiovanni, 1999; Burnham 2000). However some researchers have used pH analysis to determine intestinal placement, gastric placement on its own and establishing gastric placement as opposed to respiratory placement (Schmieding *et al.*, 1997).

Zaloga (1991) attempted bedside intestinal intubation in 231 subjects. Small bowel placement was successful in 92% (n = 213) of attempts. A change in pH of the aspirated fluids from acidic to alkaline was characteristic of small bowel placement, providing for the researchers a 100% predictive power. However, discrepancies were noted between abdominal X-ray and bedside localisation in 13% of tube placements. Intestinal tubes reported to be in the stomach were in fact confirmed by pH analysis to be in a post-pyloric position. The administration of blue dye into the intestinal tube combined with the absence of intestinal feeding solution aspirated from the nasogastric tube reaffirmed post-pyloric placement.

Metheny *et al.* (1993a) demonstrated the successful use of pH analysis in differentiating the placement of 24 enteral tubes which were either electively manipulated or had spontaneously migrated into the intestinal tract. In 79% (n=19) of the tubes manipulated, pH values were noted to increase significantly as the tube was advanced into the small intestine.

Table 2. Percentage distribution of pH-meter readings by tube site, controlling for acid inhibitors (Metheny *et al.*, 1993)

Acid inhibitors absent		
	Nasogastric (n = 185)	Naso-intestinal (n = 197)
pH 0 to 4.0	73.5%	5.6%
pH >4.0, <6.0	15.7%	8.1%
pH >6.0	10.8%	86.3%
Acid inhibitors present		
	Nasogastric (n = 219)	Naso-intestinal (n = 189)
pH 0 to 4.0	55.3%	4.2%
pH > 4.0, < 6.0	26.9%	7.9%
pH > 6.0	17.8%	87.8%

These findings were an echo of an earlier study conducted by the same authors (Metheny *et al.*, 1993a). However, they reported some differences from accepted gastric pH values (gastric pH was then considered to be between one and six) as 14% of the gastric aspirates obtained were of a pH value greater than six (n = 60). This could not be explained solely by the presence of acid inhibitors because 21 of the 60 subjects (35%) were not receiving these agents. However, the fluids found in the stomach aspirates – typically green, off-white, brown or colourless – were noted to be golden yellow, implying that intestinal reflux of alkaline bile may have been responsible for the unusually elevated pH. Nevertheless, this study supported the hypothesis that gastric placement was distinguishable from intestinal placement by the differences in pH, despite the absence or presence of acid inhibitors ($p < 0.0001$).

The ability to predict tube location accurately with the use of a pH sensor feeding tube was studied by Botoman *et al.* (1994). Thirty-nine randomly selected patients requiring enteral feeding for more than three days were to be fed using either the pH sensor tube or an identical tube Nineteen were enrolled into the control group whilst the remainder were to receive the pH sensor tube. Three patients had to be eliminated from the experimental group due to problems associated with sensor tube failure and one had to be eliminated from the control group due to X-ray equipment failure. However, duodenal placement was confirmed in nine subjects (53%, n = 17) of the experimental group versus eight (44%, n = 18) from the control group. Further analysis revealed that four subjects from the experimental group were found to be hypochlorhydric, a condition where pH sensing is an unreliable indicator of tube location. In the remaining 13 patients, 11 demonstrated 100% correlation between intraduodenal (defined as a pH >4) or intragastric (defined as pH <4) localisation and confirmation from abdominal X-ray.

In a preliminary study, Strong *et al.* (1988) also demonstrated 100% positive correlation between pH measurements as a determininjg factor (using a pH sensor tube) and confirmation with abdominal X-ray. Furthermore, Berry *et al.* (1994) reported a 92% positive correlation for intestinal placement with the aid of confirmatory X-ray when using a pH sensor tube in 25 subjects.

However, during the course of their study, Botoman *et al.* (1994) noted that tube displacement occurred in 29% of those patients in which duodenal intubation was successful. Displacement resulted in migration of the tube from the duodenum into the stomach; it was detected by routine eight-hourly pH measurement. Confirmation was carried out by X-ray to ensure respiratory placement had not occurred. Oesophageal and respiratory tube displacements were also discussed by Metheny *et al.* (1990b) in their report of inadvertent tube placement into the respiratory tract. Of the 10 subjects, four were reported to have had pH analysis of the fluid aspirated. The outcome of the aspiration produced samples from within the pleural cavity that yielded a mean pH of 7.21.

In a subsequent study to determine feeding tube placement through pH testing, Metheny *et al.* (1994a) reported

that pleural and respiratory aspirates typically produced pH values of greater than six, therefore allowing differentiation between respiratory pH and gastric pH (see Table 3). The average pH value found from 20 tracheobronchial aspirates, obtained through suctioning, was 7.81 and the 23 pleural aspirates obtained produced a mean pH value of 7.92 units, echoing earlier findings. These were considerably higher than the measured gastric pH which the authors found to be less than four.

Therefore, they concluded that if the pH value of analysed aspirate was less than four it was safe to assume that gastric intubation had been achieved. However, Gharib *et al.* (1996) suggest that, in particular cases, analysis of aspirated fluid resulting in an acidic pH value, which may suggest gastric placement, could in fact indicate infection from within the pleural space.

Nevertheless, Metheny *et al.* (1994a) suggest caution when confronted with a pH of greater than six for a number of reasons moreover because of the inability to rule out oesophageal placement and the possible aspiration of gastric contents into the respiratory tract. Oesophageal placement predisposes to potential pulmonary aspiration (Miller *et al.*, 1985; Gharhremani and Gould, 1986; Metheny *et al.*, 1989; Gharib *et al.*, 1996); especially when high volume feeds are in progress (Metheny *et al.*, 1994a). The pH method is of little help in detecting tube migration into the oesophagus because aspirated fluid could be affected either as a result of gastric reflux or by swallowed saliva. In their study Metheny *et al.* (1994a) found salival pH to be alkaline (range: 2.67–7.57, mean 5.93, n = 9).

Therefore, it is apparent that the challenge to determine other than gastric placement proves to be complex. However, when seeking clues to aid in determining oesophageal placement, Metheny *et al.* (1994a) explain, it is important to be aware of the initial difficulty in aspirating fluid from the tube and immediate effortless belching upon insufflation of air.

Despite this, there would appear to be considerable literature recommending the analysis of pH as an accurate means of determining enteral tube placement (Zaloga, 1991; Metheny *et al.*, 1993a; Metheny *et al.*, 1994a; Welch *et al.*, 1994; Viall, 1996; Metheny *et al.*, 1998) However, Schmieding *et al.* (1997) report that pH analysis is seldom used by nursing staff in ascertaining tube placement (see Table 1) for the reasons already discussed.

Visual characteristics of enteral tube aspirates

On reviewing the literature there appears to have been little formal research relating to the visual characteristics of gastro-intestinal aspirate and their effectiveness in determining enteral tube placement. Authors differ in their opinions as to descriptions of the appearance of gastric secretions. For example, Henry (1990) described pure gastric secretions as being a translucent, pearly grey, slightly viscid liquid. According to Murphy (1990), gastric fluid has a greeny-yellow colouration, probably as a result of bile reflux from the duodenum into the stomach. The variance in colour of stomach secretions, Viall (1996) explains, is dependent on the individual patient but is typically green or off-white and cloudy. Bates (1991) suggests that small amounts of bile within the stomach are a common occurrence. This effect therefore can produce variations in the gastric aspirate pigmentation. Henry (1990) characterised the colour of bile to be yellow, brown or green. Much of the colour that gastric secretions take on is related to the concentration of bile in the stomach and to what degree the bile has been worked upon by gastric acid (Metheny *et al.*, 1994). The viscosity of gastric fluid is primarily due to the secretory function of goblet cells; however, viscous naso-respiratory secretions and swallowed saliva are also present in gastric juices.

Pancreatic secretions make up the majority of intestinal juices that are present within the duodenum. Their appearance, in the absence of gastric secretions, is reported to be slightly translucent or transparent and moderately viscid (Henry, 1990). Further recent reports suggest that a more golden colour or yellow is representative of intestinal fluid (Metheny *et al.*, 1994b; Viall, 1996). Welch *et al.* (1994) explain that a colour change from brown, green or clear to one of yellow is indicative of tube placement from the stomach to the intestine.

Tracheobronchial secretions have been reported by Henry (1990) to have a clear and watery appearance. Opaqueness in the fluid is thought to be due to the suspension of cellular debris within the secretions; a yellow colour may indicate the presence of infection and epithelial cells (Metheny *et al.*, 1994). Moreover, Henry (1990) explains the normal colour of the fluid found within the pleural space is characteristic of that found within the small intestine: yellow or clear. The major difference highlighted by Henry (1990) is the amount aspirated. Pleural fluid aspirate is generally less than 20 millilitres, however for patients presenting with pleural effusions, the amount aspirated is significantly more. Pleural effusions can be classified as either transudative or exudative, the former occurring as a result of chronic liver disease or congestive heart failure, the latter in infection or neoplastic disease (Metheny *et al.*, 1994b). Transudate is typically straw-coloured and clear, whereas exudate is cloudy because of the cellular debris that is present.

Four feeding tubes inadvertently placed in the pleural space were reported to contain haemoserous fluid when aspirated (Metheny *et al.*, 1990b). Analysis of pH revealed values similar to that obtained from the small intestine (mean pH = 7.21). Some investigators mistakenly took pleural fluid as being gastric fluid due to its appearance, when aspiration revealed a straw-coloured or clear yellow fluid (Nakao *et al.*, 1983; Theodore *et al.*, 1984).

Table 3. *Meter and paper pH readings from six nasally placed tubes accidentally positioned in the respiratory tract (Metheny et al., 1994)*

Site of Tube	Meter pH	pH Paper
Right pleural space	8.36	8
Right pleural space	7.58	7
Right lower lobe	7.51	7
Right costo-phrenic angle	6.74	7
Right main bronchus	6.86	6
Right main bronchus	7.25	8

Although little formal research has been undertaken to use the aspirate colour as a means of identifying gastric placement, Metheny *et al.* (1994b) suggested that it may be possible to use this technique to determine gastro-intestinal placement or inadvertent pulmonary placement. In their study, 880 aspirates from nasally placed tubes were classified according to visual characteristics (see Table 4): stomach placement accounted for 440 aspirates and 428 were intestinal.

Eight tubes were found to be placed within the respiratory tract, three within the tracheo-bronchial tree and five in the pleural space. To determine the extent to which nurses could identify the visual characteristics of the aspirates obtained, 30 randomly selected registered nurses were recruited from three acute adult care units and were asked to predict tube location on the basis of aspirate characteristics. The nurse raters' ability to identify aspirate colour correctly, according to tube location, ranged from 81.3% to 90.47%. The reason for the variation was that, initially, the raters were not given guidance as to what colour aspirate corresponded with the appropriate tube location. In the first phase they were expected to rely solely on their own clinical experience. In the second phase, however, the raters were given descriptions of the visual characteristics of fluids from each defining area, as provided in Table 4. What is noteworthy is that, before being given the visual characteristics chart, the results for identifying tube placement by aspirate colour were quite impressive (see Table 5), whereas after suggested visual characteristics were given to the raters this result dropped to 60% (see Table 5). This implied that uncertainty as to what was analysed initially might have led the raters to question their original impressions. The authors admitted that there were limitations to the study, for example the use of photographs instead of actual samples and the problems associated with lack of agreement as to the aspirate colour and its associated location.

A further point worth noting is that the nurse raters were selected from intensive care settings. The authors reported that these nurses 'were accustomed to examining feeding tube aspirates as an adjunctive method to determining tube position' (Metheny *et al.*, 1994b). The results confirm that the raters were able effectively to distinguish gastric placement from intestinal placement in 90% of cases. Problems arose, however, in the attempt to differentiate between gastro-intestinal placement and respiratory placement using this technique. The investigators explained that the difficulties were a result of the close similarities between the visual characteristics of gastro-intestinal fluid and respiratory fluid.

Table 4. Suggested visual characteristics of feeding tube aspirates (Metheny *et al.*, 1994)

(While these suggested categories are not mutually exclusive, they are offered as possible indicators of specific tube position.)

Gastric aspirates are most likely to be:
- Green (cloudy)
- Off-white or tan (cloudy)
- Bloody or brown
- Colourless (clear)

Intestinal aspirates are most likely to be:
- Yellow or bile stained (usually clear but sometimes cloudy)

Pleural aspirates are most likely to be:
- Light yellow in colour and clear, and perhaps a blood tinged

Tracheo-bronchial aspirates are most likely to be:
- Opaque and off-white or tan-coloured, primarily containing mucus

Table 5. Comparison of correct identification made by 30 nurse raters of tube locations (gastric versus intestinal) based on visual characteristics of 100 photographed aspirates before and after reviewing the list of suggested visual characteristics of feeding tube aspirates (Metheny *et al.*, 1994)

Tube Site	Average % of correctly identified photographs Before	After	Mean Difference
Stomach	47.62%	57.62%	−10.00
Intestine	64.29%	60.00%	4.20
Pleural Space	49.17%	50.83%	−1.66
Tracheo-bronchial	45.00%	28.33%	16.67

Other indicators of respiratory placement

As described above, clinicians have used an array of techniques for determining enteral placement. However, what is particularly important is the detection of inadvertent respiratory placement and techniques used have included immersion of the tube hub under water to inspect for bubbling synchronous with respiration, and observation for signs of choking, gagging, inability to phonate or other signs of respiratory distress after tube insertion (Rakel *et al.*, 1994).

The unreliability associated with the observation of bubbling from an immersed tube hub is due, primarily, to reasons of placement (Metheny *et al.*, 1990b). Firstly, it requires the tube ports to be free of the surrounding vessel walls and free from potential mucous plugging; secondly, air trapped within the stomach may give a false impression of respiratory placement; and, thirdly, because it generally relies on exhalation to determine the presence of bubbling, inhalation may predispose the patient to water inhalation if the tube is placed within the respiratory tract. Metheny *et al.* (1990b) also demonstrated that the general acceptance of choking, gagging and inability to phonate as signs of respiratory distress was not supported by their study. Few patients coughed on tube insertion, but this may in any case be due to the enteral tube stimulating the epiglottis.

Other authors have reported using the vacuum method for effective differentiation between gastric and intestinal placement (Welch *et al.*, 1994). The investigators indicated that during fluoroscopic insertion of feeding tubes, it was noted that little of the 60 ml of insufflated air was returned when the tube was positioned within the small intestine. Conversely, the entire amount (60 ml) of insufflated air injected whilst the tube was in the stomach was returned easily. They hypothesised that this phenomenon was due to variance in lumen calibre and the distensibility of the stomach, small intestine and the oesophagus. Welch *et al.* (1994) argued that the effectiveness of the vacuum effect, when used in conjunction with other indicators, was reported to attain an 86% positive predic-

tive value. However, they stress the need for caution when using this technique as a sole indicator. Tube kinking or blockage due to food matter and other debris, and adherence of the tube to the organ wall may make this method unreliable. The need for caution is endorsed by the 45% false negative rate obtained by the authors.

In a more recent study, Metheny *et al.* (1999) used a two-stage predictive algorithm to analyse pH and bilirubin content of tubes inserted into the gastrointestinal and respiratory tract to predict inadvertent respiratory placement (n = 460). One-way analysis of variance demonstrated significant differences in bilirubin content among the three tube sites tested ($p < 0.001$) with the lowest bilirubin level within the lungs (mean = 0.08 mg/dl). Cut-off values for pH and bilirubin were established at 5; using the four pH-bilirubin combinations, all 460 cases were classified (see Table 6).

The results showed that 92.8% of tubes were identified as being intestinal (n = 180, $p < 0.001$) and 98.6% being gastric (n = 141, $p < 0.001$). Interestingly, only 5% of placements were considered true respiratory placements. Yet, while descriptive analysis (ANOVA) supported the researchers' hypothesis that respiratory pH will be high with no bilirubin, this study found that 24.5% (n = 107) of gastro-intestinal intubations were misclassified as respiratory placements and required confirmatory X-ray to establish the exact tube position. Lower intestinal pH resulting from recent gastric emptying and higher predicted gastric pH as a result of acid-inhibiting medications were thought the reasons for these inadvertent respiratory cases.

What is especially worth noting about this study is the fact that X-rays were taken to confirm position even though pH and bilirubin had successfully predicted correct placement. Why this was done the authors do not make clear. However, the use of this technique as a bedside predictor has the major drawback of the lack of a bedside bilirubin analyser, the authors in this case being reliant on laboratory testing of aspirates which took up to seven days to analyse.

Discussion and implications for future practice

The serious complications associated with the administration of drugs or feeding formula into the respiratory tract make it necessary to establish a reliable method for determining enteral tube placement.

Auscultation as a method has been studied, yet its effectiveness as a reliable indicator is questionable. Some investigators have reported high success rates (80%–100% predicted) in the use of auscultation (Thurlow, 1986; Welch *et al.*, 1994), whilst some authors predict a much lower value (Metheny *et al.*, 1990a). However, the confidence nurses have placed in the use of this method has probably been attributed to the rarity with which inadvertent respiratory placement has been reported rather than its proven accuracy as a method for determining placement (Rakel *et al.*, 1994). Likewise, clinical experience – as well as recent research findings (Schmieding *et al.*, 1997) – has highlighted that nurses still continue to use auscultation as the only means for determining tube placement.

Currently the most reliable bedside method is testing the pH of aspirated fluid. Whilst it cannot be ignored that 18% of pH readings may be outside expected ranges, due to possible unrecognised respiratory placement (Rakel *et al.*, 1994), pH testing may reduce the need for confirmatory X-rays especially when attempting tube insertion into the small intestine (Metheny *et al.*, 1993a). Unfortunately, variables within the clinical setting make the utilisation of pH analysis difficult to use reliably. One problem is the calibre of the internal diameter of the enteral feeding tube itself. These specific tubes are prone to collapsing when negative pressure is applied to them such as would happen in the case of attempting to aspirate fluid (Metheny *et al.*, 1993a), making pH analysis troublesome.

Despite the problems associated with these methods, without them nurses are left with no known reliable method to ensure correct placement of the enteral tube. The use of X-rays to determine tube position at the beginning of every feed or simply as a means to ensure correct placement would be inappropriate, dangerous and highly expensive. However, while these techniques on their own are questionable in their ability to predict the exact location of an enteral tube within the gastrointestinal tract, they are able, in the vast majority of cases, to differentiate between gastric and respiratory placement.

It would appear that little has been achieved in developing new techniques to determine enteral tube placement at the bedside without the use of radiography, endoscopy or sophisticated machinery. New methods for enteral tube checking need to be developed and tubes that may allow proper monitoring need to be identified (Metheny *et al.*, 1988). The need for increased methodological rigour within the clinical setting would strengthen external validity and potentially make generalisability of clinical research possible (Wainwright and Gould, 1996). For example, laboratory experimentation such as that conducted by Metheny *et al.* (1990a), led to greater internal validity but the generalisability to clinical practice is questionable because of inadequate control of possible outside variables. However, clinical research to date has centred on patients from the intensive care unit or high dependency unit with an emphasis on laboratory based experimentation rather than within the clinical setting. These patients present with differing pathologies, often intubated with an endotracheal tube and have two or three body system failures. Therefore, the lack of homogeneity in the subject groups makes it difficult to

Table 6. Use of pH and bilirubin content to establish gastrointestinal *versus* respiratory placement (Metheny *et al.*, 1999

pH	Bilirubin (mgs/dl)	Prediction
>5	<5	Lungs
>5	≥5	Intestines
≤5	≥5	Stomach
≤5	<5	No prediction

form generalisations about the best or appropriate methodology.

With an abundance of literature highlighting the methodologies of nasogastric tube insertion, Hanson (1988) pointed out that a new approach difficult – with creativity and research orientation – to identifying alternative non-radiological methods of safe nasogastric intubation; yet it is apparent in 2001 that this is yet to happen.

LIMITATIONS

A significant finding from this review is the small number of nursing research articles that have been published. Further, it is one group of researchers – Metheny and colleagues – who have conducted the majority of research in an attempt to define precise measurement tools and methodologies to ensure safe and reliable placement of enteral tubes. The more prescriptive work has centred on the 'how' and 'what' to do aspect of nasogastric tube insertion (Delaney, 1991; Pulling, 1992; Viall, 1996; Colagiovanni, 1999; Burnham, 2000). Why this continues to be the case is difficult to ascertain, but in the current situation, with this very limited amount of evidence-based nursing research, it may mean a return to medical reliance.

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Nurse-led chest drain removal in a cardiac high dependency unit

Martin Christensen

SUMMARY

- Within the cardiac high dependency unit it is currently a member of the surgical team who makes the decision for a patient's chest drain to be removed after cardiac surgery
- This has often resulted in delays in discharging one patient and therefore in admitting the next
- A pilot study was carried out using a working standard that had been developed, incorporating an algorithmic model
- The results have enabled nursing staff in a cardiac high dependency unit to undertake this responsibility independently

Key words: Chest drain removal • Chest drains • Chest tubes • Intra-pleural drains

INTRODUCTION

A review of the literature, both empirical and anecdotal, suggests that the prime concerns for patients with chest drains *in situ* focus predominately on pain, both at the insertion site and within the pleural cavity, and the enforced immobility and uncomfortable positioning that accompany this treatment modality (Gift *et al.*, 1991; Carson *et al.*, 1994; Owen and Gould, 1997). Therefore, it would seem that the speedy removal of postoperative chest drains – efficiently and with minimal hindrance to the patient – is paramount in aiding a quicker recovery and discharge from cardiac intensive care and cardiac high dependency units.

Decision making on the cardiac high dependency unit (CHDU) with regard to when chest drains were to be removed has in the past been carried out solely at the discretion of the attending cardiac surgical team, usually during the morning ward round. Yet, the timing of the ward round often meant delays in the discharging of patients to the wards and the unavailability of space and resources to safely accept the incoming admissions. The 'knock-on' effect of this reached not only the patient and CHDU personnel, but had wider impact on other health care professionals within the cardiothoracic directorate, for example physiotherapists, ward based nursing staff and those working in radiology services. Consequently, this led to ineffectual chest physiotherapy as a result of pain and discomfort due to the chest drains themselves, delays in the taking and reporting of post chest drain removal x-rays and a breakdown in effective patient and ward management (Figure 1).

It became evident that, for the patients, the delay in chest drain removal may have affected their recovery following elective cardiac surgery. It was vital therefore that a plan of action be initiated whereby nursing staff within the CHDU were able to make the decision to remove chest drains independently.

There was strong support within the unit for the move to nursing staff being able to undertake this change in practice. This led to the formation of a three-member steering group whose aim was to develop a framework which would facilitate the removal of post-operative chest drains without prior consultation with medical staff. The steering group's overall aim, which was central to those feelings expressed by the majority of staff within the high dependency unit, was:

> *'To explore, identify and implement an agreed protocol which would enable suitably qualified and competent nursing staff of the Cardiac High Dependency Unit to facilitate nurse-led chest drain removal independently of medical staff input.'*
>
> (Cardiac High Dependency Steering Group, March 1999)

With the aim established, the group then developed key objectives that were both achievable and practical. These included:

- To identify and agree the clinical protocol that will enable suitably qualified and competent cardiac high dependency nurses to undertake chest drain removal independently
- To prepare a working standard and audit tool to assess effectiveness and efficiency of the agreed standard
- To identify the inclusion criteria for patients who would be eligible for nurse-led chest drain removal
- To identify the educational preparation and assessment of competence in the appropriate skills necessary for 'E' and 'F' grade nurses to undertake this procedure.

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Author: M Christensen RGN, DipN, PGC (ICU), BSc (Hons), MSc, MA, RNT, Charge Nurse, General Intensive Care Unit, Southampton General Hospital, Southampton
Address for correspondence: 6 Anglesea Road, Southampton SO15 5QJ
E-mail: martinchristensen1@yahoo.co.uk

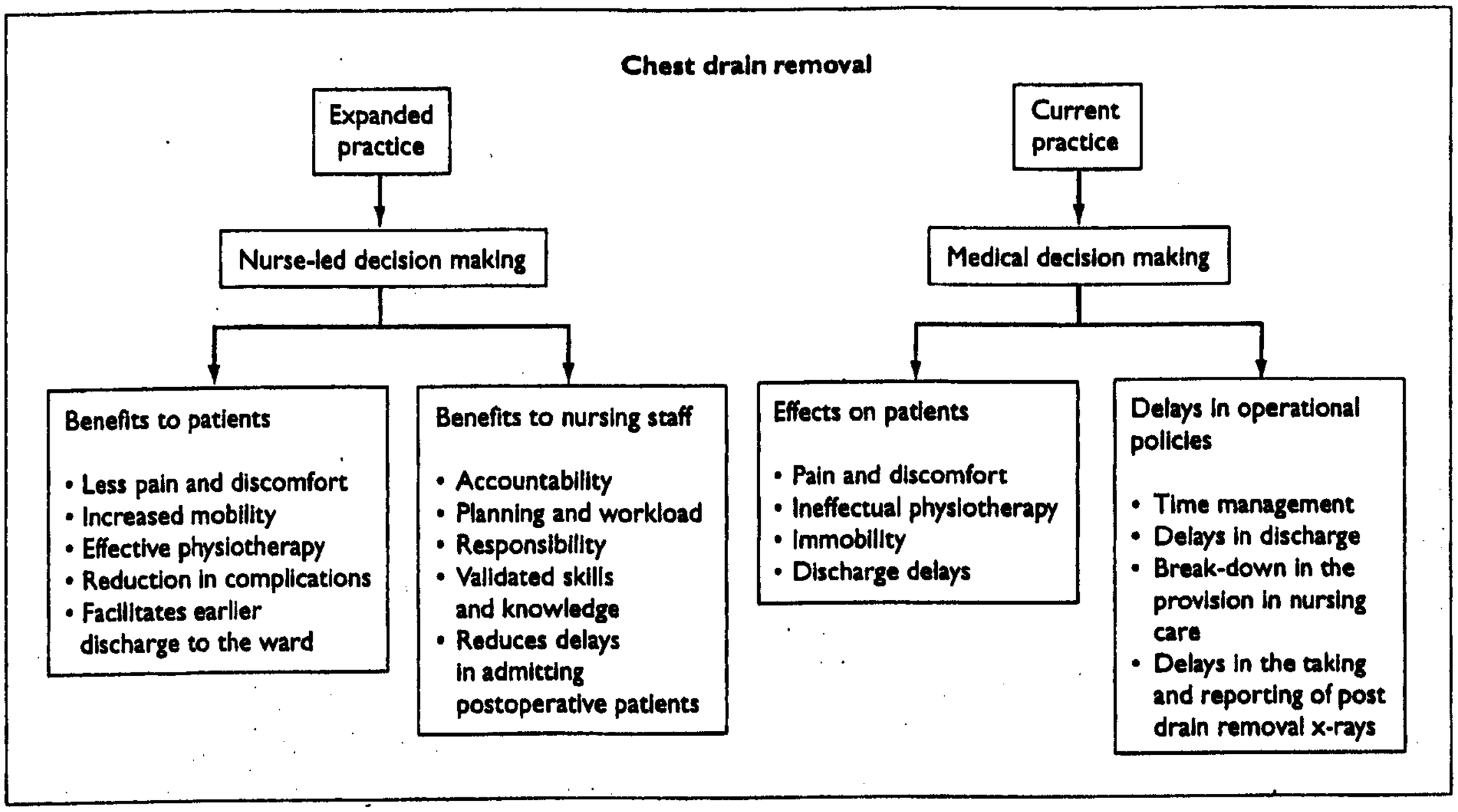

Figure 1. *Potential effects of delaying removal of postoperative chest drains*

Initially it was difficult to envisage a move away from the traditional model of medical dependence to a position where nursing staff of the CHDU could become conditionally independent. Without published literature to support this argument, it would be difficult to gain the needed support from the directorate's four consultant cardiac surgeons. Therefore, a literature review was undertaken to establish validated evidence with regard to nurse-led chest drain removal.

LITERATURE REVIEW

This review centred on research and anecdotal evidence from the last 15 years, focusing on the removal of underwater seal drains in adults. The review was carried out through CINAHL and Medline for the years 1984–1999 and consisted of human studies set both in the clinical setting and under experimental laboratory conditions. Only studies published in the English language were considered. Of the 78 studies reviewed, 57 were withdrawn due to the prescriptiveness of insertion techniques and the overall nursing management of an *in-situ* chest tube. These articles therefore were considered outside the remit of the paper.

There appeared to be very little evidence supporting or detailing nurse-led chest drain removal in the literature reviewed. Indeed, it was clear that the nursing literature appeared to concentrate solely on the more technical and prescriptive aspects that accompany intra-pleural drainage (Horsington, 1984; Mumford, 1986; Foss, 1987; Walsh, 1989; Carroll, 1991; Gross, 1993; Campbell, 1993; Macey and Landstrom, 1993; McMahon-Parkes, 1997). Interestingly, those articles outlining the procedural aspects of drain removal did not mention the rationale behind the drain being removed, i.e. what prompted the original decision and by whom it was made (Erickson, 1989; Campbell, 1993; Gross, 1993; Kinney *et al.*, 1995; McMahon-Parkes, 1997; Thomson *et al.*, 1997; Godden and Hiley, 1998; Smith *et al.*, 1999).

However, some authors had attempted to move the focus away from the technicalities of intra-pleural drainage and more towards the patient's experience of having a chest drain in place. Owen and Gould (1997), for example, in describing patients' experience ($n = 18$) of having an underwater seal drain *in situ* as well as the experience of having it removed, highlighted three key areas which they believed to be of major concern to this specific patient group, namely: discomfort, lack of knowledge and pain.

Discomfort for the patient was reported to be immediately apparent during the early postoperative period and was attributed to the chest drain itself, the restrictions on movement that it imposed and the inability to find a comfortable position, the more favoured positions being sat upright either in bed or in a chair (Owen and Gould, 1997). Others have also reported the benefits of this type of positioning (Horsington, 1984; Mumford, 1986; Erickson, 1989); in these authors' studies, however, it would appear that the rationale for supporting this aspect of patient care appeared to be more in terms of the positive effects it has on lung re-expansion, the promotion of drainage from the pleural space and protecting the equipment, rather than any specific concern for patient comfort.

Distinct from the experience of discomfort, the respondents described the experience of pain as being from the chest drain insertion site rather than from the sternal incision (Owen and Gould, 1997). Moreover, Gift *et al.* (1991) reported that patients experience a plethora of painful sensations when their chest drains are *in situ*, for example sensations of 'throbbing', 'stab-

bing' and 'aching' in the chest. These experiences also described by Jaffray (1995). When the chest drains were removed, patients reported more intense painful sensations: 'burning', 'pulling' or 'yanking' and pressure (Gift *et al.*, 1991). However, the authors go on to suggest that whilst the patient experienced short, intense sensations during chest drain removal, there was no significant difference between those who had been administered analgesia and those who had not. This finding seemed to support evidence from Carson *et al.*'s (1994) study. Here, although analysis of variance demonstrated no significant difference ($F = 79, 7260$, $p = 0.5396$) between patients grouped according to the analgesia administered, analysis of the patients response ($n = 63$) when asked, after drain removal, about their perception of pain during chest drain removal, found significant differences ($p < 0.01$). The reason for this is unclear; however, the timing of when the data were collected, that is immediately after removal of the drain, may have affected the results. The authors do note this and suggest that perhaps an explanation of both the visual analogue scale and the subjective descriptors used in the study should have been done prior to chest drain removal.

Whilst it is apparent from the articles reviewed that patients experience a plethora of sensations as a result of having a chest drain *in situ*, it was not possible to establish from the literature any criteria or a framework, anecdotally or prescriptively, for nurse-led chest drain removal. This posed a problem: a move from medical-led to nurse-led decision-making required the development of a safe, reliable and uncomplicated process which nursing staff in the CHDU area could easily establish as everyday practice. The steering group agreed that it might be instrumental to ascertain what the current practice was in other cardiothoracic units and also to determine if staff in other units were using any formalised methodology for chest drain removal.

Ten randomly selected cardiothoracic intensive care units and CHDUs were approached in a telephone survey to determine what practice was in place with regard to chest drain removal, with particular emphasis to nurse-led chest drain removal. The results of this search showed that medical decision-making remained at the forefront of chest drain removal in eight of the units surveyed.

For example, in four units, it was the practice for chest drains to remain *in situ* until the patient was transferred to the ward; the patient, in one instance, then had to wait to have the drain removed by medical staff. In other units the decision to remove the chest drains was made entirely at the discretion of the medical team. However, in two units, nurses electively removed chest drains when a set minimal drainage was achieved over a set time period, for example less than 20 millilitres/hour over a two-hour period. It appeared that no other variables, such as respiratory or cardiovascular status, were considered.

DEVELOPMENT

Having established our aim and workable objectives, discovered what practice was in place in other units and reviewed the relevant available literature, formalised meetings of the steering group began. Foremost on the agenda was the development and construction of a quality working standard and framework on which to base the inception of nurse-led chest drain removal. Several frameworks and standard setting formats were openly discussed, with an algorithmic model being chosen as a way of delineating decision-making and the Dynamic Standard Setting System (DySSSy) (Royal College of Nursing, 1990) tool for standard construction. Further meetings established criteria such as nurse eligibility and patient inclusion/exclusion, and the benefits for both groups (Figure 1).

Eligibility of the patient group focused on the uncomplicated 'fast-track' patient who had undergone elective cardiac surgery. In this case, the term 'fast-track' was derived from pre-admission assessment criteria that the patient had undergone prior to formal admission and operation. Their score after pre-assessment determines whether they will be admitted to the CHDU after surgery as a 'fast-track' patient or alternatively be admitted to the cardiothoracic intensive care unit (CTICU). Until recently the CHDU would normally have taken the 'fast-track' patients only after they had been initially ventilated, stabilised and extubated in CTITU. However, a change in operational policy has now meant that the CHDU is staffed and equipped to provide safe care for the ventilated 'fast-track' patients straight from theatre.

As a result of this, agreement was reached that only patients meeting the requirements of 'fast-tracking' would be eligible, as these were the majority of post-surgical patients admitted to the unit. The consensus was that 'E' and 'F' grade nursing staff who had completed the Entonox study day and who had been assessed competent through practical assessment would be allowed to remove chest drains independently. Those patients admitted from CTITU usually had their chest drains removed before transfer to CHDU or, if they still had chest drains in situ, it was safe to assume that they had been left for a clinical reason and as such would require a decision from medical staff before removal. In summary, the group felt that early removal of underwater seal drains would benefit both patients and nursing staff (Figure 1).

The algorithm (Figure 2) was based upon the importance of specific factors that nursing staff should be aware of or take into consideration before independently removing chest drains. The cardiovascular parameters are based upon those initially prescribed by the medical staff on admission of the patient into the unit. Whilst the algorithm appears stringent in the requirements needed to remove chest drains independently, the steering group felt it offered a number of safety steps. Even if only one parameter was outside those prescribed, it was deemed to be unsafe to re-

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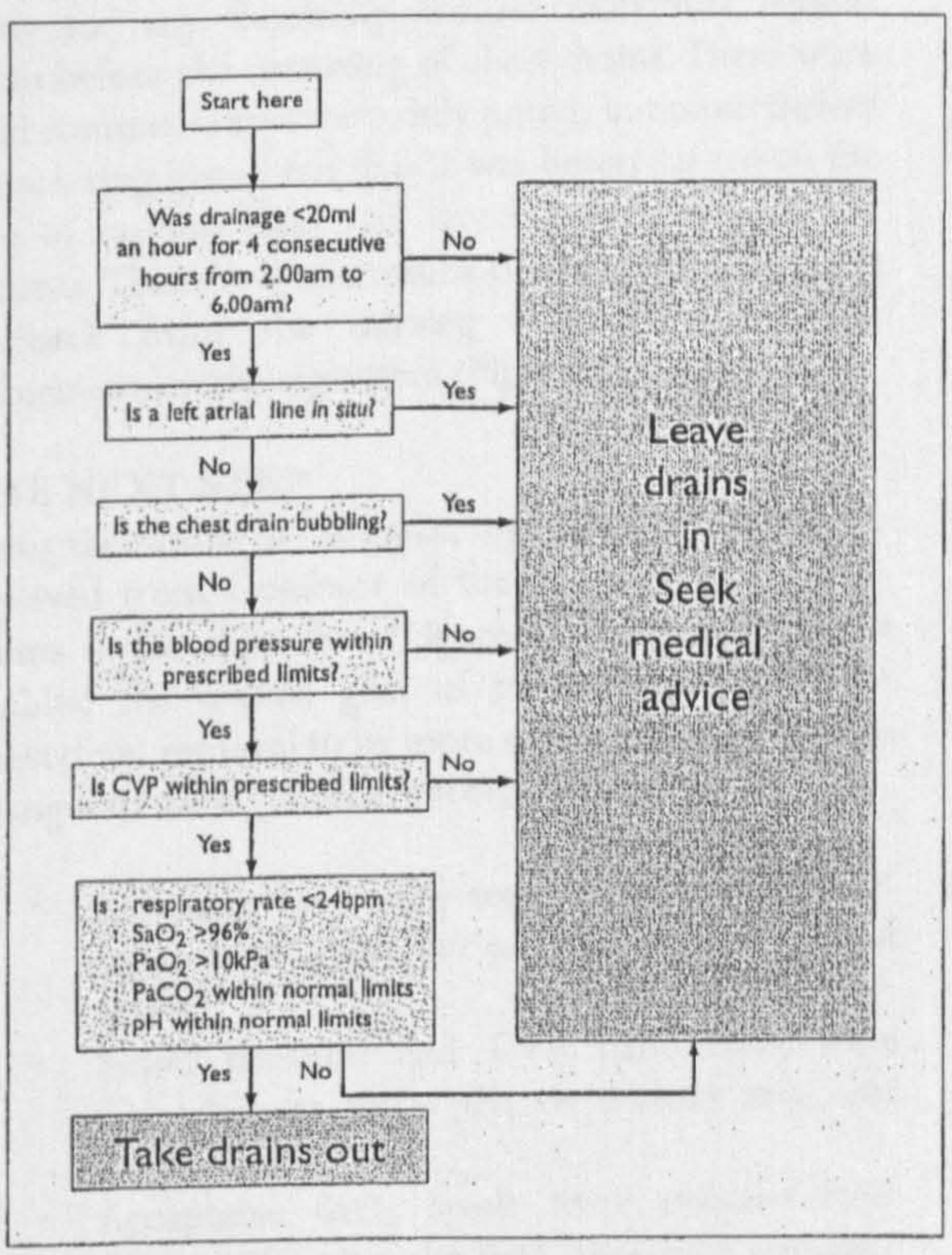

Figure 2. *Chest drain removal algorithm*

move the chest drains without first consulting with the surgical team during the morning ward round.

A draft of the working standard was completed and awaited approval by the senior nursing ; a detailed proposal was also made available to the directorates' four consultant cardiac surgeons for their comments; and at the same time the algorithm was made available to the unit nursing staff for their consultation and input.

Altogether, the algorithm was looked upon favourably as a practical decision-making tool. However, areas of concern did emerge and centred around a number of key issues, namely:

- depth of information that was needed to safely remove the patient's chest drain
- who would be eligible to do this independently
- what patient groups was the algorithm applicable to.

Having already discussed and formulated a plan to resolve these potential problems within the steering group meetings, the expressed concerns set the basis for informal teaching sessions whereby these issues could be explained, clarified and openly discussed.

IMPLEMENTATION

After discussions with the directorate's four consultant cardiac surgeons, it was decided that a pilot study of 50 postcardiac-surgery patients would be undertaken to ascertain the workability of the algorithm and standard. All nursing staff taking part in the pilot study had participated in the informal teaching sessions and had also been deemed competent in the use of Entonox. It was decided that, as the delay in patient care occurred during the morning shift, they would be responsible for chest drain removal during the pilot study period.

Initial assessment of the algorithm was undertaken using a 15-item audit tool, devised and developed by the steering group. Advice was first sought from the clinical effectiveness team, who deal primarily with clinical audit within the trust, as to the structure, format and validity of the measuring tool. Some concerns were raised about the first draft of the tool because of subjectivity in some of the questions – for example, there was one question asking whether the drains were removed using an aseptic technique. It was considered that the answer to this question would always be 'yes', for the simple reason that a negative answer would imply bad practice or unacceptable nursing care. As a result questions such as this were identified, and either re-worded or in this case discarded as not being objective enough in what was being asked. Following modifications and final acceptance from the clinical effectiveness team, the audit tool was then made available for use during the project.

THE PILOT STUDY

While only two patients (4%) had drains removed independently at the conclusion of the pilot study, the audit highlighted some areas of nursing practice that required alteration. This included hourly chest drainage totals, blood pressure and central venous pressure (CVP) parameters and the respiratory parameters (Figure 2). Chest drainage proved to be troublesome, as whilst the hourly drainage may have been less than 20 ml/hr, repositioning of the patient often resulted in a large amount of drainage occurring, for example, a 'dumping' of 60–80 ml. By following the terms of the algorithm as it stood, nursing staff were unable to remove the chest drains without first consulting the surgical team. Other areas of concern centred on the respiratory parameters. Respiratory rate, partial pressure of carbon dioxide ($PaCO_2$) or pH parameters had very little bearing on the outcome of whether to remove chest drains or not. In contrast, there were some cases where oxygen saturation levels (SaO_2) and partial pressure of oxygen (PaO_2) levels in particular inhibited nursing staff from removing their patients' chest drains.

Comments from nursing staff suggested that the algorithm was seen as a highly useful tool, especially so for the more junior members of the nursing team, in informing decision-making. They felt that the variables, whilst stringent, alerted them to areas of the patient's physiological functioning which might otherwise be overlooked; some felt the algorithm was useful in terms of helping nurses to appreciate the effects that chest drains and their removal have on the patient. However, some felt that the algorithm was too strict in terms of what was required to be assessed and did not

allow for any flexibility around individual patient needs before the removing of chest drains. These were valid comments and were duly noted, but nevertheless the steering group felt that it was better to err on the side of caution than risk any harm coming to the patients. Therefore, the results of the audit along with feedback from the nursing staff did allow for refinements in the algorithm (Figure 3).

Table 1. Potential complications associated with chest drain removal following cardiac surgery (Duncan *et al.*, 1987; Gross, 1993; Hudak, 1994; Thomson *et al.*, 1997)

- Pneumothorax
- Aspiration of tissue
- Haemorrhage
- Pneumomediastinum
- Disruption of suture lines

THE NEXT STEP

Using the results of the audit, together with comments received from members of the nursing staff, refinements to the algorithm (Figure 3) were made which enabled the overall goal of independent nurse-led chest drain removal to be more achievable. The notable changes to the algorithm were:

- Increasing the hourly total to ≤40 ml/hr for 4 consecutive hours but not exceeding a total of 100 ml.
- Blood pressure and CVP parameters were discarded, as were pH, respiratory rate, and $PaCO_2$ levels.
- Acceptable SaO_2 levels were reduced from 96% to 95%, but the PaO_2 threshold remained at 10 kilopascals.

After consultation with senior nursing and medical staff, the modified algorithm was considered workable. A second pilot study of a further 50 postcardiac-surgery patients resulted in considerably more patients (56%) having their chest drains removed independently by nursing staff with no complications being reported after removal (Table 1).

IMPLICATIONS FOR PRACTICE

This project, and in particular the development and use of the algorithm, have generated a great deal of interest from staff in the CTITU and from other clinical areas within the directorate. The relatively simple and easy-to-follow format make the algorithm an atractive and user-friendly tool. While it could be argued that the framework appears somewhat task-orientated, we believe it offers an element of safety in terms of the requirements needed for efficient chest drain removal. Furthermore, there is a strong belief that the algorithm could be an effective tool to enhance confident decision-making in the unit, especially for junior nursing staff.

There is the need, of course, for further ongoing evaluation of the project through clinical audit so that essential alterations to the documentation can be made. More importantly, because of the interest in this type of framework, it is envisaged that this can then be modified for use on other projects in the unit, for example nurse-led extubation.

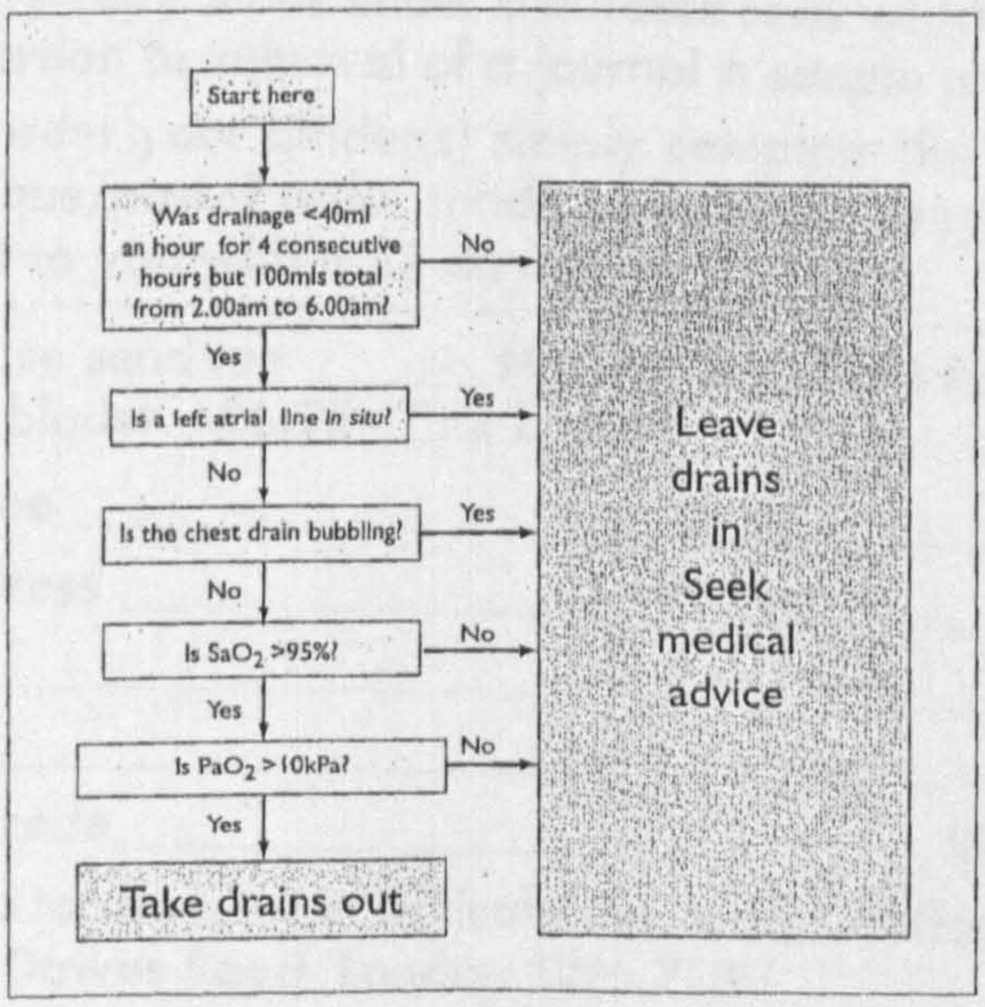

Figure 3. *Modified chest drain removal algorithm*

CONCLUSION

It was evident that there was a significant shortfall in the provision of quality nursing care both within the CHDU and concerning discharge to the ward, due primarily to delays in the removal of intra-pleural drains postoperatively. This needed to be resolved as a matter of urgency.

Though little supporting evidence could be found during a literature review, the results of the two pilot studies carried out using an algorithm reaffirmed the original notion that appropriately trained and qualified nursing staff in the CHDU are capable of making the decision to remove their patients' chest drains independently. Despite the strictness in the criteria set in the algorithm, there was positive feedback from the nursing staff which aided in making refinements to its workings, producing finally a decision-making tool that was practical, realistic and more importantly beneficial to the patient.

ACKNOWLEDGMENTS

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The physiological effects of noise: considerations for intensive care

Martin Christensen

SUMMARY

- Excessive noise levels in the modern hospital can cause major physiological and psychological disturbances in susceptible patients
- Of equal importance is the concern that noise-induced stress has been linked to burnout in critical care nurses, which can disrupt cognitive functioning to the point where errors in decision-making may be potentially deleterious to the patient
- Both implications for practice and recommendations for further research are proposed

Key words: Environmental noise • ICU • Noise • Occupational noise

INTRODUCTION

In 1993 the World Health Organisation (WHO), in its external review draft of Community Noise and the Environmental Health Criteria Document, produced guidelines on hospital-based noise in an attempt to reduce the noise levels to which patients are exposed (WHO, 1993). In its recommendations, the document stated that noise threshold levels within the hospital environment should not exceed 40 decibels (dB(A)) during the day and 35 dB(A) during the night. This restriction appears to be the practice in many German and American hospitals where both an awareness of noise levels and the use of noise-reducing materials are commonly found within the ward environments (Turner *et al.*, 1975; Balogh *et al.*, 1994).

However, a review of the literature suggests that noise levels within the confines of a hospital environment in the UK often far exceed those defined as acceptable by WHO (1993). This may suggest that the source or sources of noise pollution within the hospital are aspects of working life that nurses consider to be 'part and parcel' of the environment and as such tend to overlook (Christensen, 1997). In the case of ward-based areas, current research on the topic is dated, perhaps indicating that the problem of control of noise in these areas is perceived as insurmountable. In contrast, the literature indicates that the ICU appears to be the central area within the hospital where noise level studies primarily are undertaken (Bentley *et al.*, 1977; Kerr and Hayes, 1983; Balogh *et al.*, 1993; White and Burgess, 1993; Kam *et al.*, 1994).

There may be many reasons for this. Clinical experience, in this instance, might suggest that nursing staff attribute noise levels to the workings of mechanical instrumentats, for example ventilators, syringe drivers and cardiac monitors. However, Christensen (1997) demonstrated that the majority (55%) of the average noise level (52 dB(A)) in a four-bedded ICU was attributed to staff conversation. Likewise, Bentley *et al.* (1977), when studying the noise levels in an open Nightingale ward over a 24-hour period, found that the average noise level (50dB(A)) was due to the conversation of both patients and nurses.

Whilst nursing staff in general agree that exposure to excessive noise may lead to – or be a major contributor to – the psychological phenomenon known as 'ICU delirium' which is characterised by delusions, paranoia, disorientation and slurred speech (Helton *et al.*, 1980; Baker, 1992), anecdotal evidence suggests that there appears to be little knowledge or awareness among nursing staff of the physiological effects that noise can have on the body. Among examples of these reported are increased gastric secretion, an increase in the incidence of headaches in critical care nurses, increased cardiovascular stimulation and suppression of the immune response to infection (Marshall, 1972; Falk and Woods, 1973; Jonsson and Hansson, 1977; Andren, 1980; Long *et al.*, 1980; Snyder-Halpern, 1985; Topf, 1988; Baker, 1992; Tomei *et al.*, 1994).

BACKGROUND

Health care institutions were considered to be noise free environments, but today's modern hospital is challenging this image (Seidlitz, 1981; Grummet, 1993). After reviewing the literature it is evident that the ICU is the area where noise pollution is at its most excessive, especially when compared with that of an operating theatre, a recovery suite or a nursing ward. Yet, noise control in this area tends to be overlooked and the physiological and psychological impact that noise has on the patient is considered to be part of the hospitalisation experience.

The level of noise at which the physiological effects begin to occur varies according to the physiological function being measured. However, in general it is considered that changes in physiological functioning have little significance at noise levels of less than 70 dB(A) (Falk and Woods, 1973). This is supported by

Author: M Christensen, RGN, DipN, PGC (ICU), BSc (Hons), MSc, MA, Charge Nurse, General Intensive Care Unit, Southampton General Hospital
Address for correspondence: General Intensive Care Unit, Southampton General Hospital, Tremona Road, Southampton SO16 6YD
E-mail: martinchristensen1@yahoo.co.uk

Minckley (1968), Falk and Woods (1974) and Seidlitz (1981) who demonstrated that levels of 70dB(A) and above consistently disturbed patient sleep, increased the need for pain relief and elevated cardiovascular functioning.

Interestingly, Kryter (1994) suggested that the physiological response to noise often depends on the suddenness and intensity of the noise, and the state of quiescence of the organism being stimulated. He agreed with earlier research findings proposing that a number of physiological responses occur when the body is stimulated by excessive noise levels. These included vasoconstriction of the peripheral blood vessels; heart rate changes; bradypnoea; decreased gastric motility; increased gastric secretion; hormonal changes, namely stimulation of the pituitary and adrenal glands; and the suppression of the immune system in response to stress.

PHYSIOLOGICAL EFFECTS OF NOISE

Unlike other noxious stimuli, for example vibration, smell, pressure and light, sound pressure waves (noise) are transmitted through the ear and auditory canal, and onwards through its ascending central auditory connections. After a succession of fluid impulses that distort the basilar membrane of the Organ of Corti, the original sound wave is converted into neural impulses travelling through the central auditory nuclei in the medulla to terminate in the auditory area of the temporal lobe for interpretation (Cantrell, 1979; Guyton and Hall, 1996). However, it has been suggested that, after reaching the central auditory nuclei, some impulses reach the hypothalamic nuclei resulting in stimulation of the pituitary gland and the sympathetic nervous system, producing the endocrine and sympathetic effects commonly seen in response to a stressful episode (Cantrell, 1979). In addition, the pituitary-adrenal axis has been reported to have a low threshold to noise stimulation: some authors believe as low as 68 dB(A) (Falk and Woods, 1973).

Endocrine effects

Several authors have reported that, in response to excessive noise levels, the immediate stimulation of the hypothalamus and the sympathetic nervous system promotes the secretion of adrenocorticotropic hormone (ACTH) and the release of adrenaline and noradrenaline from the adrenal medulla. ACTH activation is accomplished by a neurohumoral mechanism between the hypothalamic nuclei and the adenohypophysis (Falk and Woods, 1973) and acts directly on the adrenal cortex to release cortisol (hydrocortisone) into the systemic circulation, thereby stimulating the body to protect itself against the systemic anabolism of tissue (Cantrell, 1979; McCarthy *et al.*, 1992; Guyton and Hall, 1996). Cortisol, adrenaline and noradrenaline achieve this effect primarily through their ability to promote the production of glucose substrates and glucose sparing. Cortisol, for example, utilises the catabolism of fat and protein and the production of fatty acids from amino acid gluconeogenesis in the liver for energy, whereas adrenaline and noradrenaline both act to increase blood glucose by inhibiting the secretion of insulin and blocking the uptake of glucose by the peripheral tissues (McCarthy, 1992; Guyton and Hall, 1996). These effects are well documented in the literature.

Fruhstorfer *et al.* (1988), for example, found that substantial elevation of serum cortisol and adrenaline levels were associated with exposure to 85 dB(A) of recorded industrial noise for 12 hours in healthy individuals. Amario *et al.* (1986) in exposing rats to 85 dB(A) of white noise showed increased serum levels of ACTH with a subsequent decrease in growth hormone 30 minutes after exposure. The decrease in growth hormone, the authors contend, is inversely related to the elevated ACTH levels that act as an inhibitor when secreted in large amounts. In studying urine and blood samples of human subjects exposed to differing levels of recorded road noise (40, 50 and 60 dB(A)), Osada and Yoshida (1973), in a semi-rigorous experimental study, demonstrated a significant increase in circulating blood cells and hormones, especially the corticosteroids, indicating an autonomic-system stress reaction occurring at noise levels greater than 50 dB(A).

Immune suppression and wound healing

Arguably more important is the effect these hormones have on the suppression of the immune response, in particular leukocyte function and wound healing (Monjan and Collector, 1977; Kryter, 1985; Durant *et al.*, 1986; McCarthy *et al.*, 1992; Wysocki, 1996). McCarthy *et al.* (1992) and Guyton and Hall (1996) suggested that cortisol has the ability to cause stabilisation of the lysosomal membranes, inhibit the mobilisation and migration of white blood cells and the proliferation of fibroblasts to the injured area and inhibit the formation of prostaglandins and leukotriennes, which ordinarily increase capillary vasodilatation and capillary membrane permeability. Cortisol is also reported to be responsible for the marked decline in the reproduction of lymphocytes, namely the T helper lymphocyte, from bone marrow and reducing macrophage secretion of the peptide Interleukin 1.

Whereas elevated serum adrenaline and noradrenaline levels are shown to impair chemotaxis, slow the migration of neutrophils and inhibit epithelial cell mitosis, as well as prolonging the duration of cell cycle mitosis thereby retarding the inflammatory and proliferative phases of wound healing (Dietch and Bridges, 1987). Therefore, as a result of stress-induced endocrine activity, the decreased levels of proteolytic enzyme being secreted and the ineffectual collagen remodelling, ensures that damaged tissue takes longer to repair (McCarthy, 1992; Guyton and Hall, 1996).

Wysocki (1996) demonstrated these effects when exposing animal models (Male and female Sprague-Dawley rats $n = 40$) to periodic white noise (85

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dB(A)) similar to that of television static. This level of noise was considered enough to slow wound healing in 19 surgically wounded, anaesthetised rats after a 19-day exposure period.

Similarly, Monjan and Collector (1977) demonstrated that exposure to 100 dB(A) of broad band noise for five seconds, every minute over a one to three hour period was significant enough to produce suppression of lymphocyte proliferation in mice, indicating that immunosuppression is mediated to large degree by elevated serum cortisol levels.

In comparison, Fife and Rappaport (1976) demonstrated in a small scale study that the length of hospital stay for post-cataract surgical patients was significantly increased whilst construction work was being undertaken near the hospital. These data were compared with length of stay data before and after the construction work and indicated that there may be a significant relationship between the physiological effects of exposure to excessive noise and wound healing in the post surgical patient. In one laboratory study, healthy young adults were deprived of sleep for three days to test for any relationship between sleep deprivation and leukocyte function. Palmblad *et al.* (1979) reported that phagocytosis by neutrophils of killed bacteria and lymphocyte proliferation was significantly depressed from control levels during the deprivation period and did not return to within control limits for five days, during which time the subjects were allowed to sleep.

Cardiovascular effects

Apart from the hormonal effects reported, the literature has suggested that elevated noise levels can induce abnormal cardiovascular functioning, for example: hypertension and changes in heart rate (Marshall, 1972; Falk and Woods, 1973; Jonsson and Hansson, 1977; Andren, 1980; Peterson, 1981; Kryter, 1985; Snyder-Halper, 1985; Baker, 1992; Baker *et al.*, 1993; Kryter, 1994). Falk and Woods (1973) for example, demonstrated that peripheral pre-capillary vasoconstriction, measured plethysmographically by a finger strain gauge, occurred on exposure to 90 dB(A) of noise. In one study the peripheral vascular resistance increased 100% with a resultant 50% decrease in stroke volume, while systolic and diastolic blood pressure and pulse rate remained comparatively unaffected during the exercise (Jansen, 1968).

However, there appears to be divided opinion as to the response mechanism accountable for these changes in peripheral resistance (Jansen, 1968; Andren *et al.*, 1980). Andren (1980), whilst supporting the hypothesis that peripheral vasoconstriction occurs at noise levels greater than 80 dB(A), suggest that this may be due in part to a non-stressful reflex response, similar to that of the aural reflex or ear protective mechanism, rather than as a result of a general, non-specific stress response, for example autonomic nervous system stimulation. Jansen (1968), when measuring pulse amplitude in relation to narrow band and wide band noise, found that exposure to 92 dB(A) narrow band noise (3,200 Hz) elicited no response in pulse amplitude. However, with exposure to broad band (>3,200 Hz) noise at 92 dB(A) a decrease in pulse pressure was demonstrated indicating that peripheral vasoconstriction was occurring. Likewise, these results may have provided researchers with an indication that at times the frequency of the noise – as opposed to the level of noise – can elicit the peripheral vasoconstrictive response by two different mechanisms, in this case low frequency sound initiating peripheral vasoconstriction through the aural reflex and higher frequency sound involving stimulation of the autonomic nervous system (Jansen, 1968; Andren, 1980; Kryter, 1994).

However, the importance of this phenomenon may go a long way in explaining the effects that excessive noise has on blood pressure and heart rate, more importantly those suffering from acute hypertension or recent cardiac injury. This is clearly demonstrated in a laboratory study (Andren, 1980) where exposing healthy, normotensive adult male subjects to 95–100 dB(A) did not elicit the expected increases in blood pressure, plasma catecholamines and cortisol hormones. However, in subjects with pre-existing hypertension, plethysmographic measurement found a significant correlation between increases in blood pressure and the vasoconstrictive response. What is of interest is that there was a significant increase in serum levels of noradrenaline found in these subjects apparently as a result of the noise exposure, suggesting that vasoconstriction and hypertension occurred as a result of autonomic nervous stimulation of the adrenal medulla (Andren, 1980).

In the rat model, Borg (1982) and Borg and Müller (1978) demonstrated similar results when normotensive animals (n = 130) exposed to 105 dB(A) showed little variation in systolic blood pressure; however, in comparison, hypertensive animals showed a 45% increase in systolic blood pressure from baseline levels. Likewise, Mosskov and Ettema (1977) report a study in which healthy individuals (n = 12) exposed first to air traffic noise and then to road traffic noise for three hours, showed significant differences in diastolic blood pressure (p <0.01) when compared with control data indicating the presence of peripheral vasoconstriction. There were also significant differences found in diastolic blood pressure (p <0.01) when the subjects were given a two task mental test to complete during noise exposure. Other variables such as heart rate, respiratory rate and systolic blood pressure were also examined, showing little or no significant difference. Similarly, in a later study, Baker *et al.* (1993) demonstrated that environmental noise accounted for a 10% increase in blood pressure and heart rate in male CCU patients (n = 20).

In the hospital setting, results from nursing research have indicated a positive relationship between hospital environment noise levels and the physiological

responses experienced by patients. Indeed, some authors have found that patient interaction with nursing staff, medical staff and relatives have recorded significant changes in heart rate and blood pressure (Brown, 1976; Silverberg and Rosenfeld, 1980; Thomas *et al.*, 1982; Baker, 1989; Simpson and Shaver, 1991). However, on reviewing the literature it would appear that little formal research has been undertaken in assessing the cardiovascular changes in, for example, hospitalised post-surgical or medical patients. The majority of work has therefore been done in acute care areas such as the ITU and CCU (Marshall, 1972; Falk and Woods, 1973; Storlie, 1976; Snyder-Halpern, 1985; Baker, 1992).

Yet, despite this, these authors have demonstrated that acute exposure to high level noise (>70 dB) has brought about dramatic changes in cardiovascular functioning, for example increases in heart rate. Snyder-Halpern (1985) for example, found, under laboratory conditions, that healthy subjects exposed to recorded CCU noise recorded increased heart rate changes whilst sleeping. In an earlier study, Marshall (1972), in categorising human and non-human sounds, found that the mean pulse rate increased in CCU patients in response to human sounds. Similarly, Storlie (1976) found that increases in heart rate were related to excessive noise levels in 81% of those CCU patients studied ($p = 0.001$). Furthermore, among patients who had experienced and were recovering from myocardial infarction, 94% had increases in heart rate when exposed to everyday CCU environmental noise.

Sleep deprivation

Sleep deprivation within the confines of ICU has been well documented in the literature with some studies suggesting that the length of sleep a patient experiences in a 24-hour period totals 4.6–8.8 hours (Hilton, 1976; Aurell and Elmquist, 1985; Freedman *et al.*, 2001). The contributing factors of sleep deprivation appear to be multifactorial, with noise often being cited as the environmental stimulus (Freedman *et al.*, 2001). Indeed there appears to be a positive correlation between noise levels and the incidence of 'ICU delirium' which is often been associated with sleep deprivation, and typified by changes in behaviour, delusions, paranoia, slurred speech, irritability and disorientation.

Helton *et al.* (1980) suggested that a major contributor to this condition was staff conversation at times usually associated with sleep, therefore depriving the patient of much needed sleep. An earlier study by Noble (1979) demonstrated this when she found that the largest single source of disturbances experienced by patients was from staff conversations. Similarly, Topf (1985) found that 40% of patients were most disturbed by staff conversations. Likewise, Soutar and Wilson (1986) found that 31% of patients reported getting less sleep in hospital primarily because of staff talking outside their rooms. Noise frequently limits the quality and quantity of sleep required by patients, with sleep deprivation often resulting (Hansell, 1984). Other researchers, when conducting controlled laboratory experiments, found that sleep-deprived individuals exhibited a variety of behavioural disturbances, therefore suggesting that a positive correlation exists between the intensity of behavioural changes and the amount of sleep deficit experienced (Falk and Woods, 1974).

Interestingly, Topf and Davis (1993), using descriptive analysis, demonstrated that subjects ($n = 35$) exposed to audio-taped critical care unit noise exhibited disturbances in rapid eye movement (REM) sleep, as evidenced by electroencephalograph, electro-oculograph and electromyograph. Significant differences in the length of REM sleep periods ($p < 0.01$), the time to reach REM sleep and REM activity ($p < 0.001$) were found in comparisons with the control group. This finding is supported in earlier work by Orr and Stahl (1977) whereby post cardiac surgical patients showed evidence of REM suppression up to four days post surgery and in some cases two to four weeks post hospital discharge.

Hilton (1976) and Richards and Bairnsfeather (1988) found that patients in a critical care unit spent more time in stage one and two sleep than sex- and age-matched subjects in a quiet sleep laboratory. Furthermore, in using continuous polysomnography to assess sleep/wake cycles in ICU patients in relation to environmental noise, Freedman *et al.* (2001) found that 17% of awakenings and arousals from sleep could be attributed to noise alone. What is of interest is that whilst the authors contend that this may be significant, they suggest that environmental noise may not be an over-riding factor in precipitating sleep disturbances within the ICU as once thought. Instead they propose that such disturbances in sleep/wake cycles could be due to the disruption of circadian rhythms evidenced in this study by a predominance in sleep patterns during the daylight hours, pain or anxiety, nursing/medical interventions and underlying disease processes.

Cognitive task performance

It is generally reported that adaptation to noisy environments often encourages less interpersonal engagement – more so in the work place where individuals exhibit behaviours likened to mechanical or robotic rote operations (Gummet, 1993). It has been suggested that people feel that their privacy is being invaded by others and may demonstrate behaviours that signify a desire to escape or disengage entirely (Spacapan and Cohen, 1984). Moreover, some researchers have reported that noisy environments are more likely to enhance non-communicative styles of interaction, over-simplify complex social relations, increase acts of impulsiveness and increase aggression (Green and Powers, 1971; Spacapan and Cohen, 1984; Gummet, 1993). Borsky (1970) demonstrated that annoyance as a result of noise exposure is cumulative with repeated exposure.

However, whilst noise can affect individuals in many ways, it has been shown to disrupt cognitive task performance in those individuals charged with the responsibility of caring for patients. Seidlitz (1981) found that noise can cause irritability and can exacerbate the stress of work requiring alertness and attention to detail. Arousal to excessive noise produces faster decisions and more wrong decisions as a result of the corruption of perceptual processes where subtle information is often missed (McLean and Tarnopolsky, 1977) due to the focus being primarily on complex tasks. Interestingly, Loeb (1986) suggested that the negative performance of people who are experiencing sensory overload and are working at near full capacity is a result of repeated exposure to noisy environments.

In other studies, researchers found that exposure to prolonged levels of noise, resulting in noise-induced stress, was a good predictor of 'burn-out' in critical care nurses (Cohen and Weinstein, 1981; Spacapan and Cohen, 1984; Bartz and Maloney, 1986; Topf and Dillon, 1988), often characterised by emotional exhaustion, depersonalisation and decreased personal accomplishment (Topf and Dillon, 1988; Baker and Holding, 1993). As a consequence of noise-induced stress, these researchers suggested that deficiencies in human performance resulted in a decrease in sustained attention, in rapid detection, in multiple signal tasks and in incidental memory. Topf and Dillon (1988) also found that altruistic and sensitive behaviour was shown to decrease with exposure to prolonged noise.

However, Colle (1980) argued that staff's ability to carry out tasks requiring information processing and short-term memory is impaired significantly more when exposed to meaningful conversation than when exposed to meaningless white noise. Yet, people often interpret sounds differently, especially in particular environments such as the ICU; therefore what may constitute a signal to one person may in fact represent noise to another (Hansell, 1984).

RECOMMENDATIONS FOR FUTURE RESEARCH

It is evident from this paper that there are potentially a number of interesting areas worthy of examination. The majority of research, especially that of physiological functioning, has focused predominately on the patient within certain clinical areas, for example the ICU, or under strict laboratory conditions. Therefore, it could be prudent to conduct studies on those who are seen to be the major cause of excessive noise levels within the hospital environment. For example:

- Does test-retest education of nursing staff on the effects of excessive noise exposure have an impact on measured noise levels within the ICU?
- Do differing levels of intermittent, white, impulse noise affect the cardiovascular and cognitive functioning of ICU nursing staff?

CONCLUSION

It is clear that excessive noise within the confines of a hospital may bring about significant physiological and psychological changes not only in patients but in health care professionals as well. However, the difficulty lies, especially in the ICU, in distinguishing the effects of noise pollution and those of the disease process such as have been seen with endocrine and cardiovascular changes. How to idenmtify these accurately is problematic in view of the fact that physiological and psychological stress is multifactorial. Yet, just as importantly, the potential effects of excessive noise on cognitive functioning in health care professionals appear to be alarming.

Yet a plethora of research studies continually informing the nursing and medical population of the noise levels found in the modern hospital, it would appear that little has been done to rectify this problem. Indeed, the major concern regarding noise levels within the hospital environment seems to indicate that medical and nursing staff are the prime contributors, producing in excess of 30–60% (Bentley *et al.*, 1977; Baker, 1992; Christensen, 1997) of the total noise made. What is of interest is that while medical and nursing staff appear to have some knowledge of the psychological effects noise has on the patient, for example ICU delirium, their knowledge of the physiological effects appears to be very limited. This is surprising when issues such as ineffective wound healing, depressed immunity and cardiovascular instability are considered a major concern. Moreover, it is questionable whether further research is needed highlighting that the hospital environment is noisy, because this is already well established within the literature. Therefore, it would appear that future developments to reduce noise levels in ward and critical care environments should be a major priority.

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Do hospital personnel influence noise levels in an operating theatre and a post-anaesthesia care unit?

Martin Christensen DipN PGC(ICU) BSc(Hons) MSc MA

Lecturer in Nursing Studies, Bournemouth University.

Address for correspondence: Bournemouth University, Bournemouth House, Christchurch Road, Bournemouth BH1 3LT. mchristensen@bournemouth.ac.uk

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Abstract

The aim of this small-scale study was to measure, analyse and compare levels of acoustic noise in two clinical areas: an operating theatre and a six bedded recovery unit. Noise level measurements were undertaken using the Norsonic 116 SLM (Sound Level Meter) recording noise levels in the internationally agreed 'A' weighted scale. Non-participant observations were undertaken to identify staff numbers present within these clinical areas and these were then compared with measured noise levels. Mean noise levels within the two clinical areas ranged from 47.57–50.93dB[A], with acute spikes reaching 80dB[A]. The quietest noise level attained was that of 43dB[A] obtained in the recovery unit during the early hours of the morning and was due to the air-conditioning. Non-parametric testing found a positive correlation ($p \leq 0.005$) between the number of staff present and the noise levels recorded, indicating that the presence of staff strongly influences the ambient level of noise within that area.

Introduction

Both hospital staff and patients are exposed to a variety of noise levels from differing sources. It would be easy to attribute the excessive noise levels to the mechanics of the hospital environment, for example monitoring equipment or alarms. Yet Christensen (1997) found that the majority of noise produced in a four bedded intensive care unit (ICU) emanated from staff conversations, with noise levels reaching as high as 78dB[A], similar to that of a disco/night-club or a working pneumatic drill at a distance of ten feet. The importance of this lies in the psycho-physiological effects of exposure to excessive noise, for example: increased gastric secretion, suppression of the immune system, increased cardiovascular stimulation, ICU delirium and, possibly more importantly, the effects of noise on cognitive task functioning (Marshall 1972, Falk & Woods 1973, Jonsson & Hansson 1977, Andren 1980, Long et al 1980, Snyder-Halpern 1985, Topf & Dillon1988, Baker 1992, Tomei et al 1994).

Literature review

Noise in the operating theatre

On reviewing the literature there appears to be little empirical research measuring noise levels produced in the operating theatre. However, some authors have likened the noise produced in the operating theatre as 'being in the kitchen with a food blender in operation', or comparable with the noise made by a 'truck' or 'train' (Shapiro & Berland 1972). Modern surgery recognised the dangers of air and water pollution a little over a century ago hence the practices of asepsis. However, the inception of aseptic practices has meant that the modern operating theatre has evolved into a 'model of efficiency and convenience from a housekeeping perspective' (Shapiro & Berland 1972). For example, tiled walls, linoleum floors, an array of stainless steel containers and instruments and disposable items all make for easy cleaning. Yet despite this, noise levels within the operating theatre may be comparable with other acute care settings, for example ICU (Kam et al 1994).

In an earlier study which measured the noise levels of a general surgical theatre during a routine procedure, Shapiro and Berland (1972) found that the noise levels ranged from 55–86dB[A]. Measurements taken using a portable sound level meter (General Radio 1565–A) at a midway point between the operating surgeon's ear and the ear of the patient, suggest that preparation procedures, the use of instrumentation and other implements, were the major contributing factors to the overall mean noise level produced in the study area.

Though not recorded, the authors make note of the constant banter and conversation between theatre personnel. Much of the conversation, the authors explain, was necessary because of its applicability to the work being done. However, at times the conversation was not related to the procedure but slipped instead onto issues such as the latest sports scores, weekend plans, interpersonal relationships and personal aspects of the patient.

In a comparative study between two large metropolitan hospitals, noise levels reported by Davies et al (1989) were similar to those found by Shapiro and Berland. The authors found that at specific periods during the operative procedure, for example anaesthetic induction (57–61dB[A]), theatre preparation (60–63dB[A]) and maintenance of anaesthesia (60–63dB[A]), that the conducting of education by personnel was found to be the noisiest (Canadian hospital 70dB[A] and the English hospital 67dB[A]). Whilst the results highlight that the mean noise level in the Canadian hospital (64.25dB[A]) was slightly higher than that of its English counterpart (61dB[A]), the authors conclude that the operating theatre still remains a relatively noisy environment for staff and patients alike. It is possible that the number of theatre personnel or students present within the theatre may have contributed to the noise levels recorded, which were similar to those demonstrated by Falk and Woods (1974), yet the authors make no comment on this.

Noise in the recovery unit

Minckley (1968) found that as noise levels in the recovery unit increased, so would the need for post-operative pain relief. Indeed, in the majority of cases when levels reached and exceeded 60dB[A], there was a dramatic increase in the demand for pain relief from patients recovering from surgery. The application of chi-squared testing demonstrated a significant difference in the number of patients requiring pain medication and the level of noise (χ^2 at 0.05 level=5.991, df=2). There was also a significant relationship between the number of doctors present and the observed noise levels (χ^2 at 0.05 level=9.488, df=4). From this Minckley concluded that when noise levels were high in the immediate post-operative period, patients' subjective sensations of pain were increased. Noise in the external environment represented an operative period when noise levels were high and patients' subjective sensations of pain were increased. Noise in the external environment represented an irritant to the patient. The primary cause of noise was the arrival of the patient from theatre, together with the surgical and anaesthetic medical staff. Relieved from imposed silence and the concentration required during the operative phase, these doctors tended to converse loudly within the recovery unit, discussing the procedure and post-operative orders and making jocular comments to nursing staff, thereby increasing the noise levels to 60–70dB[A]. At these times more pain-relieving medication was given to patients per capita. Interestingly, chi-squared testing of the presence of nursing staff and patients alone did not demonstrate a significant difference in pain-relieving medication required.

In studying the noise levels in a recovery unit, Falk and Woods (1973) found that patients and staff contributed to noise levels, ranging from 54–80dB[A]. Noises were loud and often not directly related to patient care. Machinery noise levels measured in the unit were considerably less and demonstrated a significant correlation ($p<0.01$) between the number of staff present at the bedside and noise levels recorded (0.705). Further analysis revealed that noise also appeared to be significantly associated with the number of patients present ($p<0.01$). Simple linear regression, with staff being the independent variable, demonstrated a significantly ($p<0.01$) high proportion in the variability of observed noise data. This therefore lends support to Minckley's (1968) work by highlighting that at these levels of noise, patients' post-operative comfort is compromised sufficiently to require an increase in pain relief.

Methodology

Overview

This study was undertaken to compare and contrast the measured level of noise and the presence of staff in a general operating theatre and six bedded recovery unit. The study used was descriptive. It produced data at ordinal level which was used to determine the level of noise produced and its relation to specific time periods throughout a 24 hour period.

Sample and setting

The areas studied in a 480 bedded district general hospital were a general surgical operating theatre and a six bedded recovery unit. The theatre operated on 350 routine and emergency general surgical patients and the recovery unit recovered 3,500 patients yearly. The rationale for choosing these particular areas was, 1: the theatre and recovery unit require a high level of patient monitoring, resulting in close proximity work being undertaken by nursing and medical staff, and 2: the two units are open plan.

In examining these two areas consecutively it was possible to study the planned surgical patient's theatre experience of noise exposure during their hospitalisation. This study may have had some bearing on nursing practice, in that the literature indicates that the major contributor to noise levels in the ward environment comes predominately from nursing and medical staff.

The sample consisted of a general surgical operating theatre and a six bedded recovery unit fulfilling the criteria set out in the operational definitions. The recording of noise levels was made from as near the centre of the theatre and recovery unit as possible. However, whilst this does not simulate directly the noise the patient would perceive, it allows an overall perception of the total noise within these areas (Falk and Woods 1973, Aitken 1982, Hodge & Thompson 1990, Balogh et al 1993, Kam et al 1994).

Aim and objective

The aim of this study was to measure, analyse and compare levels of acoustic noise in two clinical areas: a general surgical operating theatre and a six bedded recovery unit. In order to quantify the study's aim the following objective was formulated:

> To explore the relationship between the number of staff present (this includes all allied healthcare professionals) in the two clinical areas and the noise levels recorded.

Data analysis

The nature and design of the study allowed for a descriptive analysis of the data using measures of central tendency, for example the use of the mean and standard deviation. It was here that recorded data from each clinical area formed the basis by which descriptive comparisons of noise levels were made, for example over the 24 hour period, within specific nursing shifts and within each clinical area. Spearmans Rho, a non-parametric test to examine two sets of data for a positive or negative correlation between

the data, was used to determine if there was a relationship between the number of hospital personnel present in the study areas and the measured noise level. Spearmans Rho allows ranking of the data regardless of the nature of the data – that is, the test can be used simultaneously with ordinal, interval or ratio level data because the test simply compares rankings.

Data collection

Data collection ran over three consecutive days in the operating and the recovery unit to elicit raw data for this area. Start times began in accordance with prescribed 'normal' operating times, in this case at 0800 hours.

In order to provide distinct data on noise levels the sound level meter (SLM), the Norsonic type SLM 116, used in this study was standardised to the British Standard 5969:1981 and the European Community directive 86/188/EEC and 89/392/EEC for 'A' weighting noise measurement. The SLM 116 provided a direct reading of sound over the ranges of 22dB[A] to 135dB[A], with an accuracy of less than ± 1dB[A] over temperature ranges 0°–50° celsius. Calibration of the SLM 116 was carried out with the use of the Bruel and Kjaer sound level calibrator type 4230, which is standardised to and complies with British Standard (BS) 5969: 1981. Calibration was carried out every six hours, as per the manufacturer's recommendations, in order to correct any potential measurement drift.

Noise level data was recorded at five minute intervals, to ensure that measurements were representative of typical conditions within these areas. Placement of the monitoring equipment microphone ensured that sound detected from the areas was uniform. Therefore, placement of the SLM corresponded closely to the centre of the room and was suspended from the ceiling at a distance of 25 centimetres to take into consideration the possibility of interference from air-conditioning equipment.

Reliability and validity

Acknowledgement of reliability and validity was taken into account when identifying the data collection tools used in this study. Much of the process involved reviewing the literature to ascertain which tools would be the most appropriate. The use of sound level meters appeared to be the most commonly used collection tool.

The sound level meter (SLM) used in this study was standardised to the British Standard 5969:1981 and the European Community directive 86/188/EEC and 89/392/EEC for 'A' weighting noise measurement. Calibration of the instrument was carried out at six hourly intervals as per the manufacturer's recommendations. However, the prime importance was the potential of the staff to influence the noise levels primarily through the 'hawthorn effect'. The hawthorn effect suggests that individuals who are aware of their participation in a study change their behaviour accordingly (Seaman 1987, Skodol-Wilson 1989, Abdellah & Levine 1990, Polit & Hungler 1995, Polgar & Thomas 1996) and this could mean that staff purposely control the level of noise so as not apportion blame to themselves, such as was the case of Whitfield (1975).

This was a very real threat to the reliability and validity of the data collected. Some researchers (Falk & Woods 1973, Hodge & Thompson 1990, Baker 1992, Balogh et al 1993, Kam et al 1994) whilst using a sound level meter, make no mention of the possible influence that hospital staff may have on the noise levels being recorded. Balogh and colleagues (1993) for example placed their SLM on a wall at a distance of one metre from the floor. To the untrained observer this would suggest that there is high probability that the recording instrument would be seen and as such it would seem reasonable to suggest that people would therefore react accordingly. To overcome the problem of erroneous noise level data in this study, it was decided that the SLM would be suspended from the ceiling so that it would not be easily visible to hospital staff yet able to perform the task effectively. Issues of noise levels being influenced from air conditioning vents and noise reverberation were taken into account and the SLM positioned to minimise the effects of these.

Results

Operating theatre

At the conclusion of 72 hours of noise measurement within the operating theatre, the mean sound pressure level (SPL) measured 50.93 ± 0.22dB[A] (**Table 1**). During normal operating times (08.00–17.00), operational procedures accounted for sharp, sudden bursts of noise increasing the SPL by up to 39% above mean (maximum 80dB[A]). Yet, during periods of theatre inoccupation, eg: night time and the periods in between patients, SPL within the theatre decreased 23% below mean to its minimum level of 45dB[A], this level being attributed to air-conditioning within the theatre (**Diagram 1**, page 22). The hours between 12.15–13.15 and 12.00– 07.00 were considered to be the quietest time, with minimal fluctuations in SPL above 45dB[A] occurring infrequently. However, at 07.00 SPL increased gradually from 45dB[A] to 54dB[A] until 08.00 as the night staff prepared the theatre for the morning operating lists, upon completion of which SPL decreased back to 45dB[A].

Variable	Standard deviation	Mean dB[A]	Minimum dB[A]	Maximum dB[A]	Range
OPERATING THEATRE	6.57	50.93 (±0.22)	45	80	35
RECOVERY UNIT	6.61	47.57 (±0.22)	43	70	30

TABLE 1 Measures of central tendency for noise levels in an operating theatre and a six bedded recovery unit

However, the diversity of noise levels within this area can be seen by the variance in the range and to some degree by the standard deviation, which suggests that measured noise levels are not uniform throughout a 24 hour period. Instead, as a result of prolonged quiet periods or periods of theatre inoccupation, a normal distribution of noise level scores was not achieved, instead a positive skew resulted (**Diagram 1**).

The recovery unit

Mean SPL within the recovery unit was calculated at 47.75dB[A]. The majority of noise production (mean 58dB[A]) occurred during the units normal working hours (09.00–18.00) with acute spikes reaching 70dB[A] during these times. These data correspond closely with the operational times of the operating theatre as can be seen in Diagrams 1 and 3. The quietest times occurred, as is to be expected, during the night, with SPL reaching its minimal level of 43dB[A]. Comparing this with the 'noisiest' times within the unit

Distribution of noise levels in an operating theatre

DIAGRAM 1
Day 1

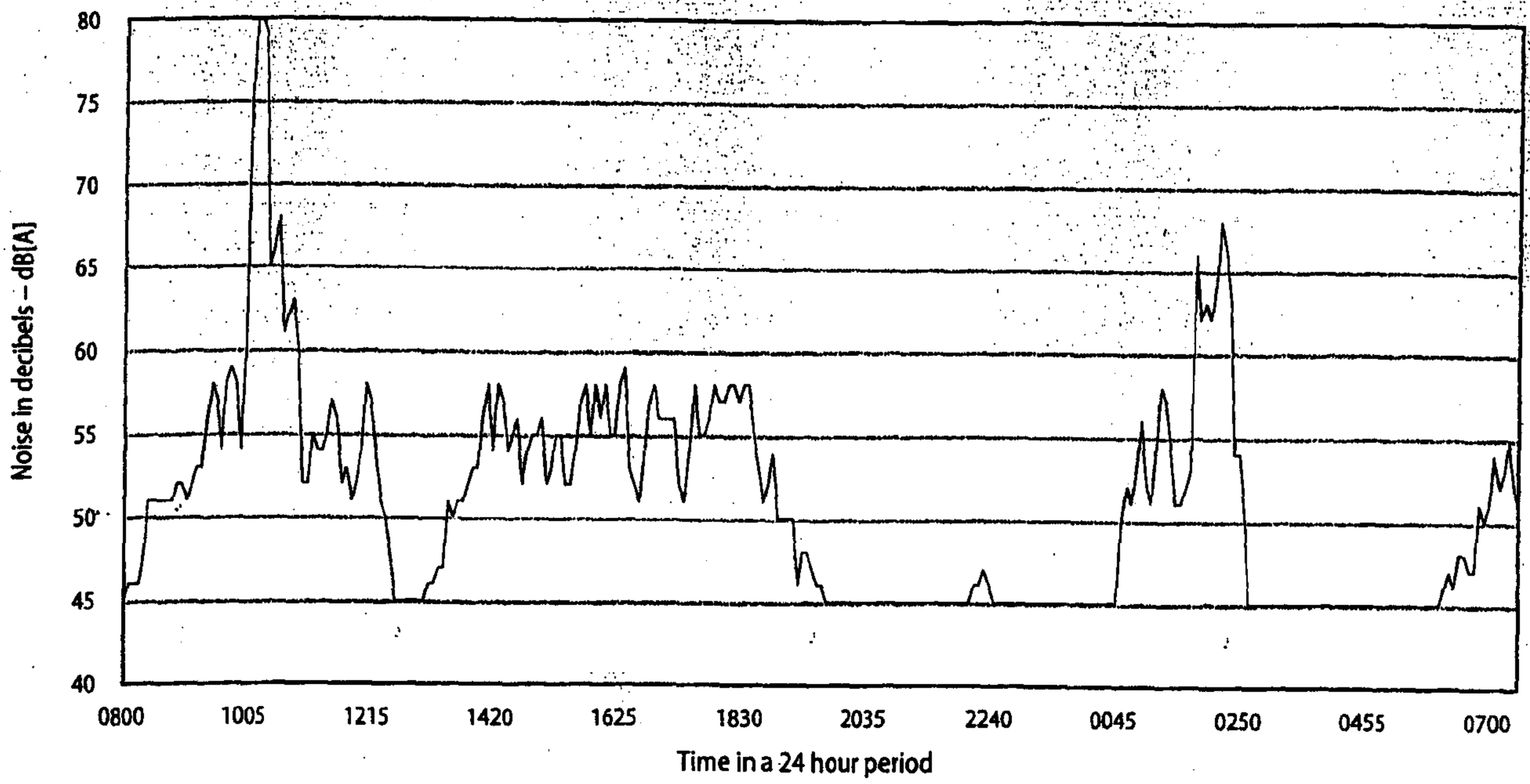


DIAGRAM 2
Day 2

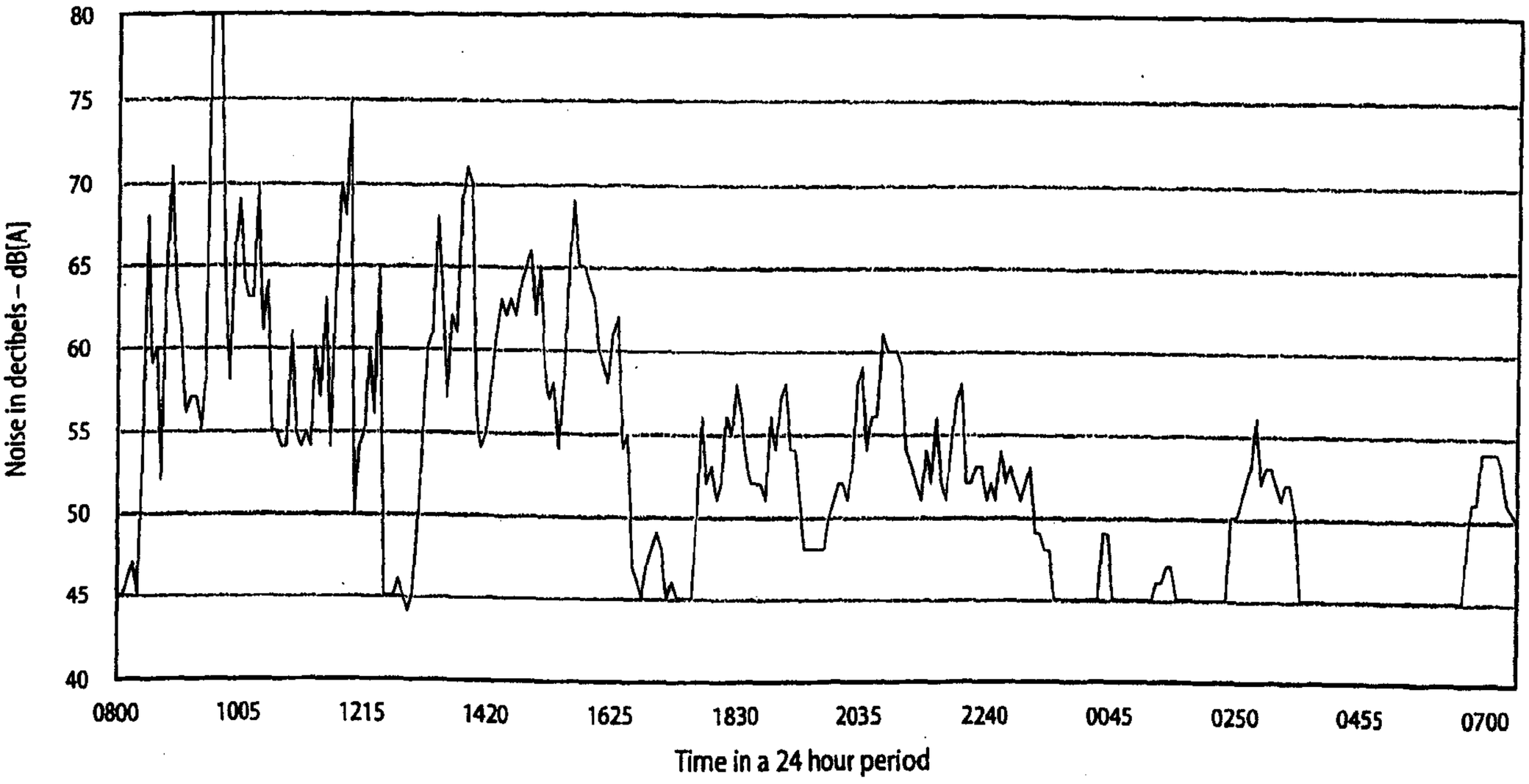
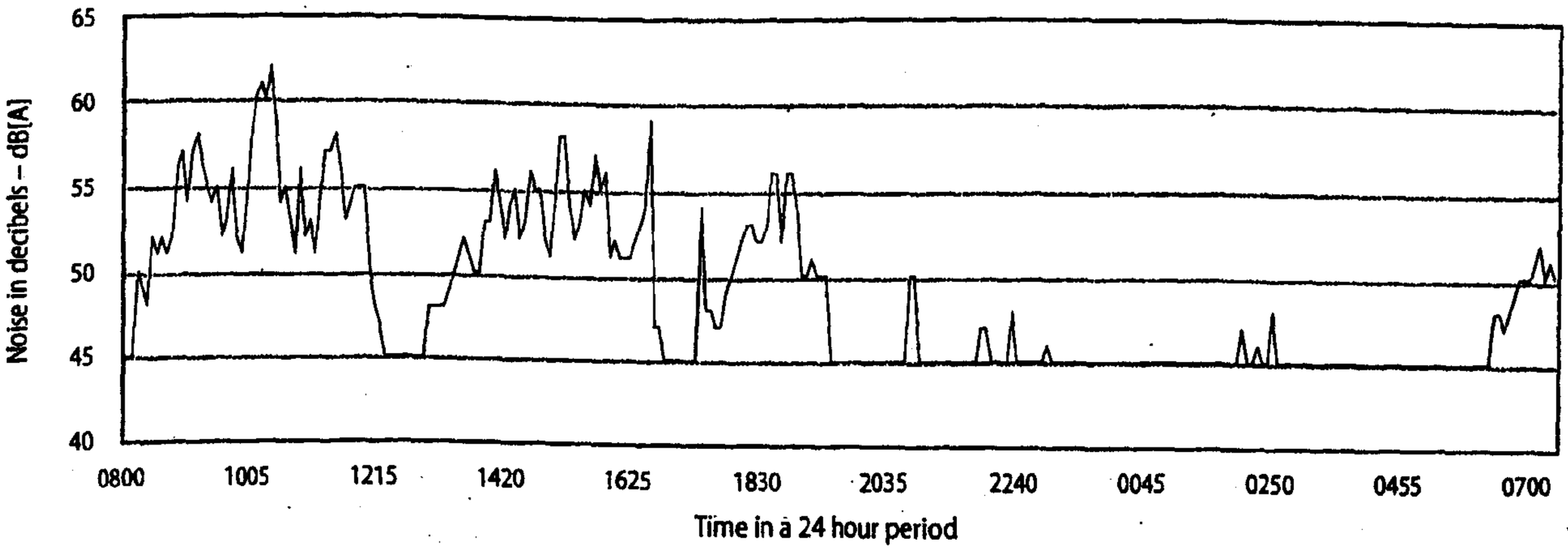


DIAGRAM 3
Day 3



(Diagram 4, page 24) it can be seen that SPL was 31% higher than the minimally attained level. Yet, interestingly acute spikes in SPL occurred during the night-time (Days 1 and 3) as the unit was used by hospital staff as a thoroughfare from the intensive care unit into the theatre complex.

Correlation between noise levels and the number of staff present

When Spearmans Rho (two tailed) was used to compute rank correlation between the number of staff present in the operating theatre and the recorded noise level, it appeared that a highly significant positive correlation existed (r_s=+0.897, p≤0.005), suggesting that 95% of all noise produced in the operating theatre is a result of the presence of theatre personnel within this area (Table 2). This is clearly evident on days one and two (2030–0405am) where emergency procedures accounted for a 35% increase in SPL above minimal and lasting for the entirety of the theatre occupation (Diagram 1).

Variable	Mean	Minimum	Maximum	Range
OPERATING THEATRE	6.45	0	11	11
RECOVERY UNIT	6.61	0	8	8

TABLE 2 Measures of central tendency for noise levels in an operating theatre and a six bedded recovery unit

Similar results were obtained for the recovery unit. This area demonstrated a highly significant positive correlation (r_s=+0.950, p≤0.005) between the numbers of staff present and the noise levels. However, because of the large number of patients present at any one time (n=6–8), the researcher hypothesised that perhaps the patients themselves also contribute to the noise level recorded in this area. It was not ethical to investigate this possibility as there were high risk patients present who required close monitoring which could be given only by a trained member of the recovery staff.

Discussion

The purpose of this study was to measure, compare and analyse the noise levels within two clinical areas of a small district hospital. The study found that staff presence within two clinical areas was an important factor involved with the production of acoustic noise levels within these areas, supporting the evidence demonstrated by Minckley (1968), Falk and Woods (1973 and 1974) and Seidlitz (1981). It also found that measured noise levels within these two clinical areas were considerably higher than those suggested by the World Health Organisation's external review draft on community noise and environmental health criteria (WHO 1993), yet fell short of those levels considered unacceptable by the Health and Safety Executive's 'Safety at Work' policy (HSE 1992).

Combined mean noise level of these areas equated to 46.92dB[A]. Whilst this may not be significant in itself because this level of noise may be perceived as normal background noise, what is important is the range of the noise levels recorded, in this case 43–80dB[A]. It has already been established by other researchers that human subjects can adapt to low level background noise (Hansell 1984, Topf & Dillon 1988). However, when acute, sharp and sudden impact noise occurs it has been shown to elicit the startle response which causes a cascade of protective mechanisms within the organism to fight off the supposed threat, in this case the 'flight or fight' response (Kryter 1994). Mean noise levels may not be enough to elicit the startle response or cause dramatic changes in cardiovascular functioning as suggested by Andren (1980) and Kryter (1994), but may be enough to interrupt patient sleep (Falk and Woods 1973, Whitfield 1975) especially if the patient is not normally exposed to this level of noise.

The operating theatre

The results of this study were similar to those found by Shapiro and Berland (1972), Davies et al (1989) and Hodge and Thompson (1990). Therefore, it is surprising that these levels of noise are still being recorded. It appears that, when considering theatre layout and décor, a greater emphasis is placed on rectifying air pollution problems to maintain sterility, for example the use of laminar flow air-conditioning, and the ease of cleaning, rather than in attempting to reduce the 'echo chamber' effect of excessive noise production. Yet, like the recovery unit, the theatre environment added to the noise pollution, its reflective properties enhancing noise reverberation times. While maintaining sterility or at least asepsis is of paramount importance within the theatre itself, the concept of noise control seems almost non-existent. This is clearly evident in the noise levels recorded (Diagrams 1–3). Mean noise levels over the three day measuring period within the theatre perioperatively were 50.93dB[A] (Table 1). However, elevations in this level were consistent pre and postoperatively as the patient was prepared for operation and transferred to the recovery unit. However, prior to the patient being wheeled into theatre there were periods when ambient noise levels were at their lowest, 43dB[A], as a result of the air-conditioning. Investigation of this phenomenon revealed that, prior to the patient entering theatre, he/she was anaesthetised in the anaesthetic room, during which the anaesthetist required absolute quiet in order for the patient to be in a relaxed and comfortable state before surgery. It appears this practice is historical in that it is believed that it will aid a less traumatic recovery. Whether this has credence or not is difficult to ascertain due to lack of available literature, but clinical evidence suggests that it is effective. Acute spikes did reach 80dB[A] as a result of doors being opened from the anaesthetic room and the service doors into theatre. Lesser degrees of acute impulse noise, ranging from 65–70dB[A], resulted from metallic instruments being accidentally banged against metal bowls, anaesthetic machine alarms and the opening of intravenous fluid bags. However, while the number of personnel present within the theatre was considered high (maximum 11), they did not appear to contribute to the 'overall' noise produced perioperatively (Diagram 4).

Rank correlation using Spearmans Rho demonstrated a significant positive correlation between noise levels and the presence of theatre personnel (r_s=+0.897, p≤0.005). This can be explained by the historical nature of theatre in which the apparent need for quiet during the operative procedure was important in enabling the surgeon to concentrate. This appeared to be the case in this instance. Whilst there were a number of personnel present perioperatively the major source of noise appeared to be the almost constant background noise produced by machinery. Occasional instructions from the surgical team appeared to be the only other noise source noted during this time. However, at the completion

Distribution of noise levels in a recovery suite

DIAGRAM 4
Day 1

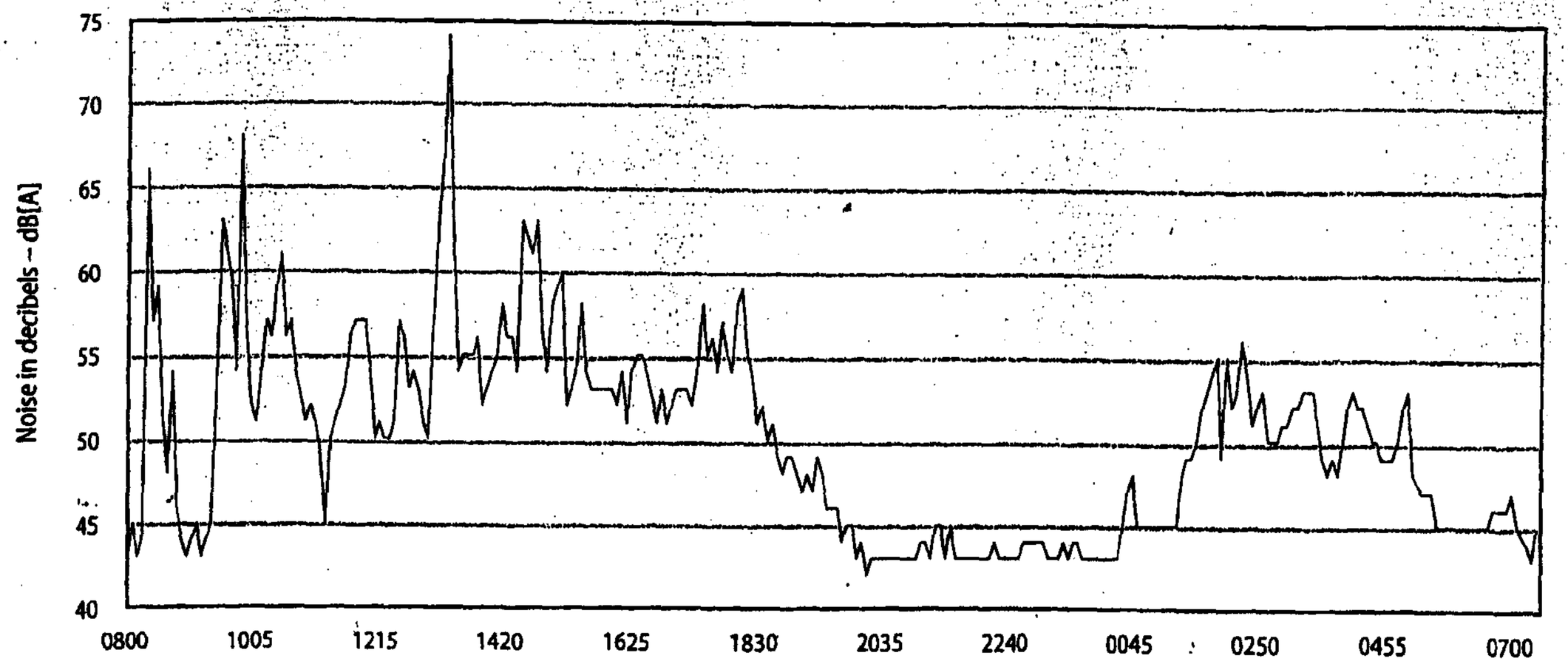


DIAGRAM 5
Day 2

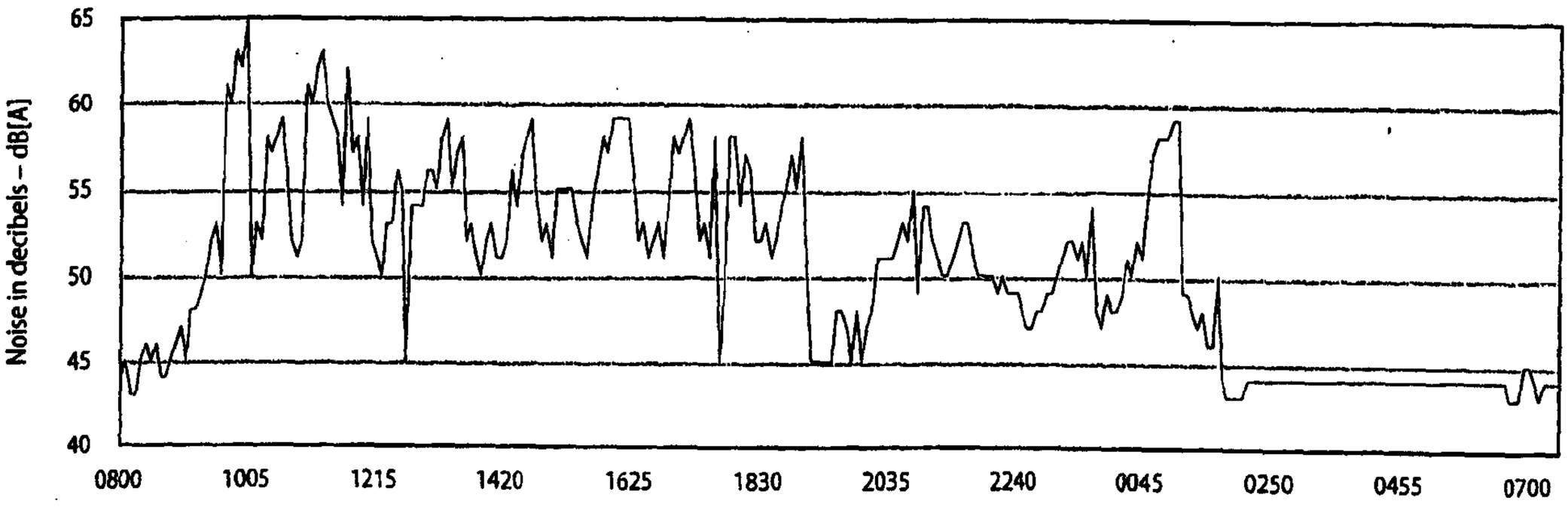
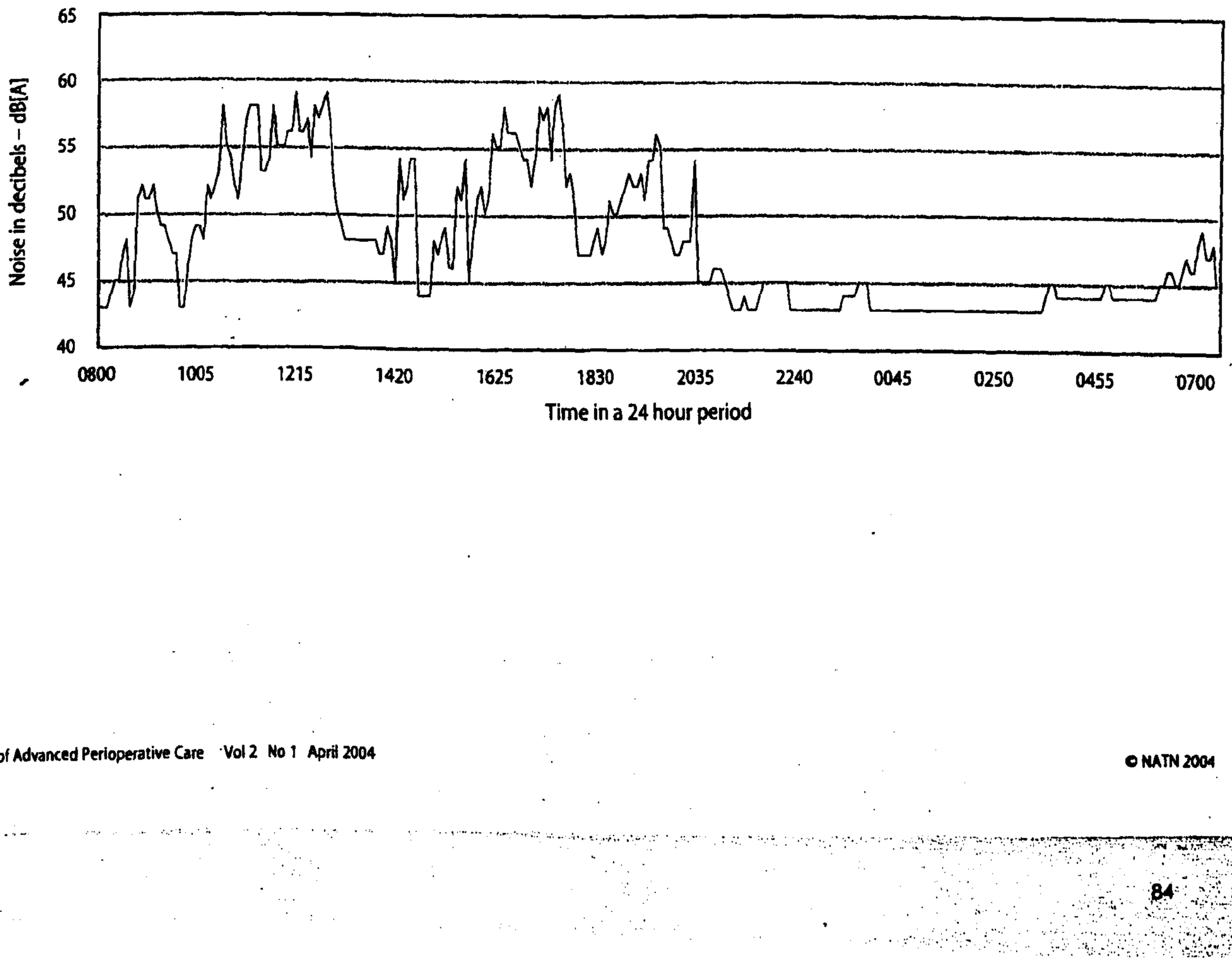


DIAGRAM 6
Day 3



of the operation, noise levels rose by approximately 10–15% indicating possibly a welcome release from enforced silence from both nursing and medical staff.

In the absence of a patient the noise levels in the theatre were still measuring greater than 45dB[A] as a result of nursing staff preparing the theatre for operation or cleaning up postoperation. One researcher has suggested that exposure to intermittent, sharp, impulse, noise, similar to that produced in the theatre, is enough to cause irritability as well as complicate work that requires alertness and attention to detail (Seidlitz 1981). Others have suggested that noise-induced stress is a good predictor of 'burn-out' in critical care nurses (Cohen & Weinstein 1981, Spacapan & Cohen 1983, Evans 1982, Topf & Dillon 1988). Whether this is the case in this particular theatre is difficult to ascertain because of the peaks and troughs in noise levels.

The recovery unit

Falk and Woods (1974) found that the average noise level in a 17 bedded recovery unit was 58.48dB[A]. Using Kendalls Tau, the authors demonstrated that a positive correlation existed between the number of staff present (mean 3.52) and the noise generated ($p \leq 0.01$). Furthermore, the mean noise level over a 24 hour period did not fluctuate either side of the overall mean, suggesting that noise levels within this unit were constant. The results of this study demonstrated similar findings, whereby the mean noise level for this six bedded unit was 47.57dB[A] with the average number of personnel present being 4.32. Non-parametric testing demonstrated a strong positive correlation ($r_s = +0.950$, $p \leq 0.005$) between the numbers of staff present and the overall ambient noise levels recorded. However, it was noted that noise levels did fluctuate significantly over the 24 hour period, unlike in the Falk and Woods study, and in some instances closely correlated with post theatre operation times. Yet, the major source of noise within the unit appeared to be that of the nursing staff, with noise levels in this area still measuring greater than 45dB[A]. Analysis of unstructured observational data showed that there were long periods of inactivity for nursing staff when the unit was empty of recovering patients. This then allowed casual conversations and discussions to occur, the majority of which had little or no clinical significance. What was alarming was that these conversations were then allowed to continue in the presence of patients brought through from theatre, many of them semi-unconscious and requiring airway management. It is outside the remit of this study to make suggestions as to how recovery staff could better occupy their time, but it is significant that this type of unchecked conversations influences the noise levels within this department. Even more disturbing was noise emitted from the intensive care unit, in particular ventilator alarms. Although this occurred infrequently, when it did occur it startled patients within the recovery unit. In some cases this was evidenced by increased heart rates recorded on the oxygen saturation monitors.

The recovery unit appeared to imitate an 'echo chamber', noise being amplified as a result of the acoustic properties of the building materials and the overall design. This was then compounded by long reverberation times within the recovery room itself, that is: hard, reflective walls and floors allowed the original sound wave to be reflected back into oncoming sound waves, thus amplifying the original noise. It was noted however, that while the windows were double-glazed to insulate against the cold, they also reduced noise emissions from outside. Despite this, on days when the air-conditioning failed to work or was turned off, nursing staff opened these windows to allow fresh air into the unit. This then added to the noise levels already being produced in the unit, thus compounding the problem of noise pollution further.

Conclusions

Noise levels measured at five minute intervals, continuously for 72 hours, in an operating theatre and a recovery unit all elicited a mean noise level greater than 40dB[A]. There were clearly visible periods when noise levels exceeded 50dB[A] and at times peaked to 70–80dB[A]. The results of non-participant observations indicated that human presence was responsible for the majority of the noise produced. This is supported by non-parametric testing of noise levels versus staff present, using Spearmans Rho, which demonstrates a strong positive correlation in both clinical areas, suggesting that the presence of staff within the clinical area will cause an elevation in noise levels. As such there were two key conclusions that were identified from this study. These are:

- The operating theatre and the recovery unit did not conform to the World Health Organisation (1993) external review draft policy regarding environmental noise, but did, however, conform to the Health and Safety Executive (1992) maximum permitted noise level in the work place regulations.
- The presence of staff within these clinical areas demonstrated a significantly positive correlation with measured noise levels.

Education and awareness

Increasing awareness of the noise that is generated in these two areas should be of paramount importance. Through ongoing education nursing staff should be made aware of the effects on susceptible patients of noise from personal conversations held at the bedside. Education through literature review or case study analysis could stimulate peer review and provide a positive medium for pin-pointing problem areas with regard to noise control. Random sampling of noise levels could be undertaken to provide positive feedback, thus allowing planning for control measures. By making staff aware of sound reducing techniques that can take place near patients, a positive influence on behaviour can be made.

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Noise levels in a General Surgical Ward: a descriptive study

Martin Christensen BSc(Hons), MSc, MA, RGN, DipN, PGC (ICU)
Lecturer in Nursing Studies, Bournemouth University, Bournemouth, UK

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Correspondence:
Martin Christensen
Lecturer in Nursing Studies
Bournemouth University
Bournemouth House
Christchurch Road
Bournemouth BH1 3LT
UK
Telephone: +44(01)1202 504 388
E-mail: mchristensen@bournemouth.ac.uk

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Noise levels in a General Surgical Ward: a descriptive study

Aims and objectives. This study was undertaken to measure and analyse levels of acoustic noise in a General Surgical Ward.

Method. Measurements were undertaken using the Norsonic 116 sound level meter (SLM) recording noise levels in the internationally agreed 'A' weighted scale. Noise level data and observational data as to the number of staff present were obtained and recorded at 5-min intervals over three consecutive days.

Results. Results of noise level analysis indicated that mean noise level within this clinical area was 42.28 dB with acute spikes reaching 70 dB(A). The lowest noise level attained was that of 36 dB(A) during the period midnight to 7 a.m. Non-parametric testing, using Spearman's Rho (two-tailed), found a positive relationship between the number of staff present and the level of noise recorded, indicating that the presence of hospital personnel strongly influences the level of noise within this area.

Relevance to clinical practice. Whilst the results of this may seem self-evident in many respects the problems of excessive noise production and the exposure to it for patients, hospital personnel and relatives alike continues unabated. What must be of concern is the psychophysiological effects excessive noise exposure has on individuals, for example, decreased wound healing, sleep deprivation and cardiovascular stimulation.

Key words: noise, noise in hospitals

Introduction

The effects of excessive noise exposure have long been recognized as being harmful to humans for at least 2500 years. The Sybarites of Ancient Greece, for example, banned metalworking involving hammering within the city limits from as early as 600 BC (Cantrell 1979, Kam *et al.* 1994). In addition, the increase of industrialization and population has meant that noise production has increased to a point whereby excessive noise exposure has become a serious health issue.

Noise has been defined as being any sound that causes subjective annoyance and irritation (Cantrell 1979, Hodge & Thompson 1990) is unwanted, undesirable or without musical quality (Turner *et al.* 1975, Hilton 1985, Griffen 1992) or disrupts performance (Kam *et al.* 1994). Moreover, noise exposure can differ in its nature either as pure tone, for example, a siren, impact, and impulse or as a broad band of frequencies such as seen with television static.

The World Health Organization's (WHO 1993) external review draft of Community Noise and the Environmental Health Criteria Document 1993, produced guidelines on hospital based noise in an attempt to improve noise levels to which patients and staff are exposed. They recommended that noise threshold levels within the hospital environment should not surpass 40 dB(A) during the day and 35 dB(A) during the night. Many German and North American

Hospitals are cognisant of this where the use of noise reducing materials and an awareness of noise levels is commonly used within the ward environments (Turner *et al.* 1975, Balogh *et al.* 1993).

However, a review of the literature suggests that noise levels within the confines of the hospital environment within the UK far exceed those defined acceptable by WHO (1993). This may suggest that the source or sources of noise pollution within the hospital are aspects that nurses consider to be 'part and parcel' of the environment and as such tend to over-look. In the case of ward based areas current research is dated, perhaps indicating that the control of noise in these areas is perceived as insurmountable. In contrast, the literature indicates that the Intensive Care Unit (ICU) appears to be the central area within the hospital where noise level studies primarily are undertaken (Christensen 1997).

There may be many reasons for this. Clinical experience in this instance, suggests that nursing staff within the ICU may attribute noise levels to the workings of mechanical instrumentation, for example, ventilators, syringe drivers, and cardiac monitors. However, Christensen (1997) demonstrated that the average noise level [52 dB(A)] in a four-bedded ICU was attributed to staff conversation (55%). Likewise, Bentley *et al.* (1977) in studying the noise levels in an open Nightingale ward over a 24-h period, found that the average noise level [50 dB(A)] was because of the conversations of patients and nurses alike.

Whilst intensive care nursing staff in general agree that exposure to excessive noise may lead to or is a major contributor to the psychological phenomena known as 'ICU Delirium' often characterized by delusions; paranoia; disorientation and slurred speech (Helton *et al.* 1980, Baker 1992). However, anecdotal evidence suggests that there appears to be little knowledge or awareness of the physiological affects that noise can have on the body. For example, empirical studies have demonstrated that excessive noise exposure can lead to increased gastric secretion, hypoxemia in neonates, increased cardiovascular stimulation and suppression of the immune response to infection (Marshall 1972, Falk & Woods 1973, Jonsson & Hansson 1977, Andren 1980, Long *et al.* 1980, Snyder-Halpern 1985, Baker 1992, Tomei *et al.* 1994).

Background to the study

Health care institutes were considered to be noise free environments, but modern hospitals are challenging this image (Seidlitz 1981). After reviewing the literature it is evident that the ICU is the area for which noise pollution is at its most excessive, especially when compared with that of an operating theatre, a recovery suite and a nursing ward. Nevertheless, noise control in these and other areas tends to be overlooked and the physiological and psychological impact noise has on the patient is considered to be part of the hospitalization experience (Christensen 2002).

The level at which the physiological effects of noise begin to occur varies according to the physiological function being measured. However, in general it is considered that changes in physiological functioning bear little significance at noise levels of less than 70 dB(A) (Falk & Woods 1973). This is supported by Minckley (1968), Falk and Woods (1974) and Seidlitz (1981) who demonstrated that levels of 70 dB(A) and above were consistent in disturbing patient sleep, increasing the need for pain relief and elevating cardiovascular functioning. In laboratory studies, Andren (1980) found that on exposure to noise levels of 85–95 dB(A), normal subjects showed elevations in cardiac functioning (increases in diastolic blood pressure, increased systemic vascular resistance and various changes in heart rate). In using normal healthy subjects, Snyder-Halpern (1985) found increases in heart rate when these people were exposed to audio-taped CCU noise whilst sleeping.

Interestingly, Kryter (1994) suggested that the physiological response to noise depends generally on the suddenness, the intensity and the state of quiescence of the organism being stimulated. Indeed, he agreed with earlier research findings proposing that a number of physiological responses occur when the body is stimulated by excessive noise levels. These included vasoconstriction of the peripheral blood vessels; heart rate changes; bradypnoea; decreased gastric motility; increased gastric secretion, hormonal changes namely stimulation of the pituitary and adrenal glands and the suppression of the immune system in response to stress.

A review of earlier studies

When compared with an ICU, ward-based noise is somewhat less in its intensity throughout a 24-h period. Aitken (1982) demonstrated this when he compared a four-bedded, a six-bedded and a single-bedded room in a large metropolitan hospital. The average daytime level corresponded to 55–60 dB(A) during the day, 10–20% less than that found on an ICU. However, after 'lights out' at 22.00 hours the level of noise dropped dramatically with the quietest time noted during the early hours exhibiting noise levels averaging 40 dB(A). These findings are similar to that of Falk and Woods (1973) who found that the mean noise level in a six-bedded room was 55.22 dB(A) and that of Bentley *et al.* (1977) who found that average noise level during the day measured 50–55 dB(A).

However, at lights out this level dropped to as low as 35 dB(A). Again in all studies, the early hours were considered to be the quietest, yet at 06.00 hours the noise levels increased as patients were woken and the day began.

Hilton (1985) found that, when compared with ICUs and Recovery Units, non-critical care areas such as medical/surgical wards exhibited noise levels ranging from 34.3 to 62.5 dB(A) over a 24-hour period, and indeed, these levels were found to be less than 50 dB(A) 90% of the time. Of interest is the results of this study have echoed findings from previous studies inasmuch that the prime source of noise within these areas was found to be communication between staff, patients and visitors with mean noise levels recorded at 56–60 dB(A). However, Hilton (1985) does comment that medical equipment can also be a source of noise although not as often and not for as long.

Likewise, in an earlier attempt to lower the noise levels in two 20-bedded male surgical wards of the traditional Nightingale design, Whitfield (1975) provided patients ($n = 55$) with a 22 item Likert Scale to determine the various causes of noise within the ward environment. Of the most likely causes that might have been expected, for example, staff conversation, it was patients coughing (72%) and patients snoring (57%) that were considered by patients to be the most disturbing with staff conversations being considered the least disturbing (21%). Yet, what is interesting is that Whitfield (1975) states that:

> The actual carrying out of the questionnaire did have an immediate effect on the wards concerned, as the nursing staff were made more aware of noise in the ward, and they themselves took active steps to carry out their morning and evening nursing duties more quietly. (Whitfield 1975, p. 409)

Despite this, Whitfield (1975) has highlighted areas that would appear to be of concern today, namely: emergency admissions to the ward, telephones ringing, patient commodes being wheeled to the bedside, and electric 'ripple' mattress motors.

Indeed, Dias (1992) demonstrated this when conducting a survey of older patients admitted to mentally infirm medical wards. He found that what was of concern to Whitfield (1975) 17 years previously still poses problems of disturbance to patients today. For example, confused patients shouting out, patients wanting the commode, patients coughing and snoring, staff conversation, 'ripple' mattress motors and noise from commodes being wheeled about within the ward. Yet, Grummet (1993) argues that little has been done to curb the ever-increasing noise levels experienced in the modern hospital ward. For example, contemporary ambient noise levels in nursing wards range from 50 to 70 dB(A) and when that is compared with that of a hospital 20 years ago [57.7–74.5 dB(A), Falk and Woods (1973)], for example, it would appear that little has changed to combat this problem. Indeed, there may not be a single answer for this problem and, perhaps, efforts at reducing excessive noise levels within hospitals should be undertaken at a more local level (McDaid 1990, Dias 1992).

Methodology

Overview

This study was undertaken to compare and contrast the measured level of noise and the presence of staff in a six-bedded bay of a 28 bedded General Surgical Ward. The study used was descriptive, producing data at ordinal level which were used to determine the level of noise produced and its relation to staff presence throughout specific time periods during a 24-hour period.

Sample and setting

The area studied was a six-bedded bay of a 28-bedded General Surgical Ward. On average the surgical ward admitted 1600 general surgical patients per year. The rationale for choosing this particular area was because of its layout and construction whereby the traditional 'Nightingale' open ward design has been replaced by four rooms consisting of six beds per room and four one bedded isolation cubicles.

Therefore, in examining this area consecutively, it was possible to study the planned surgical patient's experience of noise exposure during their hospitalization. Moreover, this study may have had some bearing on nursing practice inasmuch as the literature indicates that the major contributor to noise levels in the ward environment comes predominately from nursing and medical staff. The recording of noise levels was made from as near the centre of the six-bedded room (Bay 'D', situated 30 m south of the nurses station) of the General Surgical Ward. However, whilst this does not simulate directly the noise the patient would perceive, it allows an overall perception of the total noise within this area (Falk & Woods 1973, Aitken 1982, Hodge & Thompson 1990, Balogh *et al.* 1993, Kam *et al.* 1994).

Aim and objective of the study

The aim of this study is to compare and contrast the measured level of noise and the presence of staff in a

six-bedded bay of a 28 bedded General Surgical Ward. To quantify the study's aim the following objective was formulated:

- Explore the relationship between the number of staff present (this includes all allied health care professionals) in this clinical area and the noise levels recorded.

Data analysis

The design of this study allowed for both statistical and descriptive analysis of the data collected. It was here that recorded data from this clinical area formed the basis by which descriptive comparisons of noise levels were made, for example, over the 24-h period and within specific nursing shifts.

Spearman's Rho, a non-parametric test to examine two sets of data for a positive or negative correlation between the data, in this instance, was used to determine if there was a relationship between the number of hospital personnel present in the study areas and the measured noise level. More importantly, Spearman's Rho allows ranking of the data regardless of the nature of the data, that is to say, Spearman's Rho can be used simultaneously with ordinal, interval or ratio level data because the test compares rankings.

Data collection

Data collection ran over three consecutive days, in this case Tuesday to Thursday during early spring, in accordance with prescribed start times (7.00 a.m.) and scheduled operative waiting lists. To provide distinct data on noise levels the Norsonic type 116 sound level meter (SLM) was used in recording noise levels in the internationally agreed 'A' weighted filter. The SLM 116 provided a direct reading of noise over the ranges of 22–135 dB(A), with an accuracy of less than ± 1 dB(A) over temperature ranges 0°–50 °C. Calibration of the SLM 116 was carried out with the use of the Bruel and Kjaer Sound Level Calibrator type 4230, which is standardized to and complies with British Standard (BS) 5969:1981. Calibration was carried out every 6 hours, as per manufacturer's recommendations, to correct any potential measurement drift. The instrument is capable of storing 48 000 measurement values, whereby using the 1007 NOR-VIEW software package these values were able to be downloaded to a personal computer and incorporating the 'Noise Level vs. Time' histograms, the data were then analysed.

The recording of noise level data occurred at five-minute intervals, to ensure that measurements could be representative of typical conditions experienced within this area. Placement of the monitoring equipment microphone ensured that sound detected from the areas was uniform. Therefore, placement of the SLM corresponded closely to the centre of the room and was suspended from the ceiling at a distance of 25 cm to take into consideration the possibility of interference from air-conditioning equipment.

Reliability and validity

Acknowledgement of reliability and validity was taken into account when identifying the data collection tools used in this study. Much of the process involved reviewing the literature to ascertain which tools would be the most appropriate. The use of SLMs appeared to be the most commonly used collection tool.

The SLM used in this study was standardized to the British Standard 5969:1981 and the European Community directive 86/188/EEC and 89/392/EEC for 'A' weighting noise measurement. Calibration of the instrument was carried out at six-hourly intervals as per the manufacturer's recommendations. However, what was of prime importance was the potential of the staff influencing the noise levels primarily through the 'Hawthorn Effect'. In this instance, the Hawthorn Effect suggests that individuals who are aware of their participation in a study change their behaviour accordingly (Seaman 1987, Skodol-Wilson 1989, Abdellah & Levine 1990, Polit & Hungler 1995, Polgar & Thomas 1996). In this case this could mean staff purposely controlling the level of noise so as not to proportion blame on themselves, such as in the case of Whitfield (1975) for example.

This was a very real threat to the reliability and validity of the data collected. Some researchers (Falk & Woods 1973, Hodge & Thompson 1990, Baker 1992, Balogh *et al.* 1993, Kam *et al.* 1994), whilst using a SLM, make no mention of the possible influence hospital staff may have on the noise levels being recorded. Balogh *et al.* (1993), for example, placed their SLM on a wall at a distance of 1 m from the floor. To the untrained observer this would suggest that there is high probability that the recording instrument would be seen and, as such, it would seem reasonable to suggest that people would react accordingly. To overcome the problem of erroneous noise level data in this study, it was decided that the SLM used would be suspended from the ceiling so as not to be easily visible to hospital staff yet was able to perform the task effectively. Issues of noise levels being influenced from air conditioning vents and noise reverberation were taken into account and the SLM positioned to minimize the effects of these.

Results

Mean noise level within the surgical ward over the 72-h period produced a mean SPL of 42.28 dB(A). More intense Sound Pressure Level (SPL) [mean 52 dB(A)] was reported between 8.50 a.m. to 16.25 p.m. on days 2 and 3 with acute spikes reaching 70 dB(A) (Figs 1–3). Day 2 exhibited the highest fluctuations in noise production (8.00 a.m.–14.00 p.m.) when compared with the other two days. After these times, however, it showed similar noise levels as those of days 1 and 3. However, notably there were distinct quiet periods between 16.25 p.m. and 17.15 p.m. (all three days) where SPL dropped to 42 dB(A) and again during the night where SPL was at its lowest [36 dB(A)] a decrease of 18 and 30%, respectively. Occasional spikes above this minimum level were noted over the course of the night [maximum 45 dB(A)] but these were short lived and returned to minimum quickly. Day 1 demonstrated uniform noise levels as compared with days 2 and 3 with acute spikes in SPL reaching 55 dB(A) [mean 46 dB(A)].

There was also a highly significant positive correlation between the measured noise levels and the number of staff present ($r = 0.881$; $P = < 0.001$) within the surgical ward. However, during periods when no staff was present it was noted that SPL did not decrease significantly and perhaps this was because of the presence of relatives and patients alike. Therefore, further rank correlation was undertaken to ascertain if there was any correlation between the numbers of patients and relatives present within the measurement area and the contribution to noise levels made by these groups. Spearman's Rho (two tailed) demonstrated a significant positive correlation between the numbers of patients and relatives present ($r = 0.783$; $P = < 0.005$) during those times considered to be visiting times within the 24-hour period. Examination of noise levels and the number of patients only within the measurement area also demonstrated a positive correlation ($r = 0.812$; $P = < 0.005$).

Summary of the results

Noise levels measured at 5 minute intervals, continuously for 72 hours, in a Surgical Ward elicited a mean noise level greater than 40 dB(A) (Table 1). More importantly, there were clearly periods within the 24 hours when noise levels exceeded 50 dB(A) and at times peaked to 70–80 dB(A). This is supported by non-parametric testing using Spearman's Rho, of noise levels vs. staff present which demonstrated a strong positive correlation in this clinical area, suggesting that the presence of staff and in some instances patients within the clinical area will cause an elevation in noise levels.

Discussion

This purpose of this study was to compare and contrast the measured level of noise and the presence of staff in a six-bedded bay of a 28-bedded General Surgical Ward of a small district hospital. This study found that staff presence within

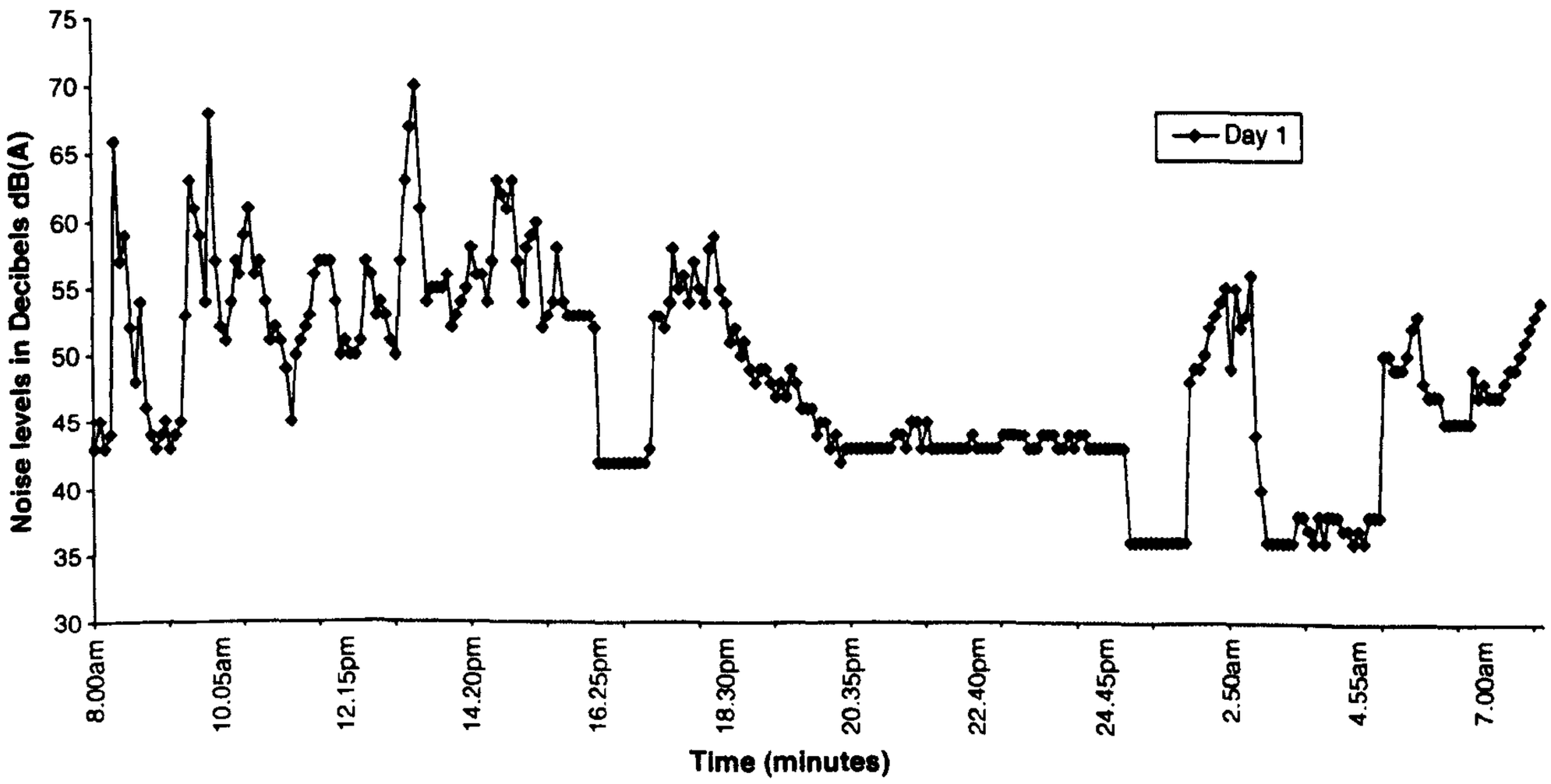

Figure 1 Distribution of noise levels in General Surgical Ward (day 1).

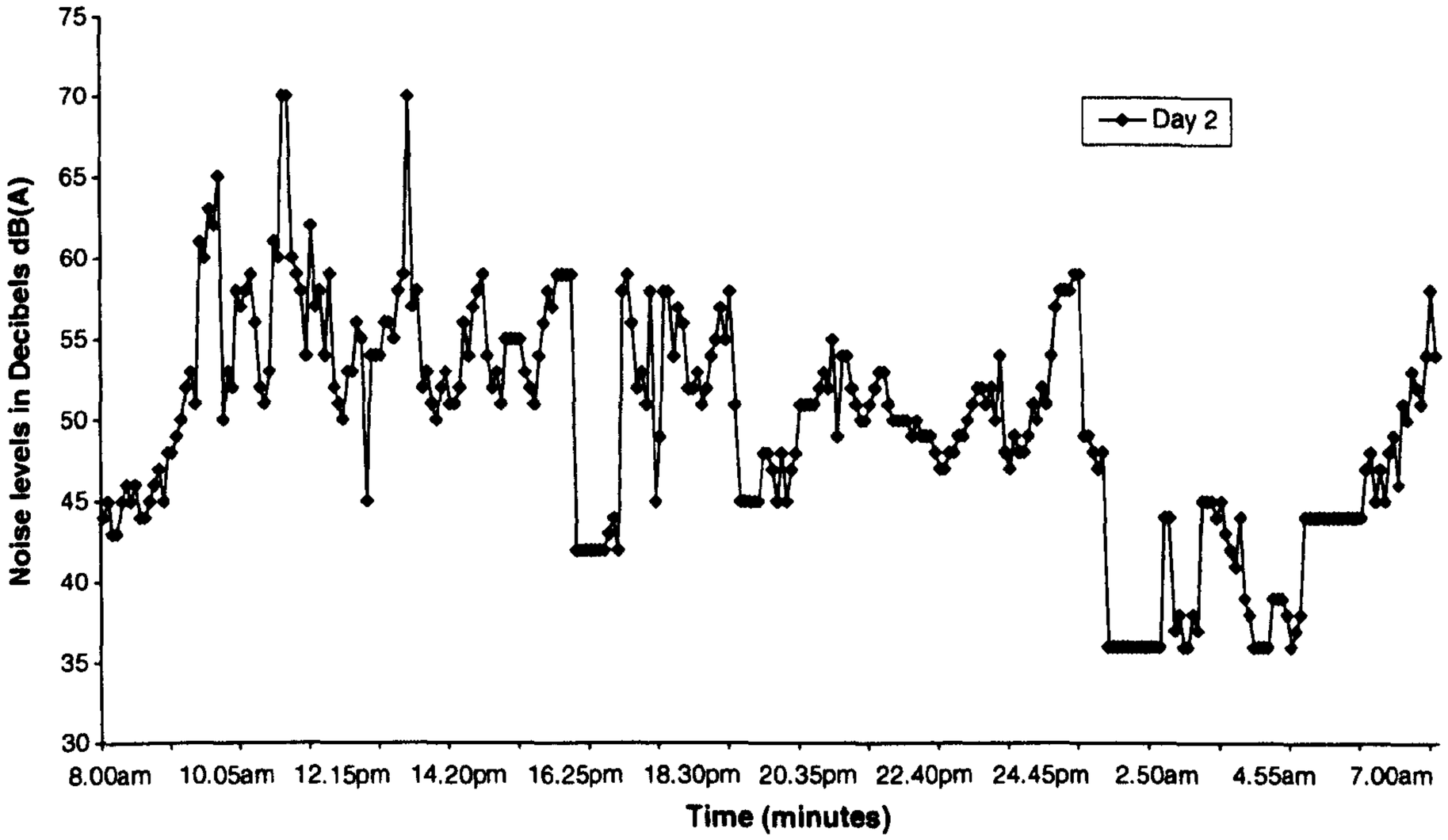

Figure 2 Distribution of noise levels in General Surgical Ward (day 2).

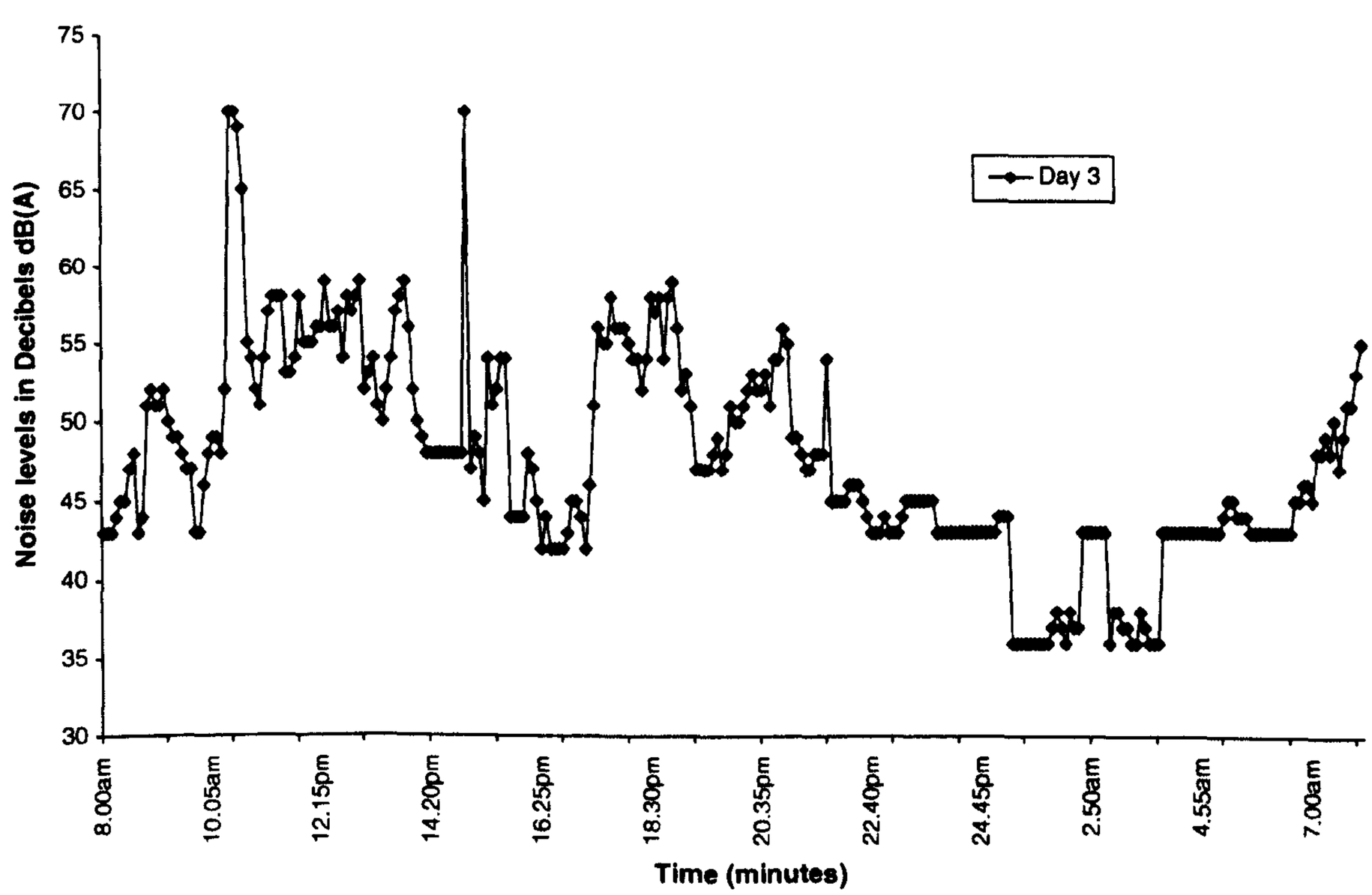

Figure 3 Distribution of noise levels in General Surgical Ward (day 3).

this clinical area was an important factor involved with the production of acoustic noise levels within this area, supporting the evidence demonstrated by Minckley (1968), Falk and Woods (1973 1974) and Seidlitz (1981). It also found that measured noise levels within this clinical area were considerably higher than that suggested by the World Health Organization's external review draft on Community Noise and Environmental Health Criteria (WHO 1993), yet fell

Table 1 Measures of central tendency of noise levels within a General Surgical Ward over 72 hours

Variable	SD	Mean [dB(A)]	Minimum	Maximum	Range
Surgical Ward	7.04	42.28	36	70	34

short of those levels considered acceptable by the United Kingdom Health and Safety Executive (1992).

The mean noise level of this clinical area equated to 42.28 dB(A). Whilst this may not be significant in itself because this level of noise may be perceived as normal background noise, which it was in this area, what is important is the range of the noise levels recorded, in this case 36–70 dB(A). It has already been established by other researchers that human subjects can adapt to low level background noise (Hansell 1984, Topf & Dillon 1988). However, when acute, sharp and sudden impact noise occurs it has been shown to elicit the startle response causing a cascade of protective mechanisms within the organism to fight off the supposed threat, in this case the 'flight or fight' response (Kryter 1994). Yet, mean noise levels may not be enough to elicit the startle response or cause dramatic changes in cardiovascular functioning as suggested by Andren (1980) and Kryter (1994), they may be enough to interrupt patient sleep (Falk & Woods 1973, Whitfield 1975) especially if the patient is not normally exposed to this level of noise.

Whilst the mean noise level within the surgical ward was 42.28 dB(A) with acute spikes reaching 70 dB(A), the lowest level of noise recorded was 36 dB(A), which was achieved, in the early hours of the morning. With the exception of acute spikes, the noise levels within this area did appear to conform with WHO's (1993) recommended 35–45 dB(A) acceptable limits. However, because the layout of the ward (longitudinal in shape) meant that rooms surrounded the nurses' station, it therefore allowed for an 'echo chamber' effect to be present. This proved to be problematic inasmuch that the study area was over 30 m from the nurses' station but people conversing, telephones ringing and rubbish bin lids being closed were able to register distinct elevations in noise levels by as much as 8–12 dB(A). While this may appear to be small in terms of the overall noise produced, the problem is then compounded by long reverberation times within the study room itself, that is to say, hard, reflective walls and floors allowed for the original sound wave to be reflected back into oncoming sound waves thus amplifying the original sound. This was especially true during the night shift where activity at the nurses' station elicited a rise in ambient noise to 45 dB(A) (Fig. 2).

It is clear from the data that noise levels were at their loudest during the morning and early afternoon. The presence of staff especially during the morning (08.00–11.00 hours), which included not only medical and nursing staff but also other allied health professionals, far exceeded those staff numbers when compared with any other time of the day. Unstructured observational data concluded that the medical ward round, Physiotherapists and Occupational Therapists visiting and reviewing patients all coincided with these times. Yet, more importantly nursing numbers were at their highest level during the morning shifts. This can be best explained because of the nature of this shift. For example, it is perceived that increased man-power is required during this time than any other time because of the increased need in assisting patients in their care (washing, bed making), assisting medical staff in their ward rounds, preparing patients for discharge or for transfer to theatre and the admission of patients for elective surgery as well as emergency admissions, as can be seen on day 2 (Fig. 2).

Whilst it must be agreed that some effort had been made to enhance the decor of the ward, for example, carpeting of non-clinical areas such as seen around the nurses' station, little had been done to reduce the reflective properties of the ward itself, in this case the absence of noise absorbent ceiling tiles and paint. However, this is a problem more concerned with financial outlay than what lies at the root of the problem of noise production in this area and that is staff communication.

These results, while echoing the findings of other researchers in terms of mean noise levels (Falk & Woods 1973, Bentley *et al.* 1977, Aitken 1982, Grummet 1993) clearly indicate that the presence of staff and to a lesser extent patients and relatives, are the major cause of excessive noise produced in this area. Indeed, rank correlation using Spearman's Rho suggests that the presence of staff within the study area will cause ambient noise levels to rise; to what degree is difficult to determine because rank correlation also suggests that the presence of patients and relatives, especially at visiting time, will cause ambient noise levels to rise as well.

However, more importantly, was the level of noise produced at the nurses' station and its impact on ambient noise levels in the study area. It was evident from the results that 25% of the overall human noise produced in the ward was made at the nurses' station. The reason for this may not be clear. However, there is an assumption that, traditionally, the nurses' station has been seen as a central place within the clinical area far enough away from the patients where issues, both professional and personal can be discussed. This, however, is a false perception suggesting that hospital staff view the nurses station as being a 'sound proof booth' in which to conduct ward business. This was not the case

inasmuch that conversations held at the nurses station about up-coming medical tests, operations or discharge plans were clearly heard in the study area over 30 m away.

This has important repercussions in terms of the effects of excessive noise on wound healing and immune functioning, but more so particularly in this area because of the threat of breaching patient confidentiality. A number of authors have successfully demonstrated that exposure to white noise greater than 50 dB(A) is enough to initiate mediation of the stress hormones which in turn depletes the body's immune response to infection and wound healing (Tanzer 1975, Monjan & Collector 1977, Cohen 1979, Kryter 1985, Durant *et al.* 1986, Wysocki 1996). This study demonstrated that noise levels within a six bedded room often exceeded this level [range 36–70 dB(A)] particularly during the morning nursing shift (Fig. 2) suggesting that ineffectual wound healing and immune depression may present a very real problem in this area.

Recommendations for future research

Clearly the results of this study highlight that hospital staff and in some cases patients and relatives do influence the noise levels in this clinical area. Whilst this may seem self-evident in many respects the problems of excessive noise production and the exposure to it for patients, hospital personnel and relatives alike continues unabated. Therefore, areas worthy of investigation include:

1 To assess what knowledge nurses possess in terms of the psychophysiological effects excessive noise has on the individual.
2 To identify noise sources within this clinical area, for example, human and non-human in conjunction with noise level measurement.

Conclusions

There were three key conclusions that were identified from this study. These were that:

1 The surgical ward did conform to the World Health Organizations External review draft of Community Noise and the Environmental Health Criteria Document (WHO 1993), however only during the night-time hours.
2 The surgical ward also conformed with the Health and Safety Executive's (1992) Safety at Work Policy in particular that of Occupational Exposure Limits as they relate to the work place through all periods of the day and night.
3 The presence of staff within this clinical area demonstrated a significant positive correlation with the measured sound levels.

Despite a plethora of research studies continually informing the nursing and medical populace of the noise levels found in the modern hospital, it would appear that little has been done to rectify this problem. Indeed, the major concern regarding noise levels within the hospital environment seems to indicate that medical and nursing staff are the prime contributors, producing in excess of 30–60% (Bentley *et al.* 1977, Baker 1992, Christensen 1997) of the total the noise made. What is of interest is that it is questionable as to whether nursing staff have knowledge of the psychological and physiological effects noise has on the patient. For example, ICU Delirium especially when issues such as ineffective wound healing, depressed immunity and cardiovascular instability are considered a major concern.

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Contributions

Study design: MC; data analysis MC; manuscript preparation: MC.

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Homophobia in Nursing: A Concept Analysis

Martin Christensen, RGN, DipN, PGC, BSc, MSc, MA

It could be argued that the term homophobia may have an array of meanings, which makes it difficult to truly define. Therefore, the purpose of this article is to explore homophobia in nursing using concept analysis as described by Walker and Avant (1995). Definitions of homophobia in general terms will be identified together with a working definition of homophobia in nursing in order for the critical attributes to be explored and identified. The formation of model, borderline, and contrary cases will exemplify the key characteristics of what homophobia in nursing is and is not. The examination of the antecedents, consequences, and empirical referents allows for further refinement of the key attributes, which define homophobia in nursing.

Search terms: *Gay, Health care, Homophobia, Homosexuality, Lesbian, Nursing.*

Introduction

Concepts may be considered to be mental images of phenomena, which enable the formation of conceptual definitions, therefore allowing individuals to attempt ordering of environmental stimuli (Walker & Avant 1995). According to Walker and Avant (1995), the focus that underpins concept analysis is the ability to examine, determine, and define the attributes and characteristics of a concept. Concept analysis in this instance is useful when overused concepts with vague meanings that are prevalent in nursing practice can be clarified; furthermore, they are able to refine ambiguous conceptual theory. The result is a precise operational definition (Walker and Avant 1995). To this end, Walker and Avant's (1995) eight-step concept analysis methodology will be used in an attempt to highlight the key aspects and essential attributes of the concept of homophobia in nursing.

This article will therefore present an in-depth analysis of the term homophobia and its relation to nursing by identifying meanings of the concept from the literature and examine nurse's attitudes towards gay/lesbian patients in the form of model cases. It will also determine the antecedents and consequences assimilated with homophobia in nursing and finally ascertain the empirical referents that are conducive with this concept.

Selection of Concept

As a result, the medical model in relation to homosexuality has had a significant effect on nursing. Traditionally, medicine and nursing are viewed as conservative professions perhaps possessing inflexible attitudes (Webb and Askham 1987). This conservatism or "professional socialization" has perpetrated these attitudes, therefore forcing a slow response to the issues of homosexuality (Jones 1988). The result, therefore, is overt discrimination, violation of rights, and social ostracism of homosexual individuals (Douglas et al. 1985). Terms such as sick, perverted, promiscuous,

and child molester that reflect some nurses' attitudes to gay men (Stables 1990) suggest that homophobia is bred from ignorance, hypocrisy, and prejudice. Platzer (1990) claims that as members of society, nurses draw mainly on their own experiences, experiences that may possess traditional and uncompromising attitudes about homosexuality and the health needs of gay patients (Webb and Askham 1987).

"... nurses draw mainly on their own experiences, experiences that may possess traditional and uncompromising attitudes about homosexuality and the health needs of gay patients."

Webb and Askham (1987) suggest that attitudes are linked to behavior and that certain predetermined beliefs and attitudes will prevent the delivery of holistic and individualized care. This is further reinforced when the homosexual individual is hospitalized. Typically, when hospitalized, the patient experiences feelings of isolation, vulnerability, and loss of control; however, being homosexual and hospitalized, these feelings are more pronounced (Barbara et al. 2001). To compound the problem even further, expressions of affection and caring by significant others may be indirectly or implicitly discouraged by nursing staff (Irwin 1992) for fear of upsetting other patients. Therefore, this may be detrimental to the psychophysiological welfare of the homosexual patient because society's prejudices against their preferred sexual orientation are strengthened by a caring profession that treats them with disdain and repugnance (Eliason 1993). Reed (1989) points out that the nurse's view of a patient can have a direct relation to how the patient views him/herself.

"... feelings of isolation, vulnerability, and loss of control; however, being homosexual and hospitalized, these feelings are more pronounced."

This is however, further reinforced by some nursing texts referring to homosexuality as a disease and not a lifestyle (Platzer 1990) and a nursing hierarchy that encourages people entering the profession to become like their peers (Burnard 1989). Moreover, this merely fortifies the social stigma about homosexuality and demonstrates the power that healthcare professionals may have in influencing societies' impressions of what is considered normal sexual behavior (Platzer 1990).

Aims of the Analysis

While the concept of homophobia may not be considered to have an array of meanings or be underdeveloped or elusive (Cahill 1996), the overall intention is to define clearly and clarify those attributes which characterize homophobia in nursing. In seeking conceptual clarity, the analysis may make it possible to promote a single vocabulary for discussion, while allowing an understanding of what signifies the parameters of homophobia in nursing to be. More importantly, it may form the platform for future conjecture and critique within the context of nursing practice (Cahill 1996). The aim of this analysis is also to highlight the potential role conflicts nurses may have in relation to the reinforcing of homophobic behaviors to patients and peers alike.

Homophobia in Nursing: A Concept Analysis

Identify Uses of the Concept

This stage of Walker and Avant's (1995) model involves examination of the plethora of uses and representations of the concept. The use of dictionary meanings and of references within the appropriate literature will yield rich meaning of the concept (Cahill 1996).

The *Concise Oxford English Dictionary* (1990) states that the meaning of the word homophobia is derived from two words: homo and phobia. Homo is taken from the Latin to mean belonging to the genus *Homo*, which includes primates and humans, the Greek meaning infers homo to mean the same and in colloquialism, the term is an abbreviation to signify a homosexual. The word phobia is taken from the Greek and Latin word *phobos/phobus*, which means fear; therefore, phobia is an abnormal aversion or morbid fear of whatever is specified. As a result, the word homophobia is taken to mean a fear or hatred of homosexuals.

However, it was not until the late 19th century that the term homophobia was first coined (Blumenfeld 1992). Weinberg (1972) popularized the word "homophobia" defining it to mean "the dread of being in close quarters with homosexuals" (Weinberg 1972). Whereas Lehne (1976) in suggesting that homophobia is in fact "homosexism," because of the reference to strict male gender roles and the intolerance of heterosexual men to homosexual deviation from these expected roles, proposed that homophobia is a socially determined prejudice. This misconceptualization and false stereotype about homosexuality led Lehne (1976) to redefine homophobia as that being an "irrational fear or intolerance of homosexuality" (Lehne 1976).

Though, in noting Weinberg's (1972) original definition, Hudson and Ricketts (1980) posited that homophobia had become universally applicable to all anti-homosexual responses and as a result had lost its exactness. The inappropriateness, the authors suggest, of blanket application of homosexuality, was that it failed to provide a distinction between intellectual and affectual responses to anti-homosexual behavior. For example, an individual may respect the notion of civil rights for homosexuals, however, they may react negatively when close social interaction with homosexuals is required. Therefore, the authors proposed the term "homonegativism," which broadened and encapsulated in their entirety the attributes defining anti-gay responses. However, this term has not gained any recognition and homophobia still prevails because of widespread acceptance of the term.

Lorde (1984) provides a good example of a clear and definitive definition of homophobia as being:

> The fear of feelings of love for members of one's own sex and therefore the hatred of those feelings in others. . . . the belief in the inherent superiority of one pattern of loving and thereby its right to dominance.

Indeed, other authors have recapitulated the definition along similar lines as that proposed by Lorde (1984). For example, Irwin (1992, p. 435) proposed homophobia to be "a fear of homosexuality," to Rose (1993) homophobia "is an irrational fear of homosexuals," and finally Blumenfeld (1992) suggests that "Homophobia is both the belief that heterosexuality is or should be the only acceptable orientation and the fear and hatred of those of the same sex."

Therefore, what is significant in homophobia is the overwhelming fear and disgust expressed by homophobes when confronted with the aspects of homosexuality. This fear can be found to spread over a number of levels, for example; fear of homosexuality in oneself (Bancroft 1989), fear of contagion (Peate 1995), fear of potential sexual advances (Jones 1988), and fear or threat to established sex role identity (Bancroft 1989). The feelings of disgust originate primarily as a result of perceived unnatural and perverse sexual acts (Weatherburn et al. 1992) thought to commonly occur within the homosexual relationship. Therefore, it would be pertinent at this stage to discuss these levels because of their relation to what nurses may experience as a result of homophobic feelings.

Fear of Homosexuality in Oneself

The fear of homosexuality in oneself stems from possible issues of comfort with one's own sexuality and gender role (Bancroft 1989). Within the Western culture, the domination of the man over the woman is seen as reinforcing the power of maleness. This social conditioning maintains the sexism of gender role identification by establishing traditional expectations, especially those acquired through socialization (Irwin 1992). However, the "reaction formation" defense mechanism proposed by Bancroft (1989), which suggests that the hostility to homosexuals by heterosexuals may in fact be a result of homosexual tendencies within oneself, is assumed by many homosexuals to be at the core of anti-gay feelings. As to the likelihood of this being a common assertion, it is difficult to say.

However, Kinsey et al. (1948) suggests that more than 33% of men have encountered orgasm as a result of a homosexual encounter at least once, which may indicate that the fear of a homosexual component within oneself may culminate in humiliation and hostility being shown towards their homosexual partner. A good example of this is within the prison system, whereby deprived of normal heterosexual sexual outlets, heterosexuals may often exploit/engage in homosexual contact while maintaining their heterosexual identity (Bancroft 1989). Therefore, recognition of this phenomenon could well intensify the reaction formation within the heterosexual individual.

Fear of Contagion

Because of the stigma already associated with being homosexual, a diagnosis of human immunodeficiency virus (HIV) infection or acquired immune deficiency syndrome (AIDS) may compound the issue even further because of its association with sexuality. Seen initially as the "gay disease," Taylor and Robertson (1994) suggest that up to 30% of nursing staff suspect homosexuals of being infected with HIV or of having AIDS. This view, however, is shared by society generally where homosexuality, HIV, and AIDS are seen as part of a deviant lifestyle (Herek 1999). Because of its association with a 100% mortality, Wells (1987) claims nurses are fearful of HIV/AIDS where concerns for self-preservation and self-protection abound. In fact, Aggleton and Homans (1987) reported that over 80% of nurses were aware of the precautionary procedures required for preventing the spread of hepatitis and HIV, yet 40% of those nurses still expressed serious concern over possible exposure and the risk of infection of HIV from AIDS-positive patients. Furthermore, Wallack (1989) commented that the more invasive the procedure on patients infected with HIV or having AIDS, the higher nurses' anxiety levels became as a result. While this fear is understandable, Bignall (1993) reports that fewer than six cases in the UK have occurred as a result of occupational exposure to HIV.

"... nurses' attitudes between homosexual patients and individuals infected with HIV demonstrated a positive correlation between negative attitudes towards gay individuals and an unwillingness to care for people who had contracted AIDS."

However, statistics do not alleviate the fear and anxiety nurses have, especially when required to care for individuals presenting with HIV infection or with AIDS. Of major concern is the way in which transmission of the virus occurs and the latency period between infection and the presence of visible symptoms (Peate 1995). Simonoff et al. (1991) reported that many healthcare workers are reluctant to or are

concerned about coming into direct contact with infected patients. In fact, 10.5% of health staff were found to be less tolerant of homosexual relationships as a result of the AIDS pandemic (Cole and Slocumb 1993, Eliason 1993, O'Donnell et al. 1987). This is supported by Barrick's (1988) study where nurses' attitudes between homosexual patients and individuals infected with HIV demonstrated a positive correlation between negative attitudes towards gay individuals and an unwillingness to care for people who had contracted AIDS. Furthermore, recent work by Surlis and Hyde (2001) demonstrated that this attitude towards HIV/AIDS patients has changed little in the proceeding years inasmuch as there still appears to be this preponderance with associating the contraction of HIV/AIDS with elicit intravenous drug use and/or sexual contact. Yet, the attitude remains the same: abruptness, rudeness, and a lack of meaningful nursing interaction and care (Surlis and Hyde 2001).

Fear of Sexual Advances

Because sexual promiscuity is believed to be associated with homosexuality, heterosexual female nurses have an inherent fear that the lesbian patient will make sexual advances towards them (Jones 1988). Jones (1988) reports that one nurse was afraid to touch her lesbian patient in potentially intimate situations fearing the patient would make suggestive comments towards her. Other nurses have commented on being afraid or embarrassed when alone behind closed curtains when providing care with lesbian clients in case "they (the client) made a pass" (Jones 1988). However, sexually suggestive behavior is statistically more likely to occur with male heterosexuals. According to Jones (1988), it is men who are considered to be the perpetrators of sexually aggressive behavior towards women and that nurses are more likely to have sexual advances put to them by heterosexual men than by their lesbian patients.

As yet the notion that homosexual men make these advances to male nurses has not yet transpired. Perhaps this could be a result of society's impression of male nurses being effeminate or homosexual anyway (Haywood 1994, Williams 1995 and Evans 1997).

"Because sexual promiscuity is believed to be associated with homosexuality, heterosexual female nurses have an inherent fear that the lesbian patient will make sexual advances towards them."

Threat to Established Sex Roles

Perhaps at the forefront of defined acceptable sexual behavior are the clear guidelines with which society decrees as being favorable to the survival of the species. Therefore, when diverse sexual behaviors are considered outside these boundaries, such as homosexuality, it threatens the "normal idealism" of sexual preference because it threatens the norms of masculinity and femininity (Bancroft 1989).

This is evident in the way that men view homosexuality as being unmasculine, referring to homosexuals as "queens, faggots, homos, and poofters," to exemplify male heterosexuality as being superior and suggesting that anything unmale-like is feminine. Female homosexuality is viewed, to a lesser extent, as unfeminine, quite the opposite to that of her male counterpart, whereby the lesbian is believed to adopt masculine traits which are characterized by the terms commonly referred to them, for example "butch and dyke," and the somewhat masculine behavior that is suggested to occur within this group. Therefore, the negativity towards homosexuality, Bancroft (1989) and Blumenfeld

(1992) suggest, was derived from the need to establish and maintain clear delineation between the roles of the male and female individual.

Unnatural and Perverse Sex Acts

It has been suggested that the initial criminalizing of homosexuality and the nonprocreative sexual intercourse that took place within these relationships, was from the fear of possible population decline (Bancroft 1989). However, what has transpired over the years is society's disgust at the unnatural sexual behaviors considered to be undertaken by homosexuals, for example anal intercourse. Taylor and Robertson (1994) report that gay men adopt a wide range of sexual practices and that the choice of sexual techniques is determined by the need for mutual pleasure, rather than conforming to recognized active and passive roles, such as those seen in heterosexual relationships. Weatherburn et al. (1992) found that the most common sexual activity among men was mutual masturbation, fellatio, and kissing, whereas anal intercourse was undertaken by a small minority of individuals.

Therefore, while the sexual techniques employed by homosexuals may be considered within the realms of heterosexual sex, homosexual sex is still seen by many as departing from the norm (Peate 1995), perhaps because of the inference of sexual contact between same sex-partners. However, this merely confirms society's misinformation concerning homosexual sex. Indeed, it could be suggested that a small number of individuals may undertake quite bizarre and perverse sexual acts because these individuals may feel less inhibited about their sexual identity and preferences, whereas heterosexuals are. Therefore, embedded in this belief that homosexual sex is deviant and perverse is the philosophy that vaginally penetrative sex is only acceptable within the heterosexual relationship, therefore attempting to maintain accepted societal norms and values for male/female sexual relationships (Peate 1995).

Determine Defining Attributes

In being able to determine the defining attributes, it is important to characterize those traits which are commonly associated with the concept. Walker and Avant (1995) suggest that for a pure example of the concept to exist, there must be defining attributes present.

The most distinctive attribute of the concept of homophobia in nursing that emerged from the literature is the internalized feelings and the portrayal of those feelings within clinical practice. Therefore, the defining attributes which may characterize the concept of homophobia within nursing are that:

- there must be an internalized awareness of anti-homosexual feelings towards homosexual individuals, and
- there must be manifestations of those anti-homosexual feelings by the corresponding behavior patterns, which occur when providing care to gay individuals.

Based on the results of the defining attributes, it may be possible to form a working theoretical definition of homophobia in nursing which can be illustrated by model cases. Therefore,

Homophobia in nursing is the inherent unconscious fear of homosexuality that leads to the corresponding failure to provide quality holistic care to this group of individuals based on these fears.

The working definition presented here can be exemplified by examples of discourse that are portrayed/exhibited by medical and nursing staff alike. For example, in semi-structured interviews of 28 doctors, Rose (1994) reported that most doctors exhibit a strong homophobic bias towards gay individuals with or without a diagnosis of HIV infection or AIDS. Comments made during the interviews highlighted an underlying, unconscious prejudice to homosexuality. In a similar study, Douglas et al. (1985), using a 21-item Likert-type self-administered Index of Homophobia

Scale, found that 32% ($n = 37$) of doctors were more negative towards homosexuals since the emergence of AIDS. Anti-gay remarks, failure to treat some patients or do so with great reluctance emphasized that medicine is influenced by an ethic that is guided by cultural ideologies and values (Rose 1994).

"... most doctors exhibit a strong homophobic bias towards gay individuals with or without a diagnosis of HIV infection or AIDS."

The negative attitudes commented on by Rose (1994) and colleagues may have come some way in influencing the nurse's perception of homosexuality. Indeed, Byron-Smith (1993) found that 57% of psychiatric nurse respondents ($n = 127$) exhibited moderate homophobia and 20% indicated severe homophobic attitudes towards homosexuals, indicating that while nurses may have a cognitive acceptance and understanding of homosexuality, they still exhibited negative feelings towards homosexuals in general. White (1979) conducted a similar study in assessing the attitudes of psychiatric nurses towards lesbianism. The results suggested that homophobic scores were related to the nurses' level of education and religious inclinations, which supported similar evidence, found in Byron-Smith's (1993) study inasmuch that religion was a significant contributing factor to the development of homophobic attitudes.

In studying 100 undergraduate nursing students, Randell (1989) reported that more than half of the respondents indicated that same sex relationships were not an expression of true human sexuality. A comparative study of the attitudes of 166 nurses towards patients with leukemia and patients with AIDS and with varying sexual orientation, resulted in the respondents expressing more negative attitudes towards the homosexual patients, regardless of disease status (Kelly et al. 1988). These few examples clearly reiterate and support the comments of Platzer (1990) by suggesting that societies view of heterosexuality as being the "norm" merely distorts heterosexuality's view of reality and therefore its view of homosexuality.

While these are but a few examples of medical and nursing discourse to this particular group of individuals, homophobia arguably has been well discussed within the nursing and medical literature. Indeed, much of the nursing texts reviewed center around issues surrounding sexuality, same sex relationships (Irwin 1992, Peate 1995, Platzer 1990, Rose 1993, Wright and Anthony 2002), and the apparent substandard care this group of individuals receive. However, it would appear that little has changed in the last 100 years with regard to homosexuality. Medical discourse and its influence on social justice, continues to be used as an instrument in the evaluation of morality within public policy (Wilkerson 1994). This is clearly highlighted by the seemingly indifferent attitude some doctors and nurses take when confronted with the issues of homosexuality, in particular homosexual patients.

Formation of Model Cases

Identification of the defining attributes allows the development of model cases, which enable the concept to be tested. The importance of testing the concept, Jasper (1994) argues, is to help identify what is and what is not an incidence of the concept in question while establishing validity of the defining attributes.

The Model Case

Mary had been qualified as a registered general nurse for 10 years. She followed in the family tradition with her two eldest sisters and her mother all being nurses while her brother was a doctor

and was nearing the completion of his part one surgical rota. The family were strict Catholics attending church every Sunday without fail. Mary shared the family's view that homosexuality was a sin against God and considered that those individuals who are homosexual as disgusting and immoral animals.

Mary was working an afternoon shift when the Accident and Emergency Department informed her of an admission that they wished to send to her. The woman, Jackie, had had numerous admissions for Crohn's disease and this admission was an exacerbation of the disease. Mary had been assigned as her primary nurse and set about taking a nursing history from Jackie. When Jackie was asked information about next of kin, she replied that her current partner Karen was her next of kin and that any information concerning this admission be freely given to her upon request. At this, Mary appeared to become quite anxious and left Jackie's bedside as quickly as possible, leaving Jackie and Karen bewildered and confused. Mary stormed into the office, and, confronting the Ward Sister, outrightly refused to care for Jackie. The Ward Sister, after defusing the situation as best she could, managed to ascertain from Mary the cause of her anxiety, as that of being afraid of any sexual advances that may be made towards her by Jackie or in that case Karen. The Ward Sister explained to Mary that she had no plausible reason to refuse care on the grounds of sexual orientation and that the possibility of sexual advances made towards her was totally unfounded. However, Mary did not find any comfort in this advice and was stuck with the continuing problem of caring for a lesbian.

Over the next few days, Mary refused to answer Jackie's call bell, paid little attention to her except when giving medication and the provision of basic cares were given only grudgingly and often with another nurse present. Karen was constantly harassed about her visiting hours, displays of affection, and assistance in providing care were looked upon by Mary with disapproval and anger. She was denied information from Mary about Jackie's progress and was treated with coldness and contempt when attempts to talk with Mary concerning Jackie's care were mentioned.

This case model includes all the defining attributes as well as those mentioned in the working theoretical definition. Mary is exhibiting the internalized feelings of homophobia and expressed these in her behavior towards Jackie and Karen. The feelings and behaviors expressed in this case are fear, anger, disapproval, contempt, avoidance, and disgust.

The Borderline Case

This case model only contains some of the defining attributes held within the definition of the concept.

Tony had been qualified for 2 years and was working in a general surgical ward since graduating. He had recently attended a gay awareness workshop designed to help healthcare professionals deal with the provision of care for homosexual patients. Tony felt he had learned a lot from this workshop, he understood the health needs of this patient group, and was currently practicing these new found skills on the ward as a result of the admission of a gentleman, Roger, who was known to be gay.

However, Tony could not help feeling disgust at the thought of two men engaging in sexual intercourse with each other. Just the mere thought made him feel angry and fearful, fearful that he may "catch something." Yet, Tony was able to put these feelings aside and deal with the situation of a patient needing his help and care in order to get over this current life crisis. A few days after

Rogers discharge, a letter arrived on the ward addressed to the Ward Sister. The letter was the typical patient's thank you letter, the only difference being that Roger wished to thank Tony personally for the compassionate, kind, thoughtful, and professional care he had given to him during his admission. Tony was pleased that he had managed this case well and had been able to put his feelings to one side although he acknowledges that he continues to have problems with the idea of homosexuality.

The borderline case in this instance still possesses some of the critical attributes found in the definition. The person described still experiences the internalized feelings of disgust and fear towards homophobia. However in this case, he does not allow these feelings to cloud his clinical judgement in providing care to this patient, which is evident in the thank you letter.

The Contrary Case

The contrary case demonstrates none of the defining attributes as outlined in the working definition.

Kelly had been working on her current ward, a day case surgical ward, for the past 5 years. She came from the typical family; mom, dad, and two elder brothers. Mom worked part-time at the local news agents, dad was the managing director of a tire company, Robert, the eldest brother, was in advertising, and Stuart was a computer analyst. Robert was gay, having "come out" 8 years ago. He met his current partner, Mark, at an art gallery and they had been seeing each other now for about 3 years and were planning to live together. Mark had met Robert's family, and they liked him very much; in fact, Kelly became one of Mark's best friends, being the sister he never had. Of course Robert did not mind in the slightest; he thought it was great to see his family members were so accepting of his preferred lifestyle, particularly Kelly. Consequently, Kelly had no misconceptions about homosexuality; it did not bother her one instance having been exposed to this type of lifestyle for so long. Therefore, it came as no shock to her when Tracy inquired about her partner Jane, who was admitted to the unit for a routine hernia repair, and asked if she was able to take an active role in Tracy's care. Kelly's approach was full of encouragement and support for both women during Jane's stay just as she behaves towards all her patients.

The contrary case in this instance is everything the concept is not. The individual described shows no internalized fears or behaviors and consequently has established an excellent rapport with her brother's partner. She is not "put off" or "phased" by the admission to her unit of a lesbian patient having experienced homosexuality at a very personal level and been accepting of this lifestyle. Therefore, this case exhibits and demonstrates none of the defining attributes found in the concept of homophobia in nursing.

Identifying Antecedents and Consequences

Antecedents

From the nurse's perspective, the antecedents to homophobia are those factors which influence the perceptions of homosexuality, singly or collectively, the basis of which in this case may be deemed historical in nature. For example, throughout history, homosexuality has acquired negative attributes, more so than those propagated by the Judeo-Christian tradition, which influenced strongly the development of today's society (Irwin 1992). Much of the influence was as a result of Aquinas's and Augustine's moralistic viewpoints that anything not considered to procreate the species is a sin against God. Therefore, acts such as bestiality and homosexuality were seen as forms of heresy (Boswell 1980, Bancroft 1989).

However, when law eventually succeeded the church in deciphering the moral needs of the righteous,

nonreproductive sexual acts such as those seen in homosexuality were criminalized (Weeks 1990). It was not until the late 19th century that the medical model of societal morality labeled homosexuality as a disease, one associated with insanity and one which medicine could cure. Treatment modalities were horrific. Castration, hormone therapy, electric shock treatment, and nausea-inducing drugs were medicine's way of attempting to be the agents of social control (Irwin 1992).

It is here, then, that the underlying notion of homophobia may be a result of the influence of religion and medicine on society's impression of homosexuality. So much so that the emergence of homophobia in nursing on an individual basis may be related to:

- Supporting a religious ideology that determines the morality of same sex relationships as being sinful and nonprocreative (Bancroft 1989, White 1979).
- Subscribing to a medical/nursing inference that homosexuality is a disease/illness that can be cured (Irwin 1992).
- Supporting societies view that homosexuality is a deviance from "normal" gender roles in terms of the expression of sexuality (Randell 1989, Peate 1995).

Consequences

The consequences as they apply to this particular concept are those incidents or events which occur as a result of an occurrence with the concept (Walker and Avant 1995). Therefore, the consequences as they relate to homophobia in nursing could include:

- An avoidance/reluctance of gay/lesbian social and/or professional interaction (Jones 1988).
- Heightened anxiety or revulsion when experiencing some gay/lesbian behavior, for example behaviors of affection (Bancroft 1989, Blumenfeld 1992).
- Heightened anxiety and fear of contagion when caring for gay/lesbian patients with a diagnosis of HIV/AIDS (Eliason 1993, Taylor and Robertson 1994, Wallack 1989, Wells 1987).
- Overt and covert stigmatization and discrimination of gay/lesbian patients as demonstrated by possible isolation, aggression, rejection, and psychological, physical, and verbal abuse (Barbara et al. 2001, Douglas et al. 1985, Eliason 1993, Webb and Askham 1987).

Empirical Referents

Walker and Avant's (1988) final stage encompasses the determination of the empirical referents. It is here the authors suggest that the referents are used to diagnose the existence of the concept, giving clear and observable phenomena with which to confirm the diagnosis. As seen from the model cases, homophobia in nursing has shown some discernible attributes. Those which may clearly show the "observable phenomena" and highlight the presence of homophobia in some individuals are:

- Avoidance of homosexual patients.
- Reluctance to provide care to homosexual patients.
- Speaking negatively about homosexuals and homosexuality.

Implications for Nursing Practice

As for future implications, many authors suggest that ongoing education in relation to the issues of sexuality is what is needed, especially that concerned with the care of gay/lesbian patients/clients (Irwin 1992, Jones 1988, Peate 1995, Platzer 1990). However, to accomplish this and move forward, nurse education must rid itself first of the prejudice and intolerance (Platzer 1990) and change from propagating conformity and similarity in thinking to promoting individuality, autonomous thinking, and critical and social self-awareness (Irwin 1992). Furthermore, as Richmond and McKenna (1998) highlight, continual education should not only transcend pre-registration nurse education, but should also extend to qualified nursing staff as well by challenging those already established attitudes and/or behaviors that some of these individuals

may harbor towards this client group. Moreover, with the insurgence of post-registration education, the ease with which the issues of sexuality can be addressed within this forum can create opportunities for nurses to achieve insight and knowledge with regard to their own and others' sexuality (Richmond and McKenna 1998). Indeed, Wright and Anthony (2002) recognize that nursing staff have a responsibility to recognize their own prejudices and in doing so take steps to address the discourses that this patient/client group commonly experience within the health care sector.

"...recognize that nursing staff have a responsibility to recognize their own prejudices and in doing so take steps to address the discourses that this patient/client group commonly experience within the health care sector."

Limitations of the Analysis

The use of Walker and Avant's (1988) model and methodology provides a systematic approach to concept analysis; indeed, for the purpose of this analysis it was successful. However, what was lacking was distinct direction and definition when carrying out certain stages of the analysis. It was here that confusion arose as to what was required at each stage, and at times it seemed that information was being replicated for the sake of conforming to the stage needs. It is here that some authors following the Walker and Avant (1995) framework agree (Cahill 1996, Rodgers 1989). Cahill (1996) for example, found it difficult to validate the presence of the proposed defining attributes and she suggests that the tool lacked distinct guidelines for certain aspects of the analysis such as the need for a literature review. Rodgers (1989) suggests that the model is too strict and static owing to its empirical direction and as such lacked congruency for the wider social issues of nursing.

Conclusion

Homophobia in nursing may undoubtedly be an extreme violation of the individual's right to receive adequate, professional, and compassionate care. Indeed patients/clients expect and have the right to receive dignified and professional nursing care at all times as dictated by the Code of Professional Practice (Nursing and Midwifery Council 2002). Unfortunately, there is evidence to suggest that this minimum standard of care is not always met; for example, Rose (1993) describes a situation whereby an Accident and Emergency nurse refused to give a gay man a pain-killing suppository in case "he enjoyed it." This merely fortifies the prejudice that homosexuals face when confronted by homophobic healthcare professionals (Taylor and Robertson 1994).

What this concept analysis has attempted to do is identify the key components or attributes that define homophobia in nursing, examine those fears expressed by nursing staff, and highlight those fears in the form of model, borderline, and contrary cases. The use of concept analysis in this instance has aided in clarifying and elucidating the nature of this concept and has potentially formed the template for critiquing and challenging homophobia within nursing practice (Cahill 1996).

Author contact: mchristensen@boournemouth.ac.uk, with a copy to the Editor: cooperconsulting@socal.rr.com

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ORIGINAL ARTICLE

What knowledge do ICU nurses have with regard to the effects of noise exposure in the Intensive Care Unit?

Martin Christensen

Bournemouth University, Bournemouth House, Christchurch Road, Bournemouth BH1 3LT, UK

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Noise;
Noise exposure;
Noise in hospital

Summary This small-scale study was undertaken to assess what knowledge nursing staff from a General Intensive Care Unit held with regard to noise exposure. To assess knowledge a self-administered multiple-choice questionnaire was used. Rigorous peer-review insured content validity. This study produced poor results in terms of the knowledge nurses held with regard to noise related issues in particular the psychophysiological effects and current legislation concerning its safe exposure. Non-parametric testing, using Kruskal–Wallis found no significant difference between nursing grades, however, descriptive analysis demonstrated that the staff nurse grade (D and E) performed better overall. Whilst the results of this study may seem self-evident in some respects, it is the problems of exposure to excessive noise levels for both patients and hospital personnel, which are clearly not understood. The effects noise exposure has on individuals for example decreased wound healing; sleep deprivation and cardiovascular stimulation must be of concern especially in terms of patient care but more so for nursing staff especially the effects noise levels can have on cognitive task performance.

Introduction

Noise, the physical characteristic of sound dependent on its amplitude or intensity, has been defined as being any unwanted sound which disrupts performance (Hodge and Thompson, 1990; Gray, 2000), is annoying and is physiologically and psychologically stressful (Baker et al., 1993; Kam et al., 1994; Kryter, 1994; McDaid, 1990; Payling, 1994). However, the interpretation and perception of the noise source and its apparent meaning varies from person to person so much so that 'noise' to one person may well be a 'signal' to someone else (Hansell, 1984).

Undeniably, the physiological effects of exposure to audible noise are well documented within the literature with reported effects including cardiovascular stimulation (Andren, 1980; Baker, 1992; Baker et al., 1993; Marshall, 1972; Snyder-Halpern, 1985) hearing loss (Smith, 1998; Thomas and Martin, 2000; Touma, 1994), increased gastric secretion (Tomei et al., 1994) pituitary and adrenal gland stimulation (Falk and Woods, 1973) and

E-mail address: mchristensen@bournemouth.ac.uk.

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suppression of the immune response to infection (McCarthy et al., 1992; Monjan and Collector, 1977; Wysocki, 1996). Moreover, some authors have suggested that continued exposure to excessive noise levels can lead to 'burnout' in critical care nursing staff (Topf and Dillon, 1988), be a contributing factor associated with post-operative delirium (Haynes, 1999) as well as affect female reproduction and fertility (Nurminen, 1995; Rachootin and Olsen, 1983; Triolo, 1989; Yassi et al., 1991).

Therefore, it is arguable that nursing staff may in fact have little knowledge or understanding about these effects. Yet, what is interesting whilst excessive noise exposure can elicit profound psychophysiological effects, an awareness and measures to control unwarranted noise within the hospital environment appears to continue without redress despite current noise reducing legislation (Aitken, 1982; Balogh et al., 1993; Falk and Woods, 1973; Kam et al., 1994; Seidlitz, 1981; World Health Organisation, 1993). The reason as to why this may occur appears to be multi-faceted, for example the building itself in terms of acoustical design and the décor especially with the use of sound reflective materials such as linoleum floors and tiling materials, all of which possess low sound-absorption properties (Grumet, 1993). In the main however, it is hospital personnel themselves that produce the majority of what could be considered noise whether it be at the patient bed-space or based at the nurse's station in the form of conversations, the playing of radios and through the daily activities inherent in the modern hospital (Aitken, 1982; Biley, 1994; Buelow, 2001; Christensen, 1997; Christensen, 2002; Falk and Woods, 1973; Hilton, 1985; Meyer-Falcke et al., 1994; Whalen, 1992).

Nevertheless, a review of the literature produced very little empirical or anecdotal evidence with regard to the knowledge nurse's possess in relation to the effects of excessive noise exposure, especially that found within the confines of a modern hospital. Two studies, that of Whitfield (1975) and Dias (1992) did examine both patients and nurses perceptions of the sources of noise within the ward environment, further confirming that both hospital personnel and patients alike are responsible for the excessive level of noise created within the ward environment. What the studies did not do however, is assess what knowledge nursing staff had as to the impact noise exposure can have on humans from a physiological point of view, instead it attempted to modify noise levels by making those responsible more aware. However, there is a plethora of literature pertaining to noise measurement and that of the psychophysiological effects of noise exposure (Aitken, 1982; Baker et al., 1993; Bentley et al., 1977; Falk and Woods, 1973; Hilton, 1985; Kam et al., 1994; Meyer-Falcke et al., 1994).

Methodology

Overview

This small-scale study was undertaken to assess what knowledge nurse's had with regard to noise related issues, especially those issues concerned with the impact of excessive noise exposure on patients and hospital personnel. This was achieved with the use of a 15-item multiple-choice questionnaire.

Setting

The area that was studied was a 15-bedded General Intensive Care Unit in a regional district/teaching hospital. The rationale for choosing the nursing staff in this particular area was because they would be in direct and close contact with critically ill patients. Patients in this instance who may be susceptible to a variety of external stimuli, which may predispose them to the phenomena, know as 'ICU Delirium'.

Sample

A total population sample ($n = 96$) of qualified nursing staff from a General Intensive Care Unit were selected. A ''closed-ended'' multiple-choice questionnaire was used to elicit ordinal level data regarding their knowledge of the effects of excessive noise exposure in relation to the ICU environment. Ordinal level data used in this instance allowed for ranking of the responses in relation to the different nurses grades and as such allows for comparisons to be made in terms of how better or how worse each grade performed (Burns and Grove, 2003).

Aims and objectives of the study

The aim of this study was to assess what knowledge this group of nurses had in relation to the effects of acoustic noise levels in a clinical area. In order to quantify the study's aim the following objectives were formulated:

1. Explore the awareness of nursing staff in relation to noise pollution within their respective clinical area.
2. Describe and compare nurses understanding and knowledge of the psychophysiological effects that excessive noise has on the body.

Ethical considerations

During the formulation, implementation and evaluation of this study a full account of the ethical codes and guidelines that exist to protect the individual and their rights were considered. These included:

1. Code of Professional Conduct (Nursing Midwifery Council, 2002).
2. Data Protection Act (1998).
3. Ethics related to research in Nursing (Royal College of Nursing, 2003).
4. Declaration of Helsinki (World Medical Association, 1983).

Therefore, as a consequence of these guidelines, informed consent for nursing staff, with regard to the questionnaire, was obtained on the basis of three key elements:

1. That information to nursing staff was comprehensive.
2. That nursing staff understood all the information that was imparted.
3. That nursing staff had the right to withdraw from the study at any time.

As the study involved approaching nursing staff it was important to gain permission and ethical approval from the appropriate hospital personnel and ethics committee. Copies of the proposal and questionnaire as well as a covering letter explaining the reasons and objectives of the study were made available to those individuals and groups mentioned previously. Once permission from the ethics committee was granted it was then deemed appropriate to approach the Divisional Head of the Critical Care Directorate, Ward Manager and nursing staff for their permission to conduct the study within their clinical area. Of prime importance was that disruption to patient care and management was kept to a minimum during the study.

Data collection

A self-administered questionnaire was used for determining the knowledge held by nursing staff with regard to noise related issues. The design centred on a ''closed-ended'' multiple-choice questionnaire, which encompassed three key elements; the political, psychological and physiological domains cognisant to the effects of excessive noise exposure and the impact it has in the hospital environment. This design was chosen over other methodologies because of the impersonal nature associated with this type of data collection tool (Polit and Hungler, 1995; Cormack, 1996). This was important because it was not only time efficient and convenient for the respondent and the researcher, but it ensured complete anonymity of the respondent.

Five questions were concerned with the socio-political aspects of noise exposure, in particular the United Kingdoms Health and Safety Executive's (1992) and the World Health Organisation's (1993) policy on noise limitations within the work environment. Ten questions regarded the psycho-physiological aspects of excessive noise exposure on humans and three questions were concerned with demographic data with regard to current nursing grade within the unit as well as length of ICU experience (Fig. 1).

Despite this, other methodologies were considered, for example structured interview techniques, however, this proved to be problematic due to sample size. Furthermore, interviewing an opportunistic sample from this study area posed problems of generalisability to the total population. It also seemed impractical, in terms of time, to conduct 96 individual interviews to glean the information required. Therefore, to ensure reliability and validity of the study the use of a self-administered questionnaire was deemed appropriate.

Questionnaire planning and design for this study encompassed question specification gleaned from the literature, for example, from the work of Falk and Woods (1973), Kryter (1994), Nurminen (1995) and Wysocki (1996). Therefore, it was an important consideration when determining whether the results obtained from the questionnaires were in fact a true depiction of nurses knowledge on this subject, in other words was the questionnaire content valid or was there simply guess work on the part of the respondents.

Reliability and validity

The challenge in the questionnaire used in this study lay in that the format that is to say self-administered multiple-choice had not been attempted previously. However, the questionnaire required validating and in this instance the instrument was put to rigorous Peer Review on two separate occasions. A five-member group comprising medical, nursing and academic staff reviewed the instrument for content validity. Prior to the pilot study, the first review suggested only a few minor alterations had to be done to the wording of the questions those of which contained numerical choices. It was here that the review team felt that respondents would simply go for the highest number if the choices were arranged in numerical order. It was suggested that the order be mixed up thereby ensuring that the respondent

Question 2.
What does the Health and Safety Executive consider the maximum permissible noise level in your area of work to be?

A: 35 decibels.
B: 65 decibels.
C: 85 decibels.
D: 45 decibels.
E: Don't know.

Question 4.
Which part of the Autonomic Nervous system is stimulated by excessive, intermittent noise levels?

A: Parasympathetic.
B: Muscurinic.
C: Limbic.
D: Sympathetic.

Question 8.
What chronic physiological changes would you expect to see in an individual exposed to excessive intermittent noise? (Choose from A, B, C or D)

1:Tachycardia.
2: Hearing loss.
3: Reduced Immune response.
4: Decreased wound healing.
5: Hypertension.

A: 1, 2 and 5.
B: 3 and 4.
C: 2, 3, 4, and 5.
D: All of the above.

Question 11.
What would you consider the effects of excessive noise to be on nursing staff whilst at work? (Choose from A, B, C, D or E)

1: May effect reproduction in female nursing staff.
2: Increased compassion to others.
3: Inability to sustain attention.
4: Decreased alertness.
5: Does not affect the ability to perform tasks and attention to detail.

A: 1, 3 and 4.
B: 2, 3 and 4.
C: 4 and 5.
D: 1, 2 and 5.
E: All of the above.

Figure 1 Example of closed-ended questions posed to candidates.

had to read the question carefully and then answer accordingly.

Pilot study

The inclusion of a pilot study allowed the questionnaire to be refined and demonstrate that the proposed research design was practical, reliable, measurable, usable and valid. The pilot study ran 4 weeks prior to the main study using 20 randomly picked nursing staff from a neighbouring critical care unit. Those respondents were given the questionnaire on two separate occasions to test for reliability of the questionnaire.

As a result of Peer Review and analysis of the results from the pilot study, only minor adjustments were made to the questionnaire in order for the questions to be more easily readable and understandable. For example, results from the pilot study questionnaires revealed an inability of some respondents to understand what the question was asking, in this case a number of questions asked the respondents to choose the appropriate answer (A, B, C, D or E) from a selection of choices (1, 2, 3, 4 or 5). On examination of the results, respondents were circling the choices rather than the answers, which indicated that the question did not relay any information about how the respondents were to answer it. Therefore, as a result of this and advice taken from post-pilot Peer Review, instructions were highlighted in the introductory text as well as in the questions so that there was little likelihood for misunderstanding and that the questions could be answered fully.

Data analysis

The nature and design of this study allowed for use of non-parametric analysis using Kruskal–Wallis to test hypotheses generated as a result of the literature review. The Kruskal–Wallis test was used to compare data obtained from the questionnaires to see if there were significant differences between the three nursing grades and the knowledge that they possessed. However, the problem with this test is that it merely establishes whether there is difference between the groups and does not indicate a trend or the direction of that trend, for example are 'G' grade sisters/charge nurses more knowledgeable of noise related issues than 'D' or 'E' grade staff nurses. As such the Kruskal–Wallis only allows for predictions to be made about the direction of these differences (Hicks, 1990).

Results

Non-parametric analysis using Kruskal–Wallis showed no significant difference between each clinical area ($H = 0.4521$, $p \geq 0.1$) and between each nursing grade ($H = 4.14$, $p \geq 0.1$) in terms of their knowledge regarding noise issues. This suggests that these were as a result of random error.

Descriptively the staff nurse grades produced better results in answering the socio-political (18%) questions than the other areas, whereas the senior sister/charge nurse grade was better at answering the physiological (23%) and psychological (21%) questions. Yet, the overall mean score for the staff nurse grade was 6% correct answers. In comparison the 'F' grade and the 'G' and 'H' grade nurses produced 4 and 5% questions answered correctly respectively (Table 1).

Descriptive analysis of individual grade performance of the questionnaire produced poor results. Overall only 5% of respondents were able to answer the questionnaire correctly. Most significantly, it was the staff nurse grade that did better than all other grades even with allowing for mathematical differences between each group.

Summary of the results

The testing of nurses knowledge using a self-administered multiple-choice questionnaire investigating the effects of excessive noise exposure on individuals, the patient and the work environment demonstrated poor results. Comparative analysis using Kruskal–Wallis demonstrated no significant difference between the nursing grades studied.

Table 1 Categorised questions answered correctly per nursing grade.

Questions ($n = 15$)	Staff nurse (D and E grade) ($n = 80$)	Sister/charge nurse (*F* grade) ($n = 9$)	Senior sister/charge nurse (G and H grade) ($n = 7$)
Socio-political ($n = 5$)	75	7	4
Physiological ($n = 6$)	78	9	8
Psychological ($n = 4$)	65	7	6
Total answered correctly	218 (18%) $n = 1200$	22 (16%) $n = 135$	18 (17%) $n = 105$

Discussion of the results

The aim of this study was to assess the knowledge held by ICU nurses working in a General Intensive Care Unit with regard to the impact excessive noise exposure has on the hospital environment. The questionnaire was derived from the literature pertaining to noise within the hospital environment. The 15 questions were arranged using a multiple-choice configuration and were divided into three key areas with regard to excessive noise impact, these being; the socio-political, physiological and psychological domains. The results obtained from the questionnaire were not surprising in themselves. Non-parametric analysis suggested that there was no correlation between each group and that respondent answers were possibly as a result of simple guesswork or in some cases possible collaboration between the respondents themselves. Indeed, less than 5% of all questions were answered correctly. However, it may be difficult to make generalisations to other hospitals or other critical care areas from this data for these very reasons. Yet, it may be possible to make some assumptions about the level of knowledge that these groups possess.

While statistical analysis indicated that there was no correlation between each nursing grade, descriptively it was demonstrated that the staff nurse grade (D and E) did better overall especially in answering the socio-political questions than the other two nursing grades, with the most noteworthy poor performer being the sister/charge nurse grade (F grade).

The socio-political questions

There was a very distinct knowledge deficit with regard to current government legislation in relation to noise control within the hospital environment. In fact less than 5% of all respondents answered correctly those questions that required knowledge of current legislation and/or health related guidelines pertaining to noise control in the work-place, for example those guidelines stipulated by WHO (1993) and the Health and Safety Executive (1992). Yet, most striking was the response from senior nursing staff, the Senior Sisters and Charge Nurses. Indeed, there was some prior expectation that this group would have some insight, if not limited, to current legislation with regard to noise control, which would have been identified in their answers. This clearly was not the case. While it must be acknowledged that 5% of this group got these questions right, breakdown analysis found that only 1% got those questions pertaining to current legislation right. However, this poor response may be explained to some degree in terms of their priorities being placed on those areas where it is perceived that more and immediate harm will befall the nurse or patient than excessive noise exposure, for example manual handling.

Yet, later debriefment and questioning about their responses pertaining to current legislation on noise control, lead this researcher to conclude that this group were not aware of these regulations and/or health related guidelines. However, there was an acknowledgement that other Health and Safety Executive (1992) guidelines did exist that were perhaps more pertinent to their current location. Moreover, it was suggested that the lack of knowledge regarding noise control legislation and its implementation into the clinical area was in part due to the lack of information and direction disseminated from the more senior managers of the trust. This statement is disturbing inasmuch that these people, at this level of responsibility (Senior Sisters and Charge Nurses), feel the need to take absolute direction in the matter of noise control from senior management, some of whom may not be ordinarily exposed to the levels of noise created in the clinical area, without first trying to curb the problem at a more local level. Perhaps this is occurring, however it was not noted during the course of this study.

While some questions asked for knowledge on current legislation, one question asked what staff thought were the major contributors to excessive noise production in the work place. Over 50% of respondents agreed that medical and nursing staff were responsible for the noise produced within this respective clinical area. It is here that scoring from all groups ranged from 20% to 80%; with the staff nurse (80%) and senior staff nurse groups (60%) performing better. This is consistent with the findings of Marshall (1972), Bentley et al. (1977), Noble (1979), Helton et al. (1980), Topf (1985), Soutar and Wilson (1986), Baker (1992) and Christensen (1997), all of whom found that over 31% of patients complained about the conversational noise nursing staff made, and that increases in heart rate were significant at the inception of human noise and as Helton et al. (1980) suggest is a significant contributory factor in the phenomena known as "ICU Delirium".

The physiological questions

Overall, the three nursing grades were similar in the correct answers that they provided in relation to the physiological symptoms of excessive noise

exposure. While all the questions were answered there were a number of respondents who demonstrated a knowledge deficit of the physiological impact of noise induced stress and the two body systems that it stimulated, namely the autonomic and endocrine systems. In fact only 10% of respondents overall answered these particular questions correctly. The reason for the poor response may be as a result of the unfamiliarity of the respondents to noise induced stress. Yet, this would seem an unreasonable assumption to consider especially when nursing staff within this areas should be aware of patient exposure to different stressors during their hospitalisation, for example pain. Indeed, the exposure to any stressor whether it be noise or pain will elicit the same autonomic or endocrine response depending on the intensity of the stressor the patient is being exposed to (Falk and Woods, 1973; Seidlitz, 1981). However, this failed to be conveyed in the results.

Interestingly the results obtained from question five indicated that 50% of those respondents could identify a specific level of noise by using ''normal'' household noise (40 dB(A)) at night as a frame of reference. This was important in establishing whether nursing staff could distinguish levels of noise within their own clinical environment and as such be consciously aware of the noise being generated. However, this ability to conceptualise a level of noise as it is occurring may be difficult to measure. Therefore, it may be prudent to suggest that nursing staff perceive levels of noise in terms of personal annoyance rather than as a specific level of noise. This of course would be difficult to measure in the clinical setting as well, yet it has been successfully demonstrated in earlier laboratory studies (Colle, 1980; Topf and Dillon, 1988).

The psychological questions

Other areas that were of interest were those concerning the psychological impact of excessive noise. A lot has been written in the literature in relation to the phenomena known as ''ICU Delirium'', a form of neuroses characterised by delusions; paranoia; disorientation and slurred speech (Baker, 1992; Helton et al., 1980) caused as a result of continual sensory overload and/or deprivation. Many of the respondents (80%) associated the behavioural changes one would expect to see in a patient suffering from ICU Delirium as being hypermanic or irritable. However, previous clinical experience suggests that some patients transferred from the ICU to the surgical ward exhibited those very behaviourisms described by Helton et al. (1980) and Baker (1992).

Yet, it is interesting that when questioned, nursing staff associated these behavioural changes (hypermania and irritability) with the lighting of the unit, the unfamiliarity of the unit or the sleeping in a strange bed, suggestions commonly expressed by patients. While these are indeed contributing factors, it could be argued that patients are not normally exposed to the alarms of monitoring equipment, the alarms of a syringe driver or a volumetric pump indicating the infusion is complete or that lines are occluded. Yet, these noises as well as conversations whether they are staff or patients, typical of a hospital, are enough to startle, frighten and wake a sleeping patient (Biley, 1994; Cohen and Weinstein, 1981; Evans, 1982; Spacapan and Cohen, 1983; Topf and Dillon, 1988).

Potential limitations to the study

Post-analysis of the pilot study revealed the issue of initial poor respondent rates. In fact only 28% of respondents returned the questionnaire at first exposure. However, this improved on the circulation of a second questionnaire and letter with information pertaining to the aims and objectives of the pilot study as well as reiterating the importance of maintaining respondent confidentiality and anonymity. Consequently, for this not to pose a problem during the main study a strategy was developed to increase response rate and make the questionnaire more respondent friendly. For example, Oppenheim (1992) reports of a number of factors that can be employed to ensure good response rates; advanced warning, sponsorship, incentives, confidentiality, length and topic of the subject and the inclusion of a return envelope have all been shown to increase response rates.

Therefore, for this study an initial questionnaire and letter were personally made available to those nursing staff taking part, outlining the aims and objectives, the issue of confidentiality, a return envelope and a specified return date. As the returns started to dwindle, a second questionnaire, a reminder letter and a return envelope was sent to those respondents who still had not replied. Following this, respondents who had not replied on the two previous occasions were telephoned, sent a reminder letter and a third questionnaire, again outlining the aims and objectives of the study, the issue of confidentiality and a return date. The respondents were also informed that the researcher would be available personally to collect the questionnaire, which then allowed any issues the respondents may have had with completing the questionnaire to be aired with the researcher.

Conclusion and recommendations

Testing of nurse's knowledge, using a self-administered multiple-choice questionnaire, of noise excess on the patient and the work environment, demonstrated poor results. However, in analysing the comparative data from the questionnaire it was found that Kruskal–Wallis showed no significant difference between the three groups studied and between the different nursing grades.

Whilst the overall results of the questionnaire were poor, this however may not be a reflection on the questionnaire itself. All of the information asked in the questionnaire was gleaned from the literature and rigorous peer review found the questions fair and easily worded. Yet, despite this the study did highlight that nursing staff demonstrated a significant knowledge deficit with regard to the impact excessive noise exposure, an everyday stressor, has on those within the hospital environment.

Therefore recommendations for future research could include:

- Does test re-test education of nursing staff on the effects of excessive noise exposure within these respective areas reduce the overall ambient noise level?

Nevertheless, it is questionable whether further research into the examination of noise levels in the hospital environment is needed, because this is already well established within the literature. Increasing awareness of the noise levels that are generated within these areas should be of importance. Education through literature review or case study analysis could stimulate peer review and provide a positive medium for pin-pointing problem areas with regard to noise control. Random sampling of noise levels could provide positive feedback, therefore consciously making staff aware of the potential unnecessary interactions that take place near patients and as such possibly provide a positive influence on behaviour.

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Defining the expert ICU nurse

Martin Christensen, Jaqui Hewitt-Taylor*

Bournemouth University, Nursing Studies, Bournemouth House, Christchurch Road, Bournemouth BH1 3LT, UK

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Summary This paper explores the concept of expertise in intensive care nursing practice from the perspective of its relationship to the current driving forces in healthcare. It discusses the potential barriers to acceptance of nursing expertise in a climate in which quantification of value and cost containment run high on agendas. It argues that nursing expertise which focuses on the provision of individualised, holistic care and which is based largely on intuitive decision-making cannot and should not be reduced to being articulated in positivist terms. The principles of abduction or fuzzy logic, derived from computer science, may be useful in assisting nurses to explain in terms, which others can comprehend, the value of nursing expertise.

Introduction

Expertise in nursing is seen as an important part of achieving quality care for patients (King and Appleton, 1997). However, the increasing use of clinical guidelines and care protocols to direct care (Department of Health (DoH), 2000) have raised to concerns over the value afforded to expert practice (Smith, 2001; Dent, 2002). There has been a move towards the use of clinical guidelines and care protocols to direct patient care in England and Wales. This was driven to a great extent by concerns over the quality of care provision following well publicised cases, where care fell short of quality standards (Kennedy, 2001), and of course concerns over unequal access to treatment between geographical regions (Department of Health, 2002). National clinical guidelines are continually being developed by the National Institute for Clinical Excellence (NICE), which was established as a special health authority with the remit of providing the NHS with guidance from evaluation of the evidence of the clinical and cost-effectiveness of new and established treatments and technologies (Goodman, 2000). The development and use of clinical guidelines at a national level has also become popular internationally, for example, in Scotland the development of the Scottish Intercollegiate Guidelines Network (SIGN), in the USA the National Guideline Clearing House, the Canadian Medical Association who publish a bank of practice guidelines, and the Medical Journals Association of Australia also providing a range of online guidelines to enhance patient care. Together with the establishment of the AGREE collaboration, an international collaboration which has developed an instrument for

* Corresponding author.
E-mail address: mchristensen@bournemouth.ac.uk (J. Hewitt-Taylor).

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assessing the process of guideline development and guideline quality which is acceptable in European and non-European countries (AGREE, 2001) further indicates that the development and use of clinical guidelines is increasingly becoming a part of international agendas. However, NICE differs in so far as it has been established by Government and, whilst being politically independent, has the authority to issue guidance with the expectation that clinicians will take this into account in decision making.

Although the use of clinical guidelines may promote equal standards of care, they may detract from nurses using their expertise to make decisions. Whilst NICE consistently state that their guidance should be used in conjunction with clinical expertise, expert intensive care nurses are a relatively expensive resource and unless their value can be articulated there is a risk that their decision making skills will be perceived as replaceable by comprehensive but prescriptive guidelines or protocols of care. It is therefore appropriate to consider how expert nurses' contribution to high quality care in intensive care practice can be articulated. This includes considering the nature of expertise in nursing practice, how this relates to the beliefs and values held by nursing and other health care professionals and how the power differential between staff groups affects policy decisions.

This paper therefore discusses the interface between expertise and clinical guidelines, what constitutes expert nursing, how expertise in nursing may be viewed in a world in which cost and quantification of benefit are often seen as necessary, how nurses and therefore nursing expertise is viewed and can be defended in a multidisciplinary context, and how the concept of fuzzy logic may enable nurses to explain their expertise.

Expertise and guidelines

Benner's (1984) work was important in the development of the concept of expertise in nursing and continues to be highly influential in debates on the subject. Benner (1984) adapted Dreyfus and Dreyfus' (1980) work to develop a framework to describe how nurses become experts. Benner (1984) views expertise as embedded in practice and considers holistic care rather than the ability to proficiently conduct a series of tasks the hallmark of expertise. This focus on holism is congruent with the Royal College of Nursing's (RCN) (2003) definition of nursing, with the Department of Health (2000) also placing value on the provision of holistic, patient centred care. However, this occurs alongside their recommendations for increased use of standardised guidelines and protocols to direct care (DoH, 2000). These two concepts are not necessarily incompatible, but in Benner's terms decisions based on understanding of individual need would override any requirement to follow prescribed protocols or guidelines. The recommended use of clinical guidelines and care protocols come with the caveat that these are not intended to replace the use of expert clinical judgment and consideration of individual need (NICE, 2004). However, if given undue emphasis, they run the risk of reducing nursing care to a series of tasks and detracting from what Benner sees as expert practice (Melling and Hewitt-Taylor, 2003).

Expertise defined

Adapted originally from the work of Dreyfus and Dreyfus (1980), Benner (1984) attempted to provide a framework upon which a model of skill acquisition for nursing practice could be used to guide nurses to attain the status of expert. The strength of Benner's (1984) model is the emphasis it places on holistic clinical practice, promoting holistic nursing as being more significant than task allocation. Benner (1984) considers the expert to be able to accurately 'zero in' on the problem without wasteful consideration on alternative, unfruitful diagnoses and solutions. Their performance is fluid, flexible, highly proficient and they are no longer aware of features and rules. For the expert practitioner situations are viewed holistically, past concrete experiences and knowledge embedded in practice allow for understanding without rationale (Meerabeau, 1992). Benner and Tanner (1987) draws upon the six key aspects of intuitive judgment devised from the Dreyfus and Dreyfus (1986) whereupon pattern recognition, similarity recognition, common-sense understanding, skilled know-how, sense of salience and deliberative rationality culminate in identifying those traits commonly seen in expert intuitive practice. Consequently, nurses base their clinical judgments on 'gut feelings' or 'there was something not quite right' when deciding what action needed to be taken before any ensuing clinical changes became apparent, what Pyles and Stern (1983, p. 52) refer to as 'falling out of pattern'.

However, Benner's work has been criticised by English (1993) for offering a model without full definition and clarification of the expert practitioner. However, not all writers share English's concerns, with Darbyshire (1994) dismissing English's (1993) work as lacking scope and insight. Nonetheless, recent literature appears to be critical of Benner's concept being without a quantifiable defini-

tion (Dowding and Thompson, 2004). In a world in which cost effectiveness as well as clinical effectiveness is important, if expertise in nursing is to be accepted, nurses must be able to articulate and debate the nature and value of their expertise (Melling and Hewitt-Taylor, 2003). Lieberman (1981) argued that professional expertise requires extensive specialised skill and knowledge whilst Moore (1970) argued that it requires the practitioner to command a substantive field of knowledge and have mastery of that knowledge. Woolery (1990) suggested that expertise results in performing expert actions without conscious awareness of the knowledge being used, a view that Benner (1984) shares. Thus, the suggestion is that nursing experts have moved beyond knowledge alone and have the ability to rapidly and accurately assimilate their knowledge with the salient points of a situation and to act appropriately on these without consciously working through the alternatives and the rationale for their decision (Meerabeau, 1992).

For example, an expert Intensive Care Unit (ICU) nurse may decide that a patient is not ready for weaning from assisted ventilation. The guidelines on weaning may suggest that the patients' respiratory effort, oxygen saturation, blood gases, heart rate indicate that weaning should commence. However, an intuitive feeling regarding the patient may make an expert nurse either delay this or follow a more cautious reduction in ventilation than the protocol suggests. This type of expert decision-making will be done rapidly, almost subconsciously, and constantly. Phillips (1994), Radwin (1995) and Rolfe (1996) see this combination of tacit, experiential and theoretical knowledge as producing best practice. This assimilating evidence from a variety of sources, and applying it appropriately to individual care situations is central to the concept of evidence-based practice as described by Sackett et al. (1996) and DiCenso et al. (1998). This should make expertise in these terms congruent with the current drive towards evidence-based practice, especially those espoused within the Peach Report (DoH, 1999), Making a Difference (DoH, 1999) and the NHS Plan (DoH, 2000). Again, herein lies a potential conflict within central policy, where evidence-based practice, a vital component of clinical expertise, and the use of guidelines and protocols to enhance standardisation of practice, are jointly promoted. Although following guidelines or rules has a place in the formation of expertise, this appears to be a transitional stage, beyond which experts have moved.

Such decision-making is what Dreyfus and Dreyfus (1980) and Benner (1984) term ''intuition'' and underpins the phenomenological approach, which Benner (1984) takes when defining expert practice (Darbyshire, 1994). Farrington (1993) described intuition as an informal, unanalytical, unstructured, deliberate calculation to facilitate problem solving. Benner's (1987) model draws upon the six key aspects of intuitive judgment devised from the Dreyfus and Dreyfus (1986) where pattern recognition, similarity recognition, common-sense understanding, skilled know-how, sense of salience and deliberative rationality combined are traits commonly seen in expert intuitive practice. This model seeks to explain formally how expert nurses base their clinical judgments on 'gut feelings' before any measurable clinical changes became apparent. In a later study, Benner et al. (1996) refined the fundamental principle of intuition in expertise, concluding that mature and practical reasoning accompanied by an intuitive grasp of the patients situation, characterised expert nursing practice. For example an expert intensive care nurse may be aware that a patient is ''going off'' before they acutely deteriorate. There may be some measurable signs such as a slightly lowered blood pressure, borderline tachycardia, minor reduction of SaO_2 and restlessness or agitation. This may leave the parameters within ''normal'' limits, but combine with a feeling, developed from caring for many patients with similar conditions over the years, and knowledge of the pathophysiology of the patients' illness and the effects and possible side effects of treatment, to produce a belief that the patient is deteriorating. This, if acted upon, may enable early intervention and thus prevent severe deterioration in the patient's condition. However, such intuition is difficult to quantify or demonstrate. This is potentially problematic in a world in which the cost of any commodity, including expert nurses, must be justified.

Moreover, demonstrating the effects of expert nursing knowledge is problematic. In many cases there is no quantifiable proof that expert input has a significant effect on patient outcomes. For example, an expert surgeon may be assessed by factors such as mortality following a given procedure, or failed procedures, but nursing care is multifaceted and involves factors, which cannot be quantified. Early intervention may mean that a patient remains stable and a problem is averted and thus the result is invisible and unmeasurable. Patient outcomes for what are deemed to be expert nurses cannot be meaningfully compared with those who are not, as too many additional variables exist within patient care situations, a variety of nurses care for each patient and expert nurses are likely to assist their junior colleagues in decision making for ''their'' patients, thus any reductionist comparison of mor-

bidity or mortality in patients cared for by experts or non-experts is flawed.

Although medical care is also multifaceted, and physicians and surgeons are increasingly encouraged to provide holistic care, an emphasis on care rather than cure has traditionally been cited as a major distinction between nursing and medicine (Wilmot, 2003). Caring is linked with the view of nurses as nurturing (Scott, 2003), with a concern for individual patients' needs, compared with medical staff being engaged in scientific decision making regarding interventions aimed at cure (Hewitt, 2002). In outcome terms, successful cure is easier to demonstrate in measurable terms than care predisposing medicine to quantifiable views of how far a practitioner is successful, or demonstrates expertise. Whilst this may be changing as the boundaries and roles of both professions become blurred, the traditional views of professions and how they measure success may be slow to change (Tweeddale, 2002).

Despite this perceived distinction between medical and nursing knowledge, expert medical staff have been identified as using similar methods of decision making to expert nurses. Elstein and Schwartz (2002) suggested that experienced physicians often use a system of matching cases either to specific previous instances or to more abstract prototypes. Diaz (2004) identified that neurologists use a variety of methods for decision-making, including patterns, exhaustive probabilistic and deductive reasoning methods, whilst making the distinction that most errors occur in the probabilistic setting are often due to a lack of intuitive judgment. This type of case matching is similar to Benner's (1984) view of expert nurses and is also an important part of Radwin's (1995) work. Thus, although expert physicians may not in fact have a different way of reaching decisions than nurses, and the nature of expertise may in fact be very similar, how the professions as a whole perceive or have perceived expert practice may differ. This is linked to how the professions perceive or have perceived their knowledge base.

Art versus science

Medicine is firmly rooted in a positivist philosophy (Clarke, 1986; Witkin and Harrison, 2001; Shulkin, 2000). Although medicine is increasingly accepting of other forms of knowledge, including using qualitative enquiry (Gardner and Chappell, 1999; Donovan et al., 2002; Rosenthal et al., 2005), the traditional stance of professions may not be easy to alter (Tweeddale, 2002). Despite historically being linked with medicine's focus on positivist knowledge, nursing has moved away from this approach to a greater degree than medicine, and expertise in nursing in Benner's terms would be difficult to fit into such a philosophy, being rooted in a naturalistic paradigm. It can be agreed that nursing practice requires knowledge which is generated from a range of sources (Rocha and Lima, 2000), although this applies to both medicine and nursing, nursing's tendency to deeper engagement with individual patients and the holistic view that this encompasses, has meant that nursing is more familiar with and accepting of naturalistic knowledge than medicine (Mulhall, 1998; General Medical Council, 2000).

Schon (1983) suggested that practice situations do not present themselves as well formed structures, but instead as messy, indeterminate situations, which cannot be solved by technical rationalisation alone. For example in an adult who would, according to a technical/rational decision regarding their respiratory status, benefit from prone positioning, there are likely to be a number of additional factors which require consideration. Some of these will be quantifiable, such as blood gases, heart rate, blood pressure, number of intravenous lines which will need to be secured, number of chest drains and how safely these can all be maintained whilst repositioning the patient prone. However, some will depend on the expert ICU nurses' intuition, on how they instinctively feel the patient will respond, how this patient has been when handled, and, often subconsciously, how "similar" patients have responded to prone positioning. The expert nurse will also think ahead, taking into account issues such as staffing and how easy it will be to swiftly reposition the patient, should the need arise.

Nursing practice is complex, and unpredictable, because it deals with people. There is therefore an artistry as well as science in it (Fish, 1991; Rose and Parker, 1994). For example, when making decisions about analgesia administration in critical care settings, a patient's vital signs and oxygen needs (which may also be attributable to other aspects of their health or treatment), facial expression, muscle tone and position must all be weighed up. The various sources of pain and discomfort alongside exacerbating factors such as fear and sensory imbalance must also be taken into account and a variety of pharmacological and non-pharmacological interventions considered alongside the patients values and beliefs, if these are known. This type of expertise moves beyond knowledge of the analgesics available, their actions and side effects, measurable pain assessment scales

or following guideline on analgesia administration, although these form a part of the expert decision. This composite expert picture is more likely to produce a high standard of pain relief but is harder to explain and report in auditable terms than to note, for example, that as a pain scale of 3 was recorded morphine administration was increased resulting in a pain score of 2 one hour later. This definition of expertise is thus problematic to justify to those favouring a positivist paradigm.

English (1993) opposed the Bennerian notion of intuition, arguing that the premise of intuition lies in cognitive thought processing (using the chess master as an example) and that empirical research methodology can be used to verify its existence. Darbyshire (1994), on the other hand, was critical of English's (1993) view, arguing that the philosophy of Benner's (1984) expert practitioner is held within Hiedeggerian phenomenology, which is incompatible with such aims. The extent to which the incompatibility of concepts of nursing expertise with positivist thinking is problematic depends upon the credence given to each paradigm. Nursing practice is conducted within a multidisciplinary context and thus the relative power of other professions in relation to nursing is relevant to how nursing expertise is viewed.

Power and nursing expertise

A significant power differential exists between medicine and nursing (Brier-Mackie, 2001; Hewitt, 2002), which Burnard (1989) and Cash (1995) suggested influences the acceptance of definitions of expertise, which fall outside accepted medical philosophies. Historically medical doctors were men and nurses were women, in a society in which women were seen as subordinate to men (Hewitt, 2002; Wilmot, 2003). Despite changes in society and the gender demographics of medical school entrants, it has been suggested that medicine remains masculinised and nursing feminised in cultural terms and the power equation between these professional groups persists (Martin, 1998; Hewitt, 2002; Wilmot, 2003). Burnard (1989) suggested that nursing intuition has thus been perceived as a feminine trait, outside the bounds rationality and masculine logic and as such if power is weighted in favour of the traditional medical paradigm, intuition will therefore not hold high value.

In England, for example, it has been medical staff who have in the past been largely involved in debates on policy and politics. They have traditionally been seen as the leaders in healthcare because it was initially medical staff that were in charge of hospitals (Wilmot, 2003). Thus, their views on knowledge and expertise have previously affected how priorities in healthcare and quality are perceived. This has important implications in a health service which is increasingly target driven, with cost as well as clinical effectiveness seen as a key issues, inasmuch that the quantifiable view of expertise which has arisen from the positivist paradigm is likely to be more acceptable to those who must demonstrate value for money and achievement of targets.

Despite this acknowledgment, and medicine being required to move towards a more humanistic approach in which patient autonomy and choice figure highly, the traditionally positivist basis of medicine may make it difficult for expertise seen in non-measurable terms to be easily or widely accepted. In addition, Hewitt (2002) argued that nurses have been reluctant to engage in political debate and Maslin-Prothero et al. (2002) suggested that many nurses in the United Kingdom accept being placed outside the political power domain, regarding politics as an undesirable distraction from care delivery. Thus, nurses may not themselves truly oppose the medically dominant scheme of power. However, unless nurses can and do articulate the value of their expert judgment in patient care their worth is likely to be less well accepted and valued than the type of quantifiable measures which fit the traditional positivist paradigm.

Fuzzy logic

Interestingly, it is from within the world of science that a definition of expertise, which may significantly assist nursing, has emerged. Computer science has developed the concept of 'fuzzy logic' enabling computers to run, work, understand and replicate expert human tasks and do what experts do. Originally, computer scientists attempted to extrapolate expert human knowledge and intuitive judgment traits into logical, analytical mathematical formulae whereby artificial intelligence systems could reproduce expert human practice. The problem emerged that experts do not rely on rules and logical thought processes in problem solving (Rolfe, 1997). A new generation of computer scientists has therefore employed what they call 'fuzzy logic' or abduction. Fuzzy logic does without the clear black and white rules of formal analytic logic, and problem solves like its human contemparies. Logical problem solving works using a linear algorithmic approach whereby A then B, B then C and so on until the answer is reached.

Fuzzy logic, however, applies the formal rules of logic, but all at once and to different degrees depending on the situation (Kosko, 1994; Rolfe, 1997). Fuzzy logic may be valuable in explaining expert nursing practice by providing an explanation of intuition (Rolfe, 1997). This may be acceptable across professional boundaries being from a scientific, logical rational paradigm, but also embracing the individualised, unquantifiable aspects, which are inherent in nursing expertise. An expert paediatric intensive care nurse will include in a decision over how much sedation an infant requires at any given time; the child's current level of sedation and its adequacy (which my be determined using scores such as a sedation score, and other physiological and behavioural aspects of how they feel the child is), the pathophysiology of the child's illness, the pharmacology of the sedation agent and how these interact, what procedures are likely to be performed in the next hour, how these are likely to affect the child and how vital these procedures are in relation to the child's overall condition, whether parents are present, what the overall plan is for the child, for example weaning from assisted ventilation. The weighting given to each of these elements of a decision will vary in each case, and the weighing up will be done swiftly and almost subconsciously, in association with decisions about the other aspects of the child's management. Logic alone would deal with each aspect of this decision, and provide guidelines of decision-making regarding sedation in an almost algorithmic, reductionist fashion. However, expertise places all these logical pathways together, at once and decides on composite priorities by weighing up each individual element of the child's condition and sedation needs.

Conclusion

The ability to articulate the nature and value of nursing expertise is likely to be crucial in a move towards standardisation of care and the increasing emphasis on following clinical guidelines and care protocols. Although definitions of evidence based practice generally include expertise in the forms of evidence which inform practice (Sackett et al., 1996; DiCenso et al., 1998) this is often left as an add on, a ''also take into account'' rather than the key element which many early proponents of evidence based practice intended (Sackett et al., 1996; DiCenso et al., 1998). Being able to articulate the nature and importance of expertise may go a long way to it gaining acceptance in a world where every aspect of cost, including the cost of expensive expert nursing staff, is considered.

Moreover, nurses form the largest part of the NHS workforce (Masterson, 2002; Jasper, 2002) but nonetheless often exhibit powerlessness to gain an equal footing with other professionals, and in day-to-day interactions still have a tendency to submit to medical domination (Martin, 1998; Hewitt, 2002). However, if nursing expertise is to be valued, and indeed sustained then it will be necessary for nurses to be able to articulate their value as experts. What may be impossible, and undesirable, is placing expertise in a positivist paradigm. It seems that expertise will never, in full, fit such a paradigm, and whilst some aspects of expertise can be articulated in such terms, the essential intuitive artistry of nursing will be lost if it is reduced to positivist principles.

The concept of fuzzy logic may be valuable in explaining nursing expertise in a way which accurately reflects how expert nurses make decisions, and which will be understood by those outside the naturalistic paradigm. This is likely to involve nurses combining the narrative nature of their practice, where individual needs and values are a key element of care with explanations of how this fits the concept of fuzzy logical thought to produce best practice. Thus, narrative explanations may ensure that the artistry and humanity of nursing are not reduced to positivist measurements, but these are expressed within a framework which is logical and although not measurable demonstrates the range of concrete identifiable factors which are taken into account and how theoretical knowledge, protocols and guidelines are incorporated into, but do not dictate, expert decision making.

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From expert to tasks, expert nursing practice redefined?

Martin Christensen RGN, PGC (ICU), BSc (Hons), MSc, MA(Ed)
Senior Lecturer, Bournemouth University, Bournemouth, Dorset, UK

Jaqui Hewitt-Taylor RGN, RSCN, BA(Hons), PhD
Practice Development Fellow, Bournemouth University, Bournemouth, Dorset, UK

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Correspondence:
Martin Christensen
Senior Lecturer
Bournemouth University
Royal London House
Christchurch Road
Bournemouth BH1 3LT
Dorset
UK
Telephone: 01202 962132
E-mail: mchristensen@bournemouth.ac.uk

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From expert to tasks, expert nursing practice redefined?

Aim. The aim of this paper was to explore the concept of expertise in nursing from the perspective of how it relates to current driving forces in health care in which it discusses the potential barriers to acceptance of nursing expertise in a climate in which quantification of value and cost containment run high on agendas.

Background. Expert nursing practice can be argued to be central to high quality, holistic, individualized patient care. However, changes in government policy which have led to the inception of comprehensive guidelines or protocols of care are in danger of relegating the 'expert nurse' to being an icon of the past. Indeed, it could be argued that expert nurses are an expensive commodity within the nursing workforce. Consequently, with this change to the use of clinical guidelines, it calls into question how expert nursing practice will develop within this framework of care.

Method. The article critically reviews the evidence related to the role of the Expert Nurse in an attempt to identify the key concepts and ideas, and how the inception of care protocols has implications for their role.

Conclusion. Nursing expertise which focuses on the provision of individualized, holistic care and is based largely on intuitive decision making cannot, should not be reduced to being articulated in positivist terms. However, the dominant power and decision-making focus in health care means that nurses must be confident in articulating the value of a concept which may be outside the scope of knowledge of those with whom they are debating.

Relevance to clinical practice. The principles of abduction or fuzzy logic may be useful in assisting nurses to explain in terms which others can comprehend, the value of nursing expertise.

Key words: art and science, expert practice, expertise, fuzzy logic, intuition, novice

Introduction

Expert nursing is considered an important part of achieving high-quality patient care (King & Appleton 1997, Aitken 2003). Quality issues are high on professional and political agenda and thus it is logical to assume that the development of expertise in nursing is also high on such agendas. It is certainly the case that the UK Department of Health (DoH 2000) espouses a commitment to developing and rewarding expert nurses. However, what is meant by expertise in this context is debatable. Despite the apparent enthusiasm for and desire to reward expertise in nursing (DoH 2000), a concurrent focus on using clinical guidelines and care protocols to direct care (DoH 2000) has given rise to concerns over the value afforded to what is truly expert practice (Smith 2001, Dent 2002). Links are made by the DoH (2000) between

expertise in nursing and nurses following protocols of care that will enable them to extend and expand their roles. However, most writers argue that expertise in nursing requires more than technical proficiency and the ability to follow prescribed care guidelines or protocols (Benner 1984, Hewitt-Taylor & Melling 2004).

Expert nurses are a relatively expensive resource. Unless their value can be articulated, there is a risk that they will be perceived as replaceable by comprehensive but prescriptive guidelines or care protocols which can be followed by staff who may be technically highly proficient but who are not able to provide the individualized and holistic care which expertise facilitates. There is often a requirement for the quality of care to be measured in quantifiable terms, particularly when cost containment is the driving force and all expenditure must be justified (Archibald 2000, Callaghan 2002). This is incongruent with the predominantly naturalistic methods that have been used to articulate expertise in nursing (Benner 1984, Darbyshire 1994). It is, therefore, appropriate to consider how expert nurses' contribution to high quality care can be articulated and how nurses can defend their expertise. This includes considering the links and conflicts between DoH policy and the concept of expert nursing, the nature of nursing expertise, how this relates to the beliefs and values held by nursing and other healthcare professionals and policy makers.

Expertise and standardizaton of practice

Benner's (1984) work was important in the development of the concept of nursing expertise and continues to be highly influential in debates on the subject. Benner (1984) insists that holistic care, rather than the ability to conduct a series of tasks proficiently, is the hallmark of expertise. This theme remains consistent in writing on nursing expertise (Rolfe 1997, Higuchi & Donald 2002, Wilkin 2002) and is congruent with the Royal College of Nursing (2003) definition of nursing. The DoH (2000) also places value on the provision of holistic, patient-centred care. However, this occurs alongside their recommendations for the increased use of guidelines and protocols to direct care (DoH 2000). Clinical guidelines are intended to provide practitioners with guidance regarding specific areas of healthcare practice (Delaney 2001, National Institute for Clinical Excellence 2004). They should arise from a systematic evaluation of the current best evidence and be presented in a manner which makes the application of evidence to practice clear (Thomas 1999, Considine & Hood 2000). National clinical guidelines aim to provide practitioners with information about what is deemed to be the best approach to an aspect of healthcare provision so as to promote equal standards of care, regardless of the individual providing that care or the location of individual patients. Similarly, care protocols aim to provide practitioners with evidence-based information which clearly demonstrates the best method of care provision in specific situations (Considine & Hood 2000, DoH 2000). It is suggested that they will contribute to evidence-based healthcare provision and, if developed nationally, to equal national standards of care (Considine & Hood 2000).

The concepts of nursing expertise, clinical guidelines and care protocols are not necessarily incompatible. National clinical guidelines come with the caveat that they are not intended to replace the use of expert clinical judgement and consideration of individual need (National Institute for Clinical Excellence 2004). Nevertheless, if given undue emphasis, such guidelines run the risk of reducing care to a series of tasks and detracting from holistic care (Melling & Hewitt-Taylor 2003). The DoH (2000) states that the provision of national care protocols will allow nurses to expand their repertoire of roles and thus enable them to take on entire caseloads and be rewarded for their expertise. The suggestion by the DoH (2000) that the introduction of care protocols will allow nursing expertise to be demonstrated and rewarded is at odds with many views on expertise and tends towards a reduction of expertise to technical or procedural proficiency.

Although following guidelines or protocols has a place in the formation of expertise, Benner (1984) sees this as a transitional stage, beyond which experts have moved. Benner (1984) describes novice nurses as relying on protocols or procedures to direct care whereas expert nurses rely, instead, on their intuitive judgement, developed over the years. Benner *et al.* (1992) argue that the transition from novice to expert requires a nurse to undergo four changes in performance: movement from reliance on protocols to abstract principles, a shift from reliance on rule-based thinking, movement from the perception that a situation is a compilation of relevant parts to seeing the situation as one whole and passage from detached observer to full involvement in the situation.

Thus, Benner's view would be that, whilst guidelines and protocols have a place in health care and are invaluable for staff who have not yet achieved expertise, they cannot replace, and are indeed a lower form of practice than, expertise. A culture in which following these are seen as the highest quality indicators would be considered to restrict care rather than enhancing it. An expert nurse will not reject guidelines or protocols, but these will be a part of, not the entirety of, what informs their decision making. In addition, as the expert nurse views situations holistically, not as composite parts, following guidelines or protocols related to one aspect of care will be weighed up by experts in relation to

how they pertain to the situation as a whole, not just the element of care to which they directly relate.

For example, a protocol or guideline may indicate the amount of time prior to surgery for which a child should be nil by mouth (NBM). This may be based on the current best evidence and outline an appropriate expertly devised time-scale. However, where this would involve waking the child at 5 a.m. the expert nurse may decide that to wake the child four hours pre-anaesthesia for a drink is inappropriate. This decision is likely to be based on a number of considerations. The protocol may be the start point for or a guide to the decision, but other factors will also be taken into account, including where on the theatre list the child is and how likely there is to be a delay which influences the actual theatre time and thus the duration of NBM time, whether waking the child will produce anxiety which will be counterproductive to its well-being, whether the child is likely to be more distressed by being woken or being NBM for longer, what time it usually wakes in relation to NBM time and when its previous last drink was, its wishes and those of its parents. The nurse will also take into account its age and weight which contribute to its energy and fluid reserves, its past and current medical history and how this may affect metabolism or emotional response to surgery and being NBM, and the surgery he will be having. Thus, whilst not rejecting a guideline, an expert nurse will incorporate it into a decision based on her knowledge of the specific situation and the child and family as a whole.

Benner's work on expertise in nursing has received much acclaim and has been widely used in the development of pre- and postregistration education and staff development tools. English (1993), nonetheless, considers that it fails to define clearly or fully the expert practitioner. Although Darbyshire (1994) dismisses English's (1993) work as lacking scope and insight, recent literature has been critical of Benner's concept having no quantifiable definition or expertise (Dowding and Thompson (2004). Although quantification of nursing expertise may be impossible and inappropriate (Darbyshire 1994), to justify it in terms of cost, nurses must be able to articulate and debate the nature and value of their expertise in relation to quality of care and how and why expert nurses are not replaceable by protocol-led care (Melling & Hewitt-Taylor 2003).

Expertise defined

Knowledge and skills

The *Oxford English Dictionary* defines an expert as 'having special skill at a task or knowledge in a subject.' Expertise is defined as having expert skills or knowledge (Thompson 2002).

In the context of professional practice, expertise should embrace both skills and knowledge (Moore 1970, Lieberman 1981). Thus, although the definition of expertise suggests that knowledge or skill is required, professional expertise should embrace both these elements as it must include the ability to provide a high standard of care, rather than simply to be able to describe how knowledge might be applicable to practice.

Woolery (1990) suggests that the level of knowledge and skills developed by experts results in them performing expert care without conscious awareness of the knowledge being used, a view that Benner (1984) shares. Thus the suggestion is that nursing experts can rapidly and accurately assess a situation, execute appropriate decisions and instigate high quality care without consciously working through the various alternatives (Meerabeau 1992). This ability is developed from a combination of knowledge and skills gained from theoretical and experiential sources that cover the range of nursing skills so as to produce holistic care. Phillips (1994), Radwin (1995) and Rolfe (1996) consider that this combination of tacit, experiential and theoretical knowledge produces best practice.

Assimilating evidence from a variety of sources and applying it appropriately to individual care situations is central to the concept of evidence-based practice as described by Sackett *et al.* (1996) and DiCenso *et al.* (1998). This implies that the development of expertise is congruent with the current drive towards evidence-based practice. Evidence-based practice, although requiring the current best documentary evidence to be sought also requires expertise in practice in appropriately applying knowledge to specific care situations (Sackett *et al.* 1996, DiCenso *et al.* 1998). Achieving this, it is argued, requires intuition (Dreyfus & Dreyfus 1980, Benner 1984, Darbyshire 1994, King & Clark 2002, James *et al.* 2003).

Intuition

Intuition is seen as a key element of expert practice (Dreyfus & Dreyfus 1980, Benner 1984, Darbyshire 1994, King & Clark 2002, James *et al.* 2003). The *Oxford English Dictionary* defines intuition as 'immediate apprehension by the mind without reasoning' or 'immediate insight' (Thompson 2002). Farrington (1993) describes intuition as an informal, unanalytical, unstructured, deliberate calculation to facilitate problem solving. Although intuition is described as unstructured or immediate and subconscious, Benner and Tanner's (1987) model uses the six key aspects of intuitive judgement devised from the skill acquisition model of

Dreyfus and Dreyfus (1986) to describe how intuition occurs in expert practice by experts using pattern recognition, similarity recognition, commonsense understanding, skilled know-how, sense of salience and deliberative rationality combined. In a later study, Benner *et al.* (1996) conclude that mature and practical reasoning accompanied by an intuitive grasp of the patients' situation, characterizes expert nursing practice. Thus intuition as seen in expert practice will mean that an expert has almost immediate insight into a situation by prompt apprehension of the salient points.

An expert nurse may be aware that a patient's condition is deteriorating before there are concrete physiological signs of this. There may be some measurable signs such as a slightly lowered blood pressure, borderline tachycardia, modest reduction of SaO_2, mild tachypnoea. This may leave the parameters within 'normal' limits, but combine with slight change in the patients' demeanour: mild restlessness or agitation, slightly changed level of responsiveness and, possibly, a slight change in colour, insufficient to be described as cyanosis or pallor, but a mild alteration, which, combined, produce a feeling, developed from caring for many patients with similar conditions over the years and knowledge of the pathophysiology of the patients' illness and the effects and possible side effects of treatment to produce a belief that the patient is deteriorating. This, if acted upon, may enable early intervention and thus prevent severe deterioration in the patient's condition. The expert nurse will be able to appreciate this composite evidence of deterioration almost immediately, and often be able to identify that the patient is deteriorating before he/she can state in concrete terms exactly what contributes to this knowledge or why he/she knows this to be the case.

Although intuitive judgements can be described, their nature predisposes to narrative description not quantification. Intuition is thus imprecise and unmeasurable. Darbyshire (1994) states that intuition belongs in the phenomenological paradigm, making it difficult and even inappropriate to attempt to quantify or demonstrate in concrete terms. This is potentially problematic in a world in which the cost of any commodity, including expert nurses, must be justified. One important distinction, which must be made, is how the expert nurse differs from the experienced nurse.

Experience

The amount of experience that an individual has is not equivalent to expertise. How expertise in practice develops in some individuals whilst others with similar experience adhere to ritual or habit-based practice is a distinction which must be made in describing what constitutes expertise and its value.

King and Clark (2002) and Martin (2002) describe analysis as a vital aspect of expertise. Paul and Heslip (1995) also suggest critical reflection as an important distinction between ritual practice and expert care. Critical reflection requires an individual to have experience on which to reflect, but to use this experience and its links with theoretical knowledge and knowledge from other experiences to form a bank of knowledge which informs their ongoing practice. This is very different from engagement in ritual care on the basis that 'it has always been done this way.' It may also distinguish technical proficiency from expert nursing. A nurse carrying out ritual care may do so with great technical proficiency, but without consideration of the individuals' needs or holism. For example, a nurse may perform intravenous cannulation with considerable technical proficiency. However, an expert nurse would combine the technical ability to place a cannula with judging when to do this, the priority of cannulation in comparison with other aspects of care, communication with the patient regarding cannulation and communication and observation during the procedure which enables them to gain a better understanding of the patient as a whole.

This view of expertise appears to contrast with the concept of intuition as described by the *Oxford English Dictionary* (Thompson 2002) and Farrington (1993), which is seen as unthinking and unanaytical. It could, nonetheless, be suggested that intuition does include thinking and analysis, but that this is the almost instantaneous and subconscious reflexive analysis of a variety of factors which is the hallmark of expert practice rather than conscious step-by-step analysis. One problem is the tendency for reflection to be seen as an academic exercise, researched and documented away from the practice setting. The development of expertise may require reflection on action, reading around subjects away from the patient care situation, to develop and refine the knowledge associated with expertise, but expertise itself is reflexive, with reflection in action occurring constantly. Reflection on action may also be helpful in describing and justifying nursing expertise by providing descriptions of how an expert nurse analyses situations.

From analysis emerges decision making, and expert practice thus has an outcome (Meerabeau 1992, Higuchi & Donald 2002). Expertise therefore includes knowledge, experience, the assimilation of these, which contributes to intuition and the ability to use this to make appropriate and prompt clinical decisions.

The scope of expertise

Although 'expert nurses' are referred to, the factors which combine to form expertise mean that expertise is usually

situation specific. Some aspects of the bank of knowledge and experience needed to become an expert will be transferable, but the whole picture view required for holistic intuitive expert practice will not be (Higuchi & Donald 2002). Higuchi and Donald (2002) also suggest that nurses in different specialities use different thinking processes to make decisions which suggests that context is important to how decisions are made as well as the knowledge used to make them. Thus, an expert nurse is not a commodity which can be transferred between areas or specialities without thought. Expert nurses are expert in their field, and their greatest value lies therein.

Measuring expertise

Although a definition of expertise is useful, unless this can be articulated in terms that other care professionals and policy makers can understand and accept there is a risk that nursing expertise will be undervalued. The market economy of healthcare tends to emphasize quantifiable aspects of care. As many of the skills associated with psychology, sociology, ethics and interpersonal skills are not measurable, they are at risk of being disregarded (Wiggens 1997, Archibald 2000). The concepts which underpin expertise in nursing rest predominantly in the qualitative domain; however, Dowding and Thompson (2004) suggest that, whilst qualitative investigation has been valuable in providing insight into the nature of expert nursing, it does not provide data on judgement accuracy. There is, they argue, a need to demonstrate the actual value or outcome of expert nursing judgements being made.

Monitoring and demonstrating the effects of expert nursing knowledge is problematic. In many cases there may be no proof that expert input has a significant effect. An expert surgeon may be assessed by factors such as mortality following a given procedure, or failed procedures, but nursing is multifaceted and involves significant human factors that cannot be quantified. Early intervention may mean that a patient remains stable and a problem is averted and thus the result is invisible and unmeasurable. In other cases expert nursing may reduce a patient's anxiety level, and thus enhance the quality of care they receive, but this is unmeasurable, and may even be unknown to those outside the encounter. Patient outcomes for what are deemed to be expert nurses cannot be meaningfully compared with those who are not, as too many additional variables exist within patient care situations, a variety of nurses care for each patient and expert nurses are likely to assist their junior colleagues in decision making for 'their' patients. This, and the multifaceted nature of what constitutes nursing makes any reductionist comparison of morbidity or mortality in patients flawed. The nature of expertise and nursing practice mean that narrative accounts inevitably become the focus of understanding expert decision making (Ritter 2003). Such narratives can encompass the range of nursing practice, for example, Johnson and Hauser (2001) describe how expert nurses deescalate violence in patients. The narratives from their accounts identify the aspects of their thinking: observation, knowing the individual patient, understanding what the patient's behaviour means, connecting with the individual patient and matching interventions with the patients' individual needs. It may not be possible to measure how many violent incidents such expertise averts, but such accounts identify the contribution of expertise and how this affects specific outcomes.

Attempts have been made to describe and measure the effects which nursing interventions have on patients and the outcomes of nursing care. For example, the Nursing Outcomes Classification system (University of Iowa 2005) offers a comprehensive and standardized classification of outcomes developed to evaluate the effects of nursing interventions. This describes outcomes of nursing care that follow the continuum of care and include outcomes related to physiological, psychological and psychosocial health, health knowledge and behaviour, perceived health, family health and community health. These form a comprehensive overview of the multiple aspects of nursing care and are intended to measure the effects on patient interventions (University of Iowa 2005). They may, therefore, form a useful method of assessing how nursing input affects the quality of care provision in relation to patient outcomes. However, they remain problematic in relation to qualitative aspects of care provision. Similarly, Nursing Quality Indicators have been developed which aim to quantify the quality of nursing care (American Nurses Association 2004). These are intended to allow collection of data in accordance with clearly agreed standards which are thought to indicate the quality of care.

However, high-quality nursing care includes seeing people as a whole and addressing their potentially idiosyncratic needs and understanding what their individual needs, priorities and perceptions of quality of health are. This creates a limitation in reducing the outcomes of nursing care to measurable statements. In addition and to some extent, the quality of care will never be able to be measured except by patients themselves (Goossen 2002).

Practice situations do not present themselves as well formed structures but, instead, as messy, indeterminate situations, which cannot be solved by technical rationalization alone (Schon 1983). This has resulted in nursing expertise often being explained using narrative accounts that are located in the naturalistic paradigm of knowledge generation (Darbyshire 1994). Although this may be entirely

appropriate for nursing expertise, understanding how this contrasts with how others may wish knowledge to be accounted for will be useful for nurses in constructing explanations which will justify the unique contribution of nursing expertise to health care.

Art vs. science

Nursing has historically been linked to medicine, which is firmly rooted in a positivist philosophy (Clarke 1986). However, nursing has moved away from this approach and expertise in nursing in Benner's terms would be difficult to fit to such a philosophy, being based in a naturalistic paradigm. Whether the incompatibility of the concept of nursing expertise with positivist thinking is problematic depends upon the relative power that those adhering to each paradigm hold in multidisciplinary decision making. It has long been suggested that a significant power differential exists between healthcare professions and that medicine has held high power in relation to other professions, including nursing (Breier-Mackie 2001, Hewitt 2002). The reasons for power differentials existing include the inclination of professions to enter the political arena and their traditional gender-related power status (Wilmot 2003). Historically, medical doctors were men and nurses were women, in a society in which women were seen as subordinate to men (Hewitt 2002, Wilmot 2003). Despite the changing gender demographics of both professions, it has been suggested that medicine remains masculinized and nursing feminized in cultural terms and that the power equation between these professional groups persists (Martin 1998, Hewitt 2002, Wilmot 2003). Burnard (1989) and Cash (1995) consider that this influences the acceptance of definitions of expertise which fall outside accepted medical philosophies.

An emphasis on care rather than cure is cited as a major distinction between nursing and medicine (Wilmot 2003). Caring and thus nursing is seen as nurturing (Scott 2003), with a concern for individual patients' needs, compared with medical staff engaged in scientific decision making regarding interventions aimed at curing, imposing rational technical decisions on patients (Hewitt 2002). Successful cure is easier to demonstrate in measurable terms than care predisposing medicine to quantifiable investigation whilst nursing's holistic focus predisposes it to naturalistic paradigms of knowledge generation.

Burnard (1989) suggests that what may be nursing's most important facet, intuition, has thus been perceived as a feminine trait, outside the bounds of rationality and masculine logic. If power is weighted in favour of the traditional medical paradigm, intuition will therefore not hold high value.

Despite this perceived distinction between medical and nursing knowledge, medical staff have been identified as using similar methods of decision making as expert nurses to achieve the best results. Elstein and Schwartz (2002) suggest that experienced physicians often use a system of matching cases either to specific previous instances or to more abstract prototypes. This type of case matching is similar to Benner's (1984) view of expert nurses and is also an important part of Radwin's (1995) work. Diaz (2004) identifies that neurologists use various methods for decision making, including patterns, exhaustive probabilistic and deductive reasoning methods and that most errors occur in the probabilistic setting often due to a lack of intuitive judgement. Thus, in medicine as well as nursing, the value of judgement which falls outside a rational technical process and which involves intuition is acknowledged.

Medicine is being required to move towards a more humanistic approach in which patient autonomy and choice figure highly, and cases such as the Bristol enquiry have brought the paramouncy of medicine into question (Kennedy 2003). However, the traditionally positivist basis of medicine may make it difficult for expertise seen in non-measurable terms to be easily or widely accepted.

Fuzzy logic

Interestingly, it is from within the world of science that a definition of expertise that may significantly assist nursing has emerged, with the development of the concept of 'fuzzy logic.' This concept has been developed by computer scientists and used to enable computers to run, work, understand, and replicate expert human tasks and to act as human experts do. Originally, computer scientists attempted to extrapolate expert human knowledge and intuitive judgement traits into logical, analytical mathematical formulae whereby artificial intelligence systems could reproduce expert human practice. This attempt was largely unsuccessful, and highlighted the point made by Benner (1984) that experts do not rely on rules and logical thought processes in problem solving and decision making (Rolfe 1997). Computer scientists have now employed what is known as 'fuzzy logic' or abduction in an attempt to replicate expert decision making. Fuzzy logic does without the clear black and white rules of formal analytic logic and problem solves like its human contemporise. Logical problem solving works using a linear algorithmic approach whereby A then B, B then C and so on until the answer is reached. Fuzzy logic applies the formal rules of logic, but rather than progressing through these in a linear fashion, considers them all at once and to different degrees depending on the situation (Kosko 1994, Rolfe 1997). This

may demonstrate how intuition works where all the salient parameters of a situation are absorbed simultaneously, rapidly and concurrently weighed up and a decision reached (Rolfe (1997). This fits Benner's (1984) suggestion that experts do not rigidly follow rules, or see situations as separate parts of a whole, but rather take into account a range of sources of information and perceive the situation as a whole. Such a description of expertise may thus be acceptable across professional boundaries being from a scientific, logical rational paradigm, but also embracing the individualized, unquantifiable aspects that are inherent in nursing expertise. It shows that, in the decision, elements of logical thought are evident and that these may form the basis of decision making, but that how these are interpreted, weighed up and applied, varies.

An expert paediatric intensive care nurse will include in a decision over how much sedation an infant requires at any given time their current level of sedation which my be determined using scores such as the comfort score and other physiological and behavioural aspects of how they feel the child is. They will also take into account the pathophysiology of the infant's illness, the pharmacology of the sedation agent, and how these interact, what procedures are likely to be performed in the next hour, how these are likely to affect the baby and how vital these procedures are in relation to their overall condition, whether parents are present and how this affects the child's responses to unpleasant stimuli, what the overall plan is for the child, for example weaning from assisted ventilation. These are all aspects which will be considered in every situation, some of which can be numerically expressed, some are logical and some are able to be expressed as 'yes/no' answers. However, the precise nature of many aspects, and the weighting given to each will vary, and will be decided swiftly and almost subconsciously, in association with decisions about the other aspects of the child's management. Thus, the expert nurse places all the logical pathways together and decides on composite priorities.

Conclusion

Definitions of evidence-based practice generally include expertise in the forms of evidence which should inform practice (Sackett *et al.* 1996, DiCenso *et al.* 1998). They also include the proviso that all evidence should be interpreted and applied in the light of individual patient circumstances, and that practitioners should use their expert judgement in deciding whether to apply evidence to a given practice situation (Sackett *et al.* 1996, DiCenso *et al.* 1998, National Institute for Clinical Excellence 2004). However, in a cost-conscious healthcare system, in which standardized clinical guidelines and care protocols are promoted, there is a danger that expert practice will become undervalued. Being able to articulate what expertise in nursing is and how expert decision making affects the quality of care may go a long way to it gaining acceptance in a world where every aspect of cost, including the cost of expensive expert nursing staff, is considered.

Bonner (2003) suggests that, although knowledge and experience are the key elements of expertise, they alone are insufficient for expertise to be said to exist and that expertise requires recognition by others of the expert's status. However, who makes a decision regarding when and how expertise is reached is an important consideration. As nursing expertise requires artistry as well as science and much of nursing expertise is intuitive and unquantifiable, it is best described using humanistic or naturalistic approaches. Attempting to explain nursing expertise using a positivist paradigm therefore seems inappropriate and undesirable as the essential intuitive artistry of nursing will be lost if it is reduced to positivist principles. Although the focus on narrative accounts to explain and explore nursing expertise is appropriate, this approach will be problematic if those making decisions regarding the value of such expertise function in a positivist paradigm.

Nurses form the largest part of the NHS workforce (Jasper 2002, Masterson 2002) but, nonetheless, often fail to gain an equal footing with other professionals, particularly medicine (Martin 1998, Hewitt 2002). This is a potential barrier to the acceptance of nursing expertise as medicine is located in a positivist tradition and medical staff often dominate in multiprofessional decision making, which often includes decisions concerning funding and resource allocation. Nurses must, therefore, be able and willing to represent the value of their expertise in a multiprofessional environment and, without detracting from the essentially humanistic nature of their expertise explain this in a way which policy makers and budget holders will accept and value.

The concept of fuzzy logic may be valuable to facilitate an explanation of nursing expertise in a way which accurately reflects how expert nurses make decisions, and which will be understood by those outside the naturalistic paradigm. This is likely to involve nurses combining critically reflective narrative accounts with explanations of how this fits the concept of fuzzy logical thought or abduction to produce best practice.

Contributions

Study design: MC, JHT; data analysis: MC, JHT; manuscript preparation: MC.

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ORIGINAL ARTICLE

The pathophysiology of emphysema: Considerations for critical care nursing practice

Sue Mattison, Martin Christensen*

Bournemouth University, Christchurch Road, Bournemouth, United Kingdom

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KEYWORDS
Emphysema;
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Summary Emphysema is caused by exposure to cigarette smoking as well as alpha[1]-antitrypsin deficiency. It has been estimated to cost the National Health Service (NHS) in excess of £800 million per year in related health care costs. The challenges for Critical Care nurses are those associated with dynamic hyperinflation, Auto-PEEP, malnutrition and the weaning from invasive and non-invasive mechanical ventilation. In this paper we consider the impact of the pathophysiology of emphysema, its effects on other body systems as well as the impact acute exacerbations have when patients are admitted to the Intensive Care Unit.

Introduction

Chronic obstructive pulmonary disease (COPD) is by its very nature a debilitating condition in terms of restrictions to activities of daily living in some circumstances. When exacerbations require critical care intervention, the complexities of the disease and its effects on other body systems can be problematic to the critical care nurse and the care that is prescribed. Pre-existing problems for example chronic malnutrition, poor respiratory reserve, muscle wasting and cor-pulmonale can have an effect on patient outcome and a successful discharge from the Intensive Care Unit (ICU).

There are a number of aetiological and epidemiological factors related to the development of emphysema. Although the exact cause is unknown it is most commonly associated with smoking, air pollution and with certain occupations, such as welding, mining and working with asbestos (Banasik, 2001; Blanc et al., 2004; Mannino, 2002). It has also been shown to be associated with an inherited enzyme deficiency, alpha[1]-antitrypsin (Banasik, 2001; Haas and Haas, 2000; Miravitlles et al., 2003), which is most commonly associated with, those aged less than 40, and people of Scandinavian descent (Banasik, 2001; Porth, 2005; Rooney et al., 1999). Yet, emphysema commonly encountered in the ICU tends to be found within the elderly population.

Generally, statistics relating to emphysema are incorporated under the broader spectrum of COPD (Mannino, 2002; Whatling, 1995). In America, for example, it is a leading cause of morbidity and mortality affecting over 14 million Americans and is the fourth leading cause of death (Copstead and

* Corresponding author.
E-mail address: mchristensen@bournemouth.ac.uk (M. Christensen).

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Banasik, 2000) with alpha[1]-antitrypsin deficiency accounting for approximately 1% of all emphysemic cases (Haas and Haas, 2000). In England and Wales, emphysema is estimated to affect 1.5 million individuals and considered to be the fifth most common cause of death (Health and Safety Executive, 2005). This has significant resource implications for the NHS. The National Institute of Clinical Excellence (2004) suggest that there are over £962 million in indirect costs yearly associated with the condition, in which nearly half is directly attributable to treatment of the disease itself (£492 million).

The impact of smoking is undoubtedly the most important risk factor and is most frequently associated with lower socio-economic status (Anto et al., 2001; Ruston, 2005). Similarly, it is this socio-economic status that influences housing and environment, with people in lower socio-economic environments having less choice, increased risk of overcrowding and poor environment thereby exacerbating the likelihood of respiratory infection (Haas and Haas, 2000). This is also combined with these individuals being in an occupation that increases their exposure to inhaled pollutants (Jones, 1994; Ruston, 2005). Although COPD is seen more predominately in men, a trend is developing with a higher incidence of COPD appearing in women as smoking is becoming more acceptable, and as such the development of COPD between the sexes is narrowing (Fehrenbach, 2002; Haas and Haas, 2000).

Pathophysiology of emphysema

Emphysema is a major respiratory disorder, characterised by narrowing of the airways and airflow obstruction. Porth (2005, p. 702) defines emphysema as, ''a loss of lung elasticity and abnormal enlargement of the air spaces distal to the terminal bronchioles, with destruction of the alveolar walls and capillary beds''. There are three main classifications of emphysema: centriacinar, panacinar and paraseptal. Centriacinar emphysema, commonly seen in chronic bronchitis, affects the central part of the respiratory bronchiole, whilst initially preserving the alveolar ducts and sacs. However, it must be remembered that centriacinar emphysema is primarily found in the apical regions of the lung during the early stages. As the disease progresses, the whole lung will eventually become involved. Panacinar emphysema, considered by some to be true emphysema, meanwhile is frequently associated with alpha[1]-antitrypsin deficiency, affecting the peripheral alveoli and eventually developing to include the more central bronchioles (Copstead and Banasik, 2000; Porth, 2005).

Smoking contributes to the development of emphysema initially through the activation of the inflammatory process. In response to inhaled irritants, inflammatory cells, released from polymorphonuclear leukocytes and alveolar macrophages, move into the lungs (Barnes, 2000; Petty, 2002; Stockley, 2002; Tetley, 2002). These are proteolytic enzymes, most specifically elastase, and are responsible for the digestion of elastin. The lungs are normally protected against proteolytic enzymes by the action of antiproteases, such as alpha[1]-antitrypsin, however smoking reduces alpha[1]-antitrypsin activity. It is thought that emphysema develops when the production and activity of antiprotease are not sufficient to counter the harmful affects of excess protease production. In panacinar emphysema, an autosomal recessive disorder, the disease process occurs due to an alpha[1]-antitrypsin deficiency and can be exacerbated by smoking (Copstead and Banasik, 2000; Porth, 2005).

The result of this activity is destruction of the alveolar walls and breakdown of elastic tissue and collagen. The loss of alveolar tissue leads to a reduction in the surface area for gas exchange, increasing the rate of blood flow through the pulmonary capillary system. On exertion, which further increases blood flow, perfusion of oxygen is severely limited and can result in hypoxia. However due to the very short time period for full haemoglobin saturation to be achieved (0.25 s, *note*: it takes 0.75 s for the red blood cell to travel past an alveolus) there remains a 0.50 of a second extra and as such perfusion remains generally unaffected. The loss of elastic tissue and fibres meanwhile, result in the reduced size of the respiratory bronchioles. Combined with this is the loss of elastic fibre resulting in a reduction of radial traction, which holds the airways open during expiration, this in turn increases the outside pressure in the airway lumen. These factors can contribute to the collapse of bronchioles, allowing air to become trapped in the distal alveoli. This leads to the alveoli becoming distended sacs of air, adding to the outside pressure and causing more proximal bronchi to become affected. As a consequence airway resistance is increased and airflow decreased (Copstead and Banasik, 2000; Porth, 2005).

Clinical manifestations of emphysema are characterised by an increase in respiratory effort. This is a result of progressively negative alteration in respiratory function due to increased resistance in the airways, hyperinflation of the lungs and loss of lung elasticity. Accessory muscles are utilised in an attempt to overcome resistance during inspiration.

Similarly these muscles are incorporated, along with pursed lip breathing, in an attempt to remove as much air from the lungs before the small airways collapse during expiration. Air trapped in the lungs increases the antero-posterior dimensions of the chest wall leading to the characteristic barrel chest. Patient's prefer to sit forward in a slightly hunched position in an attempt to maximise chest expansion and are frequently malnourished, as the effort to breath requires 15–20% of their total body energy supply, (Booker, 2005; Copstead and Banasik, 2000; Porth, 2005).

The haemodynamic effects of emphysema

Emphysema also impacts upon other systems within the body. For example, due to the destruction of alveoli, the dense network of pulmonary capillaries, are also destroyed and the area for gas exchange greatly reduced. Reducing the size of the pulmonary circuit then leads to an increase in pulmonary vascular resistance, or pulmonary hypertension (Scharf et al., 2002). This increased resistance therefore leads to a higher right-sided afterload, which the right ventricle has to pump against in order to expel its stroke volume. Consequently, in order to compensate for the increased workload the right ventricle compensates by increasing preload and right ventricle hypertrophy. These activities, along with sympathetic nervous system activation, are compensatory mechanisms that are generally activated when cardiac output fails to meet tissue demands (Copstead and Banasik, 2000; Porth, 2005).

However, as a result of pulmonary hypertension, the ejection fraction is reduced, resulting in an increased residual end-systolic volume within the right ventricle (Barbera et al., 2003). By increasing preload, the heart achieves the maximum force of contraction, maximising cardiac output, achieved by the arrangement of the actin and myosin fibres which are stretched, during preload. This is known as the Frank–Starling mechanism. However, due to increased right ventricular hypertrophy this mechanism will eventually become ineffective, leading to diastolic dysfunction and congestion within the systemic venous system leading to peripheral oedema and hepatosplenomeagly (Copstead and Banasik, 2000; Huether and McCance, 2004; Porth, 2005).

Right ventricle hypertrophy occurs partially in response to an elevation in myocardial wall tension (Copstead and Banasik, 2000). This will occur in emphysemic patients due to pulmonary hypertension, which increases systolic afterload, and as already mentioned, increased preload. If a pulmonary artery catheter were to be inserted at this point, there would be an elevation in both pulmonary artery systolic and diastolic pressures with concomitant rise in mean pulmonary arterial pressure. The mechanism of myocardial hypertrophy due to increased ventricular wall tension can be explained by the law of Laplace, who states that, tension is equal to transmural pressure multiplied by the radius/wall thickness. As the ventricular chamber enlarges to compensate for the increased afterload the pressure increases leading to increased tension within the ventricular wall. The attempt to relieve tension by increasing wall thickness is what leads to the hypertrophic response. Consequently, the increase in wall stress, at a cellular level leads to the parallel replication of myofibrils, and to an increased thickness of individual myocytes, resulting in concentric hypertrophy of the left ventricle. The resulting hypertrophy increases contractility and thus the hearts pumping force, and therefore reduces wall tension. However, in addition to myocardial cells there is also an increase in the production of myocardial fibrosis, increasing ventricle stiffness and reducing contractility. The resulting stiffness and lack of chamber size will eventually impede output (Copstead and Banasik, 2000; Scharf et al., 2002; Porth, 2005).

Electrocardiographic analysis of the emphysemic patient will reveal these very changes to right ventricular muscle size. With hypertrophy, as already explained, muscle size will increase to overcome right ventricular afterload. This then creates changes within the electro-morphology of the right ventricle. There will be a vector change from the normal +45° to a right axis deviation, which amounts to a deflection greater than +90° (Constant, 2002; Houghton and Gray, 1997). The increased muscle mass will also augment the "R" wave in the leads responsible for looking at the right ventricle, namely "aVr", "V1–V2" as well as deepening the "S" wave in those reciprocal leads; V5–V6.

Of interest at this point is the potential for right bundle branch block (RBBB). It must be remembered that the right bundle branch (RBB), unlike the left bundle which are smaller diameter nerves and split into the anterior and posterior branches soon after the Bundle of His, is a relatively thick nerve fibre close to the surface of the right ventricular septum. It has been thought by some that the larger calibre nerve fibres such as the RBB are more susceptible to compression making them vulnerable to conduction delays (Constant, 2002). Therefore, dilation of the right ventricle and the

consequent rise in intra-ventricular pressure compresses and stretches the RBB giving rise to the characteristic RBBB picture—a double "R" wave in lead V1—V2 and a widening of the QRS complex ≥0.12 of a second (three small squares) (Constant, 2002; Dubin, 1989). This progression to RBBB is not commonly seen in hypertrophic states because of the reduction in chamber size and as such decreases the potential for compression thus protecting the RBB from increased intra-ventricular pressure (Constant, 2002).

The term for the progressive 'demise' of the right ventricle is called cor-pulmonale referring to right heart failure as a result of primary lung disease and characterised by right ventricular hypertrophy. However, due to the pulmonary circuit being comprised of a short, low-pressure circuit, the right ventricle has a third of the musculature of the left ventricle. Therefore hypertrophy can only partially compensate for the increased workload. As a result forward effects, more recently classified as systolic dysfunction of right heart failure lead to a reduced supply to the left heart with the subsequent reduction in systemic cardiac output and low blood pressure (Copstead and Banasik, 2000; Porth, 2005).

In response to a decrease in output from the left ventricle, and subsequent fall in blood pressure, pressure-sensitive baroreceptors situated in the aortic arch and carotid arteries relay information to the central nervous system. This occurs in conjunction with decreased oxygen supply and increased carbon dioxide levels, which for the emphysemic patient may lead to hypoxemia. These factors stimulate the sympathetic nervous system to increase heart rate and myocardial contractility, and leads to widespread vasoconstriction. The sympathetic nervous system also decreases glomerular filtration rate, therefore influencing the rate of sodium filtration. Hormonal response to low blood pressure, meanwhile involves the activation of the rennin—angiotensin—aldosterone pathway. In response, therefore, to neural and hormonal activity, the other bodily system that is affected as a consequence of reduced arterial pressure, caused by emphysema, is the renal system, as the body attempts to increase blood pressure through an increase in fluid volume (Copstead and Banasik, 2000; Porth, 2005).

This occurs in a number of different ways. For example, in response to low arterial pressure, the afferent arterioles dilate increasing glomerular hydrostatic pressure, which helps to maintain an adequate glomerular filtration rate. This is one of the intrinsic controls operated by the kidneys, and is referred to as the myogenic mechanism. The other auto regulatory mechanism operated by the kidneys is tubuloglomerular feedback. Within the walls of the distal tubules are macula-densa cells. In response to reduced osmolality in the filtrate or reduced filtrate flow, these cells also stimulate vasoconstriction of the afferent arterioles, thereby increasing glomerular filtration rate. The macula densa cells are also responsible for the release of renin. In response to a much-lowered systolic blood pressure, below 90 mm Hg, the auto-regulatory mechanisms can no longer cope and extrinsic mechanisms take over (Copstead and Banasik, 2000; Marieb, 2004).

Renin is an enzyme produced and released by the juxtaglomerular cells surrounding the afferent arteriole, within the kidneys. Renin is released into the bloodstream where it has an enzymatic reaction with the inactive plasma protein angiotensin, converting it into angiotensin I. Angiotensin I, is a powerful vasoconstrictor, acting primarily on the efferent arterioles, it also quickly travels to the lungs where it is converted to angiotensin II by the action of the angiotensin converting enzyme (ACE). Angiotensin II acts in a number of ways, it is a powerful vasoconstrictor that acts on smooth muscle within the arterioles, increasing peripheral vascular resistance and temporarily improving preload through increased pressure of the venous system, however this action is short lived. Angiotensin II also stimulates the distal tubules to increase sodium reabsorption and causes afferent and efferent constriction, further reducing glomerular filtration and increasing sodium reabsorption. Finally, angiotensin II stimulates the release of aldosterone from the adrenal cortex. This is the long-term mechanism for increasing blood pressure, which also acts by increasing sodium uptake, as a consequence due to the osmotic pull of sodium; water is retained in the system. Although normally aldosterone is metabolised by the liver as a result of congestion within the systemic system, the actions of aldosterone are continued (Copstead and Banasik, 2000; Porth, 2005).

Therefore, one of the consequences of increased fluid retention, associated with emphysema, is peripheral oedema. In response to increased resistance in the pulmonary circuit, venous congestion and widespread vasoconstriction, there is reduced volume capacity in the circulatory system and an increase in capillary filtration pressure. Consequently, fluid is forced out of the capillaries and into the interstitial space. This fluid is referred to as extra cellular fluid and leads to the formation of oedema. Although as mentioned right ventricular preload is temporarily assisted, eventually the compensatory mechanisms such as right ventricular

hypertrophy reach a stage where the heart becomes overstretched. Consequently, on exertion when increased cardiac output is required there is no longer any cardiac reserve contributing to increased dyspnoea on exertion and eventually contributing to complete heart failure (Copstead and Banasik, 2000; Marieb, 2004).

Considerations for intensive care nursing practice

Whilst treatment of emphysema involves bronchodilator therapy, steroids and in some cases supplemental oxygen therapy to maintain arterial oxygenation greater than 7.3 kPa (National Institute of Clinical Excellence, 2004; Plant and Elliott, 2005), these types of patients pose distinct challenges within the ICU. For example, because of increased compliance and resistance as a result of elastic tissue destruction and the resultant small airway obstruction, positive pressure ventilation of emphysemic patients can lead to dynamic hyperinflation and ''Auto PEEP''. Compounded with this is the poor nutritional status that these patients commonly present with (Huber et al., 1994; Shankar et al., 2004; Zolty, 1998) and the prolonged weaning from invasive ventilation.

Dynamic hyperinflation and Auto-PEEP

PEEP and Auto-PEEP is simply the result of air trapping at the end of expiration (Peirce, 1995). However, this is an over-simplified definition of Auto-PEEP because Auto-PEEP is the result of progressive dynamic hyperinflation (Leatherman, 1996). This can be best demonstrated in the ventilated emphysemic patient whereby tidal volumes cannot be exhaled fully during the expiratory phase because of early airway closure and the loss of 'normal' radial traction to maintain airway calibre and patency. With subsequent tidal volumes, incomplete emptying is repeated until a point of equilibrium has been reached whereby the entire tidal volume can now be exhaled as a result of increased elastic recoil and airway calibre albeit now at a much larger lung volume, commonly referred to as the ''waterfall effect'' (Gladwin and Pierson, 1998; Leatherman, 1996; Lessard and Brochard, 1996; Pruitt, 2004; Wilkins et al., 2003).

Yet, this process of early airway closure does not necessarily contribute to Auto-PEEP. It has been suggested that aggressive ventilation such as rapid respiratory rates and large tidal volumes can reduce expiratory time; in effect 'stacking' breaths until equilibrium has been attained. This becomes problematic in that as a consequence of increased alveolar pressure there is an associated rise in peak airway pressure; plateau pressure remains unchanged, resulting in potential deleterious effects on haemodynamics and the lung parenchyma (Gladwin and Pierson, 1998; Keith and Pierson, 1996; Mah and A'Court, 1999; Pierson, 1994; Ranieri et al., 1996).

However, monitoring and/or assessing Auto-PEEP in the invasively ventilated patient becomes difficult simply because the expiratory valve during expiration is open to the atmosphere and as such does not register added PEEP (Jubran and Tobin, 1996). Therefore, the most practical method of determining Auto-PEEP is occlusion of the expiratory limb at the end of expiration and temporarily delaying the next inspiration. What this then produces is a trapping of air within the alveoli that is allowed to equilibrate with the airways over and above critical closing pressure, thus identifying a residual positive pressure. This positive pressure then represents the summation of Auto-PEEP throughout lung units, providing of course the end-expiratory is held long enough for full equilibrium (Gladwin and Pierson, 1998; Jubran and Tobin, 1996; Pepe and Marini, 1982). However, the reliability of this method is questionable in patients who are spontaneously breathing and using excessive abdominal muscles to aid expiration, consequently measurements become difficult to interpret (Gladwin and Pierson, 1998). Of course there is an inherent danger in carryout this manoeuvre especially if the patient is spontaneously breathing or receiving some form of respiratory support such pressure support. Occlusion of the expiratory port and as such delaying inspiration increases the patient's work of breathing and the potential for pneumothoraces. Therefore, this should be done with extreme caution and preferably by someone who is experienced and competent in carry out this skill.

Nutrition

Malnutrition is surprisingly common in COPD patients especially so in those with emphysema (Engelen, 1994; Markou et al., 2004) and what is of interest is that weight loss is an independent prognostic factor of poor survival (Landbo et al., 1999; Shankar et al., 2004; Wouters et al., 2002; Zolty, 1998). However, more importantly, poor nutritional status affects not only ventilatory function in terms of muscle fatigue and wastage but it inhibits cell-mediated immunity and adversely effects lymphocyte numbers (Mowaatt and Brown,

1993; Pingleton, 1996; Quirk, 2000; Thomsen, 1997) leading to probable bacterial colonisation of the tracheo-bronchial epithelial cells resulting in an increased incidence of gram-negative infections (Wedzicha, 2002; Zolty, 1998).

The exact mechanism of muscle wastage in this patient group is not clearly understood. Some studies have shown that a combination of increased resting energy expenditure and an increase in oxygen demand of the respiratory muscles, due to the increased work of breathing, leads to skeletal muscle wastage. This can be explained to some degree in that oxygen demand to the respiratory muscles, in this case hampered due to the chronic hypoxic state, results in less cardiac output being delivered to the peripheral muscles (Donahue, 1997; Zolty, 1998). This is further hampered by poor caloric intake for a variety of reasons for example; arterial desaturation during eating, gastric filling that reduces functional residual capacity and the hypermetabolic effects of Beta^2 agonists, corticosteroids and the xanthines drugs such as Theophylline and Aminophylline. The last three being of particular importance because of the role they play in promoting muscle proteolysis, the inhibition of amino acid transportation and protein synthesis as well as increasing resting energy expenditure (Engelen, 1994; Shankar et al., 2004; Zolty, 1998).

Therefore, the goal for adequate nutrition in emphysemic patients especially in the ICU is the provision of adequate calories to offset chronic protein catabolism. However, what type of nutritional support to use is challenging. A high-carbohydrate diet, whilst providing immediate, accessible energy can increase carbon dioxide (CO_2) production. The result of this is to increase the work of breathing, which can exacerbate the condition further and may lead to respiratory failure and problems with weaning (Cai et al., 2003; Ferreira et al., 2001; Lessard and Brochard, 1996; Quirk, 2000).

Standard enteral feeds in the ICU contain in some cases less than 20% protein and fat with the remainder being carbohydrate providing one kilocalorie per millilitre. For some patients this may well be adequate to provide the caloric needs during their stay in ICU. However, special considerations need to be afforded the emphysemic patient who would not ideally benefit from this type of formula. For example, the ingestion of a high carbohydrate meal in emphysemic patients produces a significant increase in CO_2 production and the respiratory quotient, whereby exercise tolerance decreases resulting in an increase in dyspnoea (Brown et al., 1985; Efthimiou et al., 1992; Frankfort et al., 1991; Ferreira et al., 2001; Huber et al., 1994).

However, Cai et al. (2003) demonstrated that COPD patients who received a high-fat low-carbohydrate enteral formula were able to significantly improve respiratory function as evidenced by an increase in FEV^1, reduction of arterial CO_2 and an improvement in arterial oxygenation. What this then confirmed was an improvement in respiratory and accessory muscle strength, endurance and overall effort rather than as a change to airway calibre and patency. Earlier studies have also demonstrated that the overall effect of low-carbohydrate and moderate to high fat diets in emphysemic patients improves ventilation. The increase in ventilation is believed to be associated with fat oxidation producing less CO_2 per unit calorie than carbohydrate (Brown et al., 1985; Efthimiou et al., 1992; Frankfort et al., 1991).

Failure of weaning from invasive and non-invasive ventilation

There is general agreement that the use of non-invasive ventilation (NIV) for the treatment of acute exacerbations of severe hypercapnic respiratory failure in emphysema is invaluable when faced with possible endotracheal intubation (Conti et al., 2002; Plant et al., 2000). Indeed, some studies have identified that early initiation of NIV in COPD has been shown to reduce mortality (50% of cases), reduce intubation rates (44% of cases), and reduce length of hospital admission when compared with invasive mechanical ventilation in the same instance (Conti et al., 2002; Lightowler and Elliott, 2000; Moretti et al., 2000; Peter et al., 2002; Plant et al., 2001). This improvement in patient outcome attributed to NIV can be explained in most cases as a result of the early treatment of respiratory acidosis and the positive pressure support of respiratory effort (Brochard, 2000; Plant et al., 2000). However, whilst invasive mechanical ventilation can also provide both effective treatment for resting respiratory muscles and reversing the incumbent respiratory acidosis, it must be remembered that it is not without its problems for example ventilator induced pneumonia (Gladwin and Pierson, 1998; Keith and Pierson, 1996; Nava and Ceriana, 2004) a problem which may already be precipitating the exacerbation in the first place. Therefore, it is for these reasons, that NIV is successful in reducing mortality rates in patients experiencing acute exacerbations of COPD (Brochard, 2000).

Nevertheless, NIV can fail and invasive ventilation is necessary to prevent sudden deterioration. It has been suggested that NIV failure is multifactorial and in some cases attributable to the

degree of acidosis, level of hypoxia, status of the $PaCO_2$ and the overall condition of the patient at admission (Moretti et al., 2000; Nava and Ceriana, 2004; Plant et al., 2001). The work of Moretti et al. (2000) and Plant et al. (2001) identified the most significant clinical variable in this case being the degree of acidosis. For example, Plant et al. (2001) demonstrated that patients with a pH <7.30 ($PaCO_2$, 6 kPa) were three times more likely to need intubation than a patient with a pH of 7.35 and the same $PaCO_2$ (6 kPa). However, when compared with an elevation in $PaCO_2$ the propensity for intubation rises, in the most severe cases a 22-fold increase (pH, 7.25 and $PaCO_2$, 12 kPa). Whilst these studies demonstrated NIV was successful in improving arterial blood gas (ABGs) tensions, this occurred within the first hour of initiation. Subsequent failure to maintain optimal ABGs then showed a significant decline after 4 h indicating an overall deterioration in the patient's condition. This could be explained in some cases by worsening pH and the presence of other pathologies all of which contributed to overall failure of NIV.

However, it is questionable whether this process contributes to the failure to wean from invasive ventilation. The difference in this case may lie in the reversal of severe hypercapnia when invasively ventilated. In some chronic emphysemic's there is a degree of compensation maintaining pH at normal levels. This is done primarily through renal retention of bicarbonate (HCO_3) (Gladwin and Pierson, 1998; Mah and A'Court, 1999). Moreover, there are significant differences in respiratory pattern to off set the changes in CO_2 retention and potential muscle fatigue. For example, the typical respiratory pattern of an emphysemic corresponds to rapid, shallow, pursed lip breathing which results in significant increases in VD/VT (physiological dead space ventilation/tidal volume). This is done in some respects to minimise ventilatory muscle work and thereby limit muscle fatigue. In this group of patients the muscle tension-length is considerably higher due to early airway closure and over inflation giving an increased residual volume (Gonce-Morton et al., 2005; Shapiro et al., 1991; West, 1992).

However, within compensated respiratory acidosis, that is retention of CO_2, renal preservation of HCO_3 develops to maintain a near-normal arterial pH. Conversely, when emphysemic patients are aggressively ventilated to reduce elevated arterial CO_2 levels and restore normal pH, a potentially life threatening metabolic alkalemia can result. Consequently, over the next 48–72 h the kidneys will excrete the retained HCO_3 until an overall "normal" acid–base balance has been achieved. This becomes problematic when the patient begins to wean because they are unable to sustain an adequate alveolar ventilation to maintain a normal $PaCO_2$ and once again will develop acute respiratory acidosis. This then compounds the weaning process because the patient will fatigue a lot quicker due in part to the absence of elevated serum HCO_3 to buffer the acidosis caused by retention of excess CO_2 (Gladwin and Pierson, 1998; Mah and A'Court, 1999; Pruitt, 2004; Tasota and Dobbin, 2000). Of importance is that weaning from invasive to non-invasive ventilation still presents the same problems with respiratory muscle fatigue in attempting to maintain optimal pH.

One method to overcome this problem of early respiratory fatigue during the initial weaning process may be to allow for permissive hypercapnia. Permissive hypercapnia has been shown to provide a protective function within lungs and with other organs of the body (Pruitt, 2004). In the lungs, for example, hypercapnic acidosis reduces inflammatory responses by blunting the effect of respiratory neutrophil recruitment, one of the main contributing factors associated with acute lung injury (Laffey et al., 2004; Pruitt, 2004). Laboratory studies have also confirmed the benefits of permissive hypercapnia namely in its protective role in delaying liver cell death especially as a result of anoxia and preserving myocardial function following prolonged periods of ischemia together with limiting infarct size (Kitakaze et al., 1997; Nomura et al., 1994). The exact mechanism to this protective role is complex but involves the regulation of gene expressive codes involved in the inflammatory response (Laffey et al., 2004). Therefore, it becomes questionable whether the administration of HCO_3 to correct academia is beneficial (Pruitt, 2004).

However, permissive hypercapnia is not without its drawbacks, for example in patients with an acute head injury where elevated levels of CO_2 lead to an increase in intra-cranial pressure because of its dilatory effects on the cerebral vasculature. Pilbeam (1998) has suggested that elevated CO_2 in the presence of haemodynamic instability does have a tendency to decrease myocardial contractility and increase arrhythmogenesis. Of course this strategy of allowing CO_2 to rise artificially through manipulation of respiratory parameters, as would be seen in the ventilated patient, would be unlikely due to illness severity. Yet this process may well be of benefit to weaning emphysemic patients in that it could allow for renal reabsorption as well as deterring renal excretion of HCO_3 and as such make the weaning process less problematic for the patient (Mah and A'Court, 1999).

Conclusion

Emphysema is an obstructive airway disorder that occurs either in response to smoking, inhaled pollutants or as a result of an inherited alpha[1]-antitrypsin deficiency. Damage occurs in response to an imbalance between the destructive action of elastic proteases and the protective mechanisms of anti-protease. Two types of emphysema exist; centriacinar emphysema found predominately in the terminal and respiratory bronchioles and is considered to be a key feature in the development of chronic bronchitis, whilst in panacinar emphysema located in the peripheral alveoli is thought to pertain to the true emphysemic patient. Emphysema is generally incorporated under the broader heading of COPD and is a leading cause of morbidity and mortality worldwide (Copstead and Banasik, 2000; Marieb, 2004).

Emphysemic patients especially ones experiencing an acute exacerbation of their disease process challenges nursing care provided in critical care. Namely, because of the different pathologies that sometimes co-exist for example malnutrition. Therefore, nursing care should have as its focus a key understanding of the pathophysiology of emphysema within an intensive care context to be able to provide effective care especially with regard to the fragility of this patient group in terms of their respiratory function. Of importance within this context is an understanding of the factors that may well lead to weaning failure. That is to say the provision of adequate nutritional support to meet their high energy needs and allow patients to normalise their pre-admission acid–base balance prior to weaning.

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Empowerment in nursing: paternalism or maternalism?

Martin Christensen, Jaqui Hewitt-Taylor

Abstract

The aim of this article is to explore whether patient empowerment flourishes in the wake of current health reforms or if there is a power struggle between nursing and medicine as to what is in the patients' best interest. Shifting the balance of power from healthcare professionals to patients has become a key element of healthcare policy in England. The RCN's definition of nursing places patient empowerment as a central remit of nurses. However, achieving genuine patient empowerment is not easy and requires individuals and organizations to alter their beliefs, values and behaviours. To empower patients nurses must be in a position to share power and this may require a realignment of the traditional power base within health care. Although empowerment is often viewed on a one-to-one level between professionals and patients, for true patient empowerment to occur, issues of power and control must also be addressed at a national and political level.

Key words: Patients: empowerment ■ Patient focused care

Although the phrase 'patient empowerment' has become popular, it is not an easy goal to achieve. It involves those who are in traditional health care power bases being willing to reduce their level of power in favour of patients; patients being ready and willing to accept greater control and responsibility for their health; and those seeking to empower patients being in a position to do so. Empowering patients contrasts with the traditional stance adopted in health care, and it is likely that, even when they are well intentioned, healthcare professionals will need to be critically aware of the attitudes, beliefs and values they hold in relation to patient empowerment. It also requires patients to want to take control and responsibility for their own health.

In addition, where power is to be transferred, caution must be exercised that the group to be empowered are in fact the beneficiaries. Those involved in patient empowerment should be sure that their efforts enhance patient power, not the power of other healthcare staff or government. This article explores the concept of empowerment, how this relates to patient empowerment within the NHS, and some of the factors that nurses may need to address in their quest for patient empowerment. Finally it considers the wider political agendas and issues involved in patient empowerment.

History of empowerment

Patient empowerment is currently seen as a desirable, if not essential, part of nursing care provision. The Royal College of Nursing (RCN, 2003) describes this as a central part of nursing, a position that is congruent with current national healthcare policy which aims to shift the balance of power from healthcare staff to patients (Department of Health (DH), 2001a,b). Empowerment has been defined as: 'to give power to, or to make able' (Soanes and Stevenson, 2005) Gibson (1991) nonetheless suggested that the precise nature of empowerment depends on the situation and context in question and the individuals involved. It may differ in specific areas of practice, such as primary care, acute care and intensive care, in different situations, such as critical illness, acute illness and continuing illness, and for staff and patients. Thus, although the blanket term 'patient empowerment' is often used, and the principal definition may be the same, how empowerment is actually enacted may vary in different healthcare settings. The way in which a patient with a long-term illness is empowered may be very different from the patient in a critical care environment.

One central theme in empowerment is that it concerns power (Gilbert, 1995). Rogers (1979) claimed that empowerment occurs when an individual gains increased personal power. The intention of patient empowerment is therefore to increase the personal power that patients have in relation to their health and health care, and the control which they can exert over their own health. This may be by patients with long-term conditions becoming knowledgable about their condition and the best options for treatment. In a critically ill patient it may begin with healthcare staff assisting the patient to gain psychological control in a siutuation in which their actual control over their life and health has temporarily been lost. This then necesitates a change in the power differential, which has traditionally existed between patients and professionals, to a situation where the aim is to restore and maximize the control and choice which individuals can exercise regarding their health and health care.

Empowering patients

The concept of patient empowerment represents an almost complete reversal of the paternalistic approach which has traditionally dominated healthcare. Until recently, healthcare staff, and in particular medical staff, were considered to know what was in a patient's best interests and thus able to make decisions on their behalf (Kennedy, 2003). Kennedy (2003) identified that, despite now being seen as inappropriate, paternalism was historically seen as both appropriate and in patients' best interests, with it being considered unreasonable and even uncaring to impose the burden of decision making on those who were unwell. Hewitt (2002) suggested that this view was allowed to persist and was considered justified because the tradition of paternalism meant that patients were unaccustomed, disinclined and unequal to questioning medical decision making. This perpetuated the view that they were unable to make decisions regarding their health and

Martin Christensen is Senior Lecturer and Jaqui Hewitt-Taylor is Practice Development Fellow, Bournemouth University, Bournemouth House, Christchurch Road, Bournemouth

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should rely on professionals for this. However, Chavasse (1992) suggested that the more an individual is encouraged and enabled to do, the more their abilities and self-reliance increases; the inverse is also true. The trend in health care is now away from paternalism and towards a culture of shared power, respect, and encouraging patients' ability to self manage (Coulter, 1999; DH, 2000).

The benefits of patient empowerment include encouraging individuals to take personal responsibility for their health, to make choices that best suit their personal needs and circumstances, and to increase their feelings of personal autonomy. Gaining this level of personal control is said to increase self-esteem and therefore improve the individual's overall sense of wellbeing. It may also make specific aspects of healthcare provision more appropriate for them personally (Gibson, 1991).

The demise of paternalism

Recognition of the benefits of empowerment is usually cited as the reason for the shift from paternalism. However, Gallant et al (2002) suggested that an increase in democratic thinking in society as a whole has contributed significantly to this. In British culture individuals are now generally more aware of their rights and expect to have choices (Kennedy, 2003). In addition, deference is no longer unquestioningly given to professionals, including healthcare staff (Wilmot, 2003). A further factor which may have contributed to the demise of paternalism is a loss of trust in healthcare staff as a result of well-publicized cases of misconduct, and instances where healthcare professionals and organizations have fallen short of the standards expected of them (Canter, 2001). Cases surrounding Beverly Allitt (Clothier, 1994), Harold Shipman (Smith, 2005) and the Bristol Enquiry (Kennedy, 2001) have indicated that it cannot always be assumed that healthcare staff have their patients' best interests at heart or that they will always do what is best for their patients. This has been accompanied by more general concerns over standards of healthcare, for example increasing rates of hospital acquired infection.

The legal right of healthcare professionals to decide about the care of individual patients has also been publicly challenged (Dyer, 2004). This combination of events means that many patients may no longer unquestioningly accept the views of healthcare professionals. Thus, the move towards patient empowerment is likely to be a result of the changes in the dominant views of society and a lack of confidence in healthcare professionals, not simply because healthcare professionals have adapted their thinking to be more respectful of patients' rights.

Knowledge is power

Knowledge is a tool of power, and the knowledge that patients have regarding their health and options for treatment will therefore affect their power. Patients need information about their health to be empowered to make informed decisions about the variety of options available to them (Feste and Anderson, 1995). However, staff giving information is not enough to achieve patient empowerment. The quality of this information and the context in which it is given and received will influence how far it empowers individuals. Although healthcare discussions and patient decision making have moved away from the guise of paternalism, these discussions usually occur on unfamiliar territory for patients, with information presented from a biomedical perspective (Canter, 2001). This is perhaps inevitable, as giving truly unbiased information presents a significant challenge as one's own beliefs and values however well-intentioned one is (Canter, 2001). Patients should be able to access and discuss a range of information, options and views – not only those provided by healthcare professionals – and to discuss these in an open and unbiased environment.

Furthermore, the difficulties patients experience in gaining unbiased information is made more problematic by the attitudes and beliefs of healthcare staff, and patients which may not be easily altered to embrace empowerment. Tweedale (2002) argued that, despite apparently accepting the desirability of patient empowerment, medicine's culture of paternalism is difficult to fundamentally alter and may surface when patients ask staff to follow a course of action which is in conflict with their own perspective. It may also occur when patients choose to follow a course of action other than that recommended by healthcare staff. It is relatively easy to 'allow' a patient to choose a course of action which accords with one's own standpoint. The skill required in empowerment is to enable patients to make informed choices which accord with what they, not healthcare staff, want and see as important.

Getting patients used to empowerment

It may not only be healthcare professionals who find moving away from paternalism difficult. Waterworth and Luker (1990) found that some patients are reluctant to participate in the decision-making process and would rather leave healthcare decisions to 'those who know best' – sometimes perceived as the healthcare professionals. One difficulty in such situations is determining how far patients feel they should be the relinquishing their autonomy as a necessary part of their hospitalization. This is seen as a sign of patient disempowerment by health service processes; this is not seen as a genuine unwillingness to make descisons. An autonomous person can choose to defer to others, but if autonomy and empowerment, rather than imposed paternalism, is the aim, this must be the individual's choice, for which they take responsibility (Lowden, 2002). If patients are not used to being involved in decision making regarding their health, they are likely to be unaccustomed to it. Kendrick (1994) identified that patients often see their role as subservient and passive. This view may have changed over time; however, for many patients who were brought up in the tradition of medical paternalism, a shift towards empowerment is unthinkable if not actually unwelcome. Forcing empowerment upon an individual is something of a contradiction in terms, but the challenge is to ascertain whether they really wish to be passive recipients of care – and take responsibility for the consequences – or whether they simply see this as their 'role' as patients and feel that they should not challenge professionals.

Central to the achievement of patient empowerment is therefore the formation of a partnership between healthcare staff and patients, involving a mutual commitment to giving and receiving comprehensible, unbiased information. It requires healthcare staff to acknowledge a patient's right to self determination and to facilitate and develop this, and patients to accept this and take responsibility for their choices.

Nursing and empowerment

Although the concept of patient empowerment is described as being a central function of nursing (RCN, 2003), nurses work within a multidisciplinary team and any differences of opinion between team members over patient empowerment may interfere with this function. This is especially likely if those seeking to empower patients are less powerful than those working against it. In health care, nursing has traditionally been seen as somewhat subordinate to medicine, and the way in which the two groups view patient empowerment has differed. If this continues

to be the case, it may impair nurses' ability to empower patients (Brier-Mackie, 2001).

It has been suggested that medical staff tend to aim for interventions and successful treatment whereas nurses tend to aim for more respect for patients, their individuality and autonomy (Tuxhill, 1994; Wilmot, 2003). This is an important difference if nursing is seen as more likely to support the ideal of patient empowerment than medicine, and if the power differential between medicine and nursing is uneven. If nurses only have power that is subordinate to medicine, then this is all that they can share with patients (Martin, 1998). If they are themselves working from a position of unequal status with other staff (perceived or otherwise), they cannot truly assist patients to a position of equal status. Hewitt (2002) suggested that nurses' deference to medical staff often leaves patients with the perception that nurses are powerless, which is unlikely to result in a situation in which they are seen as facilitators of empowerment. It is also unlikely that they will be in a position to alter patients' tendencies to accept medical dominance if they are seen as subordinate to medicine. This need not prevent nurses from providing patients with information that will assist them to have better informed discussions regarding healthcare, but it will diminish their ability to empower patients if other staff oppose this and if patients see them as disempowered.

Nurses' own power

This seems to indicate that to achieve the aim of empowering patients, nurses may need to increase their own level of power in healthcare. However, Gibson (1991) cautioned that rather than seeking to accumulate power, healthcare professionals should focus on caring for patients, not self promotion. This may be problematic, as for nursing to empower patients it seems that nurses must improve their own power base. In addition, it has been suggested that one of nursing's difficulties in achieving political power over the years may have been the nature of nursing work – the caring that Gibson (1991) considers essential.

Caring is the most consistent theme in defining nursing (McCance et al, 1999), and its almost undisputed central function (Henderson, 1966; Roach, 1984; Watson, 1985; Leninger, 1991). However, it has been linked with the view of nurses as lacking in power. Their caring role has ben interpreted as being a naive concern for individual patients, without awareness of wider political issues or their own status. This has been compared with medical staff engaged in scientific decision making regarding interventions aimed at cure, imposing technical-rational decisions on patients and also on nurses, whose role was to carry out their orders (Hewitt, 2002; Scott, 2003). If this is the general interpretation of the caring role of nurses, then nursing is likely to be devoid of power (Scott, 2003) and unable to empower patients.

Gender differences/role differences

This view of nursing can be linked with the fact that historically medical staff were male and nurses were female, in a society where women were seen as politically naive and subordinate to men (Wilmot, 2003). Thus, nurses who were female were subordinate to and took instruction from medical staff who were male (Hewitt, 2002). Despite the changing gender demographics of medical school entrants, in many respects medicine remains masculinized and nursing, feminized and the basic power equation between the two unchanged (Martin, 1998; Wilmot, 2003).

However, the gender demographics between the two parties are not the only explanation for nurses' relative lack of power. Although it is commonly held that medicine rose to power in health care because of its perceived scientific knowledge basis and the ability of medical staff to make and impose decisions on others, this does not explain its rise to power in the 19th century when medical treatment was often ineffective. There is a suggestion that medical staff have been the dominant party in healthcare politics because of their political acumen in ensuring that they retained central control of the NHS (Wilmot, 2003). The initial development of the NHS was significantly influenced by the power that was held by medical staff (Wilmot, 2003). To a degree, this situation (in which medical staff are the principle power players) persists, although the power that medicine has traditionally wielded appears to be faltering in relation to government. The NHS was created on the basis that it was a hospital-dominated system of delivering medical care – its main focus was medicine, with the consultants who ran hospitals controlling the majority of NHS resources. It was initially medical staff who were in charge of hospitals and thus had responsibility for financial decisions, bed availability and overall service management. Medical staff allegedly became the leaders of health care and managers of hospitals because of the philosophy that hospitals were set up to treat physical ill health. They were the individuals to whom patients presented themselves, they decided whether or not an individual was ill, and because of their subsequent role in diagnosing disease, referring on and coordinating care, theirs was the central focus of healthcare provision.

Maternalism as a phenomenon

As well as the potential problem of retaining a caring function while increasing their power, Salvage (1990) argued that the caring function of nurses may itself be a disempowering phenomenon for patients. Despite, or even because of, their emphasis on care, nurses are more likely to exhibit maternalistic behaviour towards their patients than empowering behaviour. Malin and Teasdale (1991) believed that nurses view caring as doing things for the patient, including protecting them from harm or worry. This is a similar stance to paternalism in which the patient is seen as burdened by responsibility and unable to make decisions. Hewison (1995) suggested that despite their differences in values and roles, nurses may be no more likely than medical staff to empower patients. They may simply disempower them in a different way.

This suggests that if nurses are to achieve the change in power status which patient empowerment seems to require they must be prepared to take leading roles in health care, engage in political debate and seek to change their public and political status. The logical conclusion is that to act as facilitators of patient empowerment nursing as a whole individual nurses need to seek to increase their own power. This must be tempered with respect for others and equality of power. It also requires nurses to view patients as capable of decision making and as equal partners.

Empowerment at the macro level

Malin and Teasdale (1991) viewed empowerment as occurring at two distinct levels: the micro and macro levels. At the micro level, empowerment involves a one-to-one relationship where one individual seeks to facilitate development of power in the other, for example, between a nurse and a patient. However, Malin and Teasdale (1991) argued that empowerment at the micro level is dependent on the macro level. Nurses are the largest group of employees in the NHS and should perhaps logically yield a significant degree of power in relation to healthcare provision (McDonald and Bodzak, 1999). However, this is not the case (Antrobus and Kitson, 1999). If nurses are really to empower their patients it seems that they must gain greater power themselves at a macro level.

It has been suggested that medicine rose to power largely because hospital-based medical care was the mainstay of healthcare at the time of the inception of the NHS. The position of hospital-based medicine in relation to resource management has now been altered by reorganizations of the NHS. Responsibility for hospital management has shifted from medical staff to general managers. Medical staff are usually no longer in charge of hospitals, although medical directors tend to manage a great deal of the business of hospital directorates. There has also been a shift towards community-based care, health promotion and public health, rather than hospital-based care aimed at curing ill health. It therefore seems that this element of medical power has been reduced and, logically, overall medical power could legitimately be questioned. The changes in NHS management have the potential to alter the power that medicine holds in relation to overall healthcare provision. They also have the potential to influence the power that medicine holds relative to other healthcare professions and patients.

The shift in roles

Nursing's subordination to medicine may also be changing as a result of alterations in nursing and medical roles. The power of the medical profession is said, at least in part, to stem from the fact that doctors were responsible for diagnosing and defining a patient's health needs and acting as the first point of contact and referral point (Blank and Burau, 2004). This pattern may now be altering. The Department of Health (2002) suggested that it will be possible for nurses to manage entire caseloads, and, possibly, to be the point of referral to other agencies and professions. This, with shifts in the management structure and basis of healthcare may alter the power demographics of the professions.

Interestingly, at the same time, medical staff are now being encouraged to become more caring. This includes them engaging in discussions with patients, promoting openness and honesty and power sharing with patients, understanding the holistic nature of illness and desisting from their traditional paternalistic stance and their detachment from patients. If medicine rose to power because of the tendency for medical staff to impose decisions on patients and other staff, then the changes in the view of medical paternalism bring with it changes in the power which medicine can yield. The changes to a more caring role may also mean that medicine moves closer to nursing. This may mean that medical staff are more inclined to honour patient autonomy. However it may equally mean that they, like nurses, become maternalistic, rather than paternalistic, in their behaviours.

The shift in power

This, and the changing roles of professions, may mean that medicine becomes less dominant, as their stance and that of nursing become closer. This may result in the distribution of power being more equal. However, while this may be attractive to many, particularly to nursing and professions allied to medicine, this change may not enable other professions, or even the public, to increase their power. It may simply mean that Government becomes more dominant in healthcare decision making and healthcare professionals collectively lose power. Power shifting from one profession may not enhance the power of another. As a result, this change in balance may simply move decision-making out of health care and, despite assurances to the contrary, may not necessarily transpose itself to patients.

Those apparently benefiting from shifts in power should therefore be certain that it is a move which genuinely empowers them. Like oppressive regimes which give the impression of valuing those they oppress in an attempt to continue their subordination (Freire, 1970), medicine may only apparently value nursing or patient's views. In reality they may wish to continue their subordination while making them allies against the common foe of government. Government may wish to gain favour with nursing or patients so as to ally against medicine and weaken overall healthcare power while strengthening their own position. They may also see this as a way to reduce costs if, for example, nurses are cheaper to employ than medical staff and patient self care is more cost effective than medical care. Thus, those apparently benefiting from changes in power demographics should be aware of the possible reasons for the opportunities which they are offered. For example, nurses who are offered the opportunity to take on additional roles must be sure that this will enhance their work, and the care which patients receive, not simply to enable medical staff to free up their time. Similarly, patients who are encouraged to self manage should be sure that this is in their best interests.

As well as the many tactics which a dominant group may use to retain power, those seeking a redress of the power differential must be accepting of and see themselves in need of this newly aquired power and authority (Freire, 1970). Nursing and other allied professions must, in order to gain greater power, want this and actively seek to change the power demographic. It cannot be assumed that nursing's lack of political power lies outside nursing. Nurses may not wish to challenge their political place or may not see this as a priority. Maslin-Prothero and Masterson (2002) suggested that many nurses in the UK accept the model which places them outside the political power domain, regarding politics as an undesirable distraction from their core purpose of care delivery. Thus, nurses may themselves not truly oppose the medically dominant scheme of power, or the power of government, or wish to increase their own involvement in national and local decision making. That is the profession's choice, but if this is a choice that nursing collectively makes, by decision or default, then they are responsible for this.

Conclusion

The Royal College of Nursing's (2003) definition of nursing includes the clear intention for nurses to play a central part in facilitating patient empowerment. This is in line with current government policy (Department of Health 2000, 2001a, 2001b). However, true patient empowerment is not easy to enact, and the tendency to pay lipservice to "empowerment" by providing information based on a biomedical or healthcare dominated viewpoint and seeking consent from patients for healthcare staff to follow the course of action which they favour is not congruent with the principle of empowerment.

The aim of empowerment and acknowledgement of shared humanity should encompass those with whom nursing works. Medical paternalism must not be replaced by a nursing paternalism in which patients are forced to a greater part in decision making than they truly desire, or a rejection of medical interventions or perspectives.

If patient empowerment is to become a reality, then the attitudes and values which are held by staff and patients as well as overt behaviours need to be congruent with the principles of empowerment. This includes a move away from both paternalistic and maternalistic behaviours, and a genuine desire to enable patients to be in control of their health and healthcare. This includes seeking to identify whether patients who appear to tolerate or even welcome decision making on their behalf truly value this or are simply socialised into a compliant behaviour mode.

For nurses, historically, medical dominance has meant that they, as well as patients, have

been disempowered. Although changes in healthcare provision and organisation may mean that medical dominance is reduced, nurses and other healthcare staff should ensure that apparent changes in power which favour them do in fact achieve the goal of patient empowerment and more equal power between professions, not covert increase in central control by government.

The autonomy which comes with empowerment goes hand in hand with responsibility (Draper and Sorell, 2002). Appropriately informed autonomous individuals are responsible for the outcomes of their decisions in relation to their health as much as in any other area of life. Thus, a part of professionals or patients accepting the benefits of empowerment is them also accepting responsibility for the outcomes of their decisions. BJN

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KEY POINTS

- Empowerment is seen as a philosophy based upon the belief of the inherent worth and creative potential of each individual.
- The Royal College of Nursing sees patient empowerment as being one of the central tenents of nursing.
- Current national healthcare policy aims to shift the balance of power from healthcare staff to patients.
- Empowerment involves healthcare staff valuing and accepting patients' rights to make decisions.

Noise levels in a general intensive care unit: a descriptive study

Martin Christensen

ABSTRACT

The aim of this small-scale study was to measure, analyse and compare levels of acoustic noise, in a nine-bedded general intensive care unit (ICU). Measurements were undertaken using the Norsonic 116 sound level meter recording noise levels in the internationally agreed 'A' weighted scale. Noise level data were obtained and recorded at 5 min over 3 consecutive days. Results of noise level analysis indicated that mean noise levels within this clinical area was 56·42 dB(A), with acute spikes reaching 80 dB(A). The quietest noise level attained was that of 50 dB(A) during sporadic intervals throughout the 24-h period. Parametric testing using analysis of variance found a positive relationship ($p \leq 0{\cdot}001$) between the nursing shifts and the day of the week. However, Scheffe multiple range testing showed significant differences between the morning shift, and the afternoon and night shifts combined ($p \leq 0{\cdot}05$). There was no statistical difference between the afternoon and night shifts ($p \geq 0{\cdot}05$). While the results of this study may seem self-evident in many respects, what it has highlighted is that the problem of excessive noise exposure within the ICU continues to go unabated. More concerning is that the prolonged effects of excessive noise exposure on patients and staff alike can have deleterious effect on the health and well-being of these individuals.

Key words: Hospital noise • ICU noise • Noise

INTRODUCTION

The control of noise exposure in the hospital environment is fast becoming a serious issue in which many European and American hospitals are adopting a policy of extensive noise reduction. The World Health Organisations (WHO) (2002) external review policy on community noise has produced guidelines that identify specific noise levels within hospital environments. The recommendations include noise levels not exceeding 35 decibels [dB(A)] during the night and 40 dB(A) during the day; however, the Health and Safety Executive (2005) stipulate that noise levels within the work place should not surpass 85 dB(A). While the latter may well be acceptable within the confines of an industrial complex, within the hospital environment this is unacceptable when consideration is given to the effects of excessive noise exposure.

The physical characteristics of sound determine noise in that the loudness of sound is dependent on its amplitude or intensity. However, defining noise is difficult because it may be influenced by a number of variables for example cultural and social factors as well as individual sensitivities. Furthermore, the very nature of noise may vary considerably; it may appear as a pure tone, a narrow- or wideband frequency, as an impulse or as an impact (Christensen, 2005a). Therefore, noise may be considered random, fluctuating waveforms that interfere with desired signals (Kam *et al.*, 1994) and as such may be further defined as any unwanted sound that physiologically and psychologically disrupts performance, is annoying and is stressful (McDaid, 1990; Baker, 1993; Kam *et al.*, 1994; Kryter, 1994). To quantify sound levels, the decibel, an arithmetically non-dimensional linear scale, defines measured sound pressure (Bentley *et al.*, 1977; Seidlitz, 1981), in which sound is measured as the force per unit area that sound waves produce. For sound pressure measurement that closely resembles the normal curve for loudness frequency of the human ear, the internationally agreed 'A' weighted filter is used (Kam *et al.*, 1994).

The consequence of exposure to excessive noise levels is well documented within the literature with effects including cardiovascular stimulation (Marshall, 1972; Andren, 1980; Snyder-Halpern, 1985; Baker, 1992; Baker *et al.*, 1993), pituitary and adrenal gland stimulation (Falk and Woods, 1973) and an ineffectual immune response to infection as a result of immune system suppression (Monjan and Collector, 1977;

Author: M Christensen, RGN DipN, PGC (ICU), BSc (Hons), MSc, MA (Ed), Senior Lecturer (Critical Care), Bournemouth University, Bournemouth House, Bournemouth, UK
Address for correspondence: Bournemouth University, Bournemouth House, Christchurch Road, Bournemouth BH1 3LT, UK
E-mail: mchristensen@bournemouth.ac.uk

McCarthy *et al.*, 1992; Wysocki, 1996). Just as important and relevant to the intensive care unit (ICU) environment is that exposure to excessive noise levels is a contributing factor in the development of the condition known as 'ICU delirium' (Helton *et al.*, 1980; Baker, 1992; Marshall and Soucy, 2003). As for effects on critical care staff, studies have shown that prolonged exposure to excessive noise levels has a deleterious effect on cognitive task function and altruistic behaviour (Seidlitz, 1981; Topf and Dillon, 1988; Baker and Holding, 1993; Christensen, 2002; Cacase, 2006; Patterson and Schrader, 2006); indeed, Topf and Dillon (1988) suggested that excessive noise exposure can result in 'burnout' in critical care nurses.

Yet, critical care nursing staff appear to have little appreciation/knowledge of the wider psychophysiological effects of exposure to excessive noise levels. In this instance, nursing care of the critically ill patient appears to remain consistent throughout a 24-h period and as such the ritualistic practice of subduing lighting during the night appears to make little difference in the noise levels being reported (Balogh *et al.*, 1993; Kam *et al.*, 1994; Christensen, 1997). Indeed, the early work of Morgan and White, (1983) identified that while critical care nursing staff appeared to have a good understanding of the patients' need for sleep, found that in some cases nursing staff could not differentiate between essential and non-essential procedures and acceptable levels of noise. Moreover, nursing staff felt that because the majority of patients were critically ill, sedated and mechanically ventilated, the need for noise reduction was not applicable yet were unable to provide a rationale as to why this might be. Therefore, the taking and recording of observations was done primarily because of the nature of the job.

The latter work of Christensen (2005b) strengthens this premise that ICU nursing staff do have a knowledge deficit with regard to the effects of excessive noise exposure particularly within the ICU where the consequences can have a profound effect on patient well-being. Using a multiple-choice questionnaire, this study found that ICU nurses were unable to identify specific levels of noise; the physiological effects of noise exposure in terms of immune suppression, wound healing and stress hormone stimulation; and current legislation regarding noise exposure. However, even more interesting while this cohort was able to attribute noise exposure as being one of the contributing factors causing ICU delirium, many of the nurses (80%, $n = 76$) were unable to identify the typical behaviours associated with this condition.

NOISE IN THE ICU

On reviewing the literature, there appears to be substantial dated work concerning not only the noise levels within the ICU but also the effects of excessive noise exposure in particular sleep deprivation and the phenomena known as ICU delirium often characterized by delusions, hallucinations, disorientation and paranoia (Helton *et al.*, 1980; Baker, 1992; Topf, 2000; Litton, 2003; Borthwick *et al.*, 2006). When compared with ward-based environments, the noise intensity within the ICU far exceeds that found in ward-based environments, for example (Christensen, 2005a), and in many cases is consistent throughout a 24-h period.

In early studies, researchers have found that noise levels present in the ICU ranged from 59 to 83 dB(A) enough to stimulate the cardiovascular and endocrine systems as well as disrupt sleep as a result of noise-induced stress modulation (Falk and Woods, 1973; Bentley *et al.*, 1977; Hilton, 1985). Latter work continues to show the average noise level in the ICU to be 55–66 dB(A) far exceeding that recommended by WHO (2002), with peaks reaching as high as 85 dB(A). Put into context, if this level of noise was compared with everyday activities, it would equate to prolonged exposure to heavy traffic [average 60 dB(A)] and at the extreme a pneumatic drill in operation [85 dB(A)]. This must be concerning inasmuch that patients and staff alike are exposed to these levels of noise at regular intervals during a typical shift in the ICU (Balogh *et al.*, 1993; Kam *et al.*, 1994; Meyer-Falcke *et al.*, 1994; Christensen, 1997; Kahn *et al.*, 1998; Chmiel *et al.*, 2004).

Yet, the exact source of excessive noise pollution within the ICU is multifactorial for the very reason of close proximity care and the array of medical instrumentation seemingly attached to patients to monitor their progress throughout their stay in ICU. Balogh *et al.* (1993) suggested that the majority of noise created in their ICU was created by mechanical alarms, they cite the alarm of the Servo 900 C ventilator that had an average level of 76 dB(A) and cardiac monitors reaching levels of 72–77 dB(A). Falk and Woods (1973) found similar findings from their study, which showed that mechanical noise produced decibels ranging from 48 to 80 dB(A). Kahn *et al.* (1998) found that the most common mechanical sound producing high-intensity sounds were the monitor alarms and strangely the television. In an observation period lasting 160 min, the monitor alarms were being triggered 20% of the time equating to an alarm every 5 min throughout this period. While this is cause for concern, it must be remembered that alarms are not going off continuously and as such while they comprise of high-impact sound are intermittent.

Apart from mechanical equipment, other researchers discovered that medical and more so nursing staff were just as responsible for noise production in the ICU (Bentley *et al.*, 1977; Noble, 1979; Hilton, 1985; Kam *et al.*, 1994; Meyer-Falcke *et al.*, 1994; Christensen, 1997; Kahn *et al.*, 1998; Chmiel *et al.*, 2004). These researchers concluded that nursing and other allied health care staff were responsible for approximately 80% of the noise produced within the ICU. Staff conversations, the playing of radios, doctor's ward rounds, staff teaching sessions, providing patient care and communicating with relatives were found to be the most common cause for excessive noise being produced on the ICU.

METHODOLOGY

Overview

This small-scale study was undertaken in 2005 to compare and contrast the measured level of noise of a nine-bedded, open-planned general ICU in a regional teaching hospital. The study used was descriptive, producing data at interval level that were used to determine the level of noise produced throughout specific time periods during a 24-h period.

Aims and Objectives of the Study

The aim of this study was to measure, analyse and compare levels of acoustic noise in a nine-bedded, open-planned general ICU. The specific research questions were as follows:

(i) Is there a fluctuation in noise levels over a 24-h period in the ICU?
(ii) Is there a difference in noise levels over the three different nursing shifts in a 24-h period?
(iii) Is there a difference in noise levels over different days of the week?
(iv) Does the overall mean noise level measured in ICU conform to the WHO's recommended maximum permitted noise level in hospitals?

Sample and Setting

The study area was a nine-bedded general ICU in a regional teaching hospital. The rationale for choosing this particular area was because of the direct and close contact with critically ill patients, patients in this instance who may be susceptible to a variety of external stimuli and that may predispose them to the phenomena, known as ICU delirium. Ethical approval for the study was granted by the Trusts Ethics Committee. No written consent was needed in this study because neither staff nor patients were going to be approached. Moreover, permission was granted by the senior nurse and medical director of the ICU to undertake this study.

Data Collection

Data collection ran over 3 consecutive days in the ICU to elicit raw data for this area. Start times began in accordance with prescribed 'normal' nursing shift patterns times in this case at 0700 hours ending at 0700 hours 3 days later. To provide distinct data on noise levels within this clinical area, the Norsonic type 116 sound level meter (SLM) was used. Standardized to the British Standard BS/EN/60804:2001 [British Standards Institute (BSI), 2001] and the International Electrotechnical Commission's (IEC) Standard IEC 61671-1/CEI:2002 (IEC, 2002) for 'A' weighting noise measurement, the SLM 116 provided a direct reading of sound over the ranges of 22 –135 dB(A), with an accuracy of less than ±1 dB(A) over temperature ranges 0–50° C. Calibration of the SLM 116 was carried out every 6 h by the author, as per manufacturer's recommendations, to correct any potential measurement drift using the Bruel and Kjaer Sound Level Calibrator type 4230, standardized to and complying with British Standard BS/EN/60804:2001 (BSI, 2001). The 5-day period of acclimatization also allowed for small refinements to be made to the recording device to ensure consistency was going to be maintained during the study, for example, to ensure that recordings were constantly being taken.

The recording of noise level data occurred continuously at 5-min intervals, as previously validated by Christensen (2005a), to ensure that measurements were representative of typical conditions within this area. Placement of the monitoring equipment microphone ensured that sound detected from the areas was uniform. Therefore, placement of the SLM corresponded closely to the centre of the room and was suspended from the ceiling at a distance of 25 cm to take into consideration the possibility of interference from air-conditioning equipment (Christensen, 2005a). However, while this does not simulate directly the noise the patient would perceive, it allows an overall perception of the total noise within this area (Falk and Woods, 1973; Aitken, 1982; Balogh *et al.*, 1993; Kam *et al.*, 1994).

Reliability and Validity

Because of the nature of this study that is to say the direct measurement of noise levels within a clinical environment meant there was the potential for staff to influence the noise levels primarily through the 'Hawthorn effect' inasmuch that individuals who are aware of their participation in a study change their behaviour accordingly (Seaman, 1987; Skodol-Wilson,

1989; Abdellah and Levine, 1990; Polgar and Thomas, 1996; Polit and Becks, 2004), which in this case could mean staff purposely controlling the level of noise and in the case of Whitfield (1975), for example, so as not attract blame on themselves (the nursing staff).

This was a very real threat to the reliability and validity of the data collected. Previous research (Falk and Woods, 1973; Baker, 1992; Balogh *et al.*, 1993; Kam *et al.*, 1994) similar in many instances to this study make no mention of the possible influence hospital staff may have had on the noise levels being recorded in their respective areas. Balogh *et al.* (1993) and Bentley *et al.* (1977), for example, placed their SLM on a wall at a distance of half to one metre from the patient's head to try and simulate the noise levels that the patient may experience. To the untrained observer, this would suggest that there is high probability that the recording instrument would be seen and as such it would seem reasonable to suggest that hospital personnel would therefore react accordingly. Therefore, it was decided that the SLM used would be suspended from the ceiling so as not to be easily visible to hospital staff yet was able to perform the task effectively and as such minimize the potential for erroneous noise levels being recorded. Consideration for noise levels being influenced from air-conditioning vents and noise reverberation were taken into account and the SLM positioned to minimize the effects of these. Moreover, a period of 'acclimatization' was initiated to reduce any influence that staff may have had over the level of noise being recorded. Therefore, the SLM was placed in the unit 5 days prior to actual data collection being commenced; these data were then discounted from the study.

Data Analysis

Means and standard deviations were used to describe the noise levels obtained on the different shifts and different days. Three-way analysis of variance (ANOVA) was used to compare the mean noise levels obtained on the three different shifts and three different days. Where significant differences were obtained in the three-way comparisons, the Scheffe multiple range test was used post hoc to identify which time periods were significantly different from the others included in this comparison (Shelly, 1984; Hicks, 1990; Burns and Grove, 2005).

RESULTS

Mean noise level within the ICU over the 72-h period produced a noise level of 56·42 dB(A) (SD = 5·22) (Table 1). More intense noise levels [mean 58·82 dB(A), SD = 5·67] were reported between 7·30 a.m. and 14·30 p.m. on days 2 and 3, with acute spikes reaching 80 dB(A). Day 2 exhibited the highest fluctuations in noise production between 8·00 a.m. and 14·00 p.m. when compared with the other 2 days [60·62 dB(A), SD = 6·66]; yet, after these times, it showed similar noise levels as those of days 1 and 3 (Figure 1). However, notably there were distinct quiet periods between 16·30 p.m. and 18·00 p.m. (Figures 2–4) where noise levels dropped to 50 dB(A) [mean 54·92 dB(A), SD = 2·85] and again during the night where noise levels were at their lowest [50 dB(A)]. Occasional spikes above this minimum level were noted over the course of the night [maximum 75 dB(A)], but these were short lived and returned to minimum quickly. Day 1 (Thursday) showed uniform noise levels as compared with days 2 and 3 (Friday and Saturday) (Figure 1), with acute spikes in noise levels reaching 80 dB(A) [mean 56·22 dB(A), SD = 4·68] (Table 3). However, the diversity of noise levels within this area can be seen by the variance in the range and to some degree by the standard deviation, suggesting that measured noise levels are not uniform throughout a 24-h period (Table 3). Instead, as a result of quiet periods or periods of increased ICU activity, a normal distribution of noise level scores was not achieved, instead a positive skew resulted.

When selected nursing shifts (morning, afternoon and night) were analysed, statistical differences ($F_{2,286}$ = 5·07; p = 0·005) were observed between day of the week (weekday or weekend) and the respective nursing shift (Table 2). When comparisons were also made between day of the week, mean noise levels reported for each day were found to be statistically significant to each other ($F_{2,285}$ = 6·481; p = 0·005).

Table 1 Mean score distribution of noise levels [dB(A)] in a nine-bedded intensive care unit over 3 days

Variable	Mean [dB(A)]	Standard deviation	Minimum [dB(A)]	Maximum [dB(A)]	Confidence limit (99%)
Intensive care unit (over 3 days)	56·42	5·22	50	80	51·2–61·64
Weekday (Thursday and Friday)	56·75	5·37	50	80	51·58–62·12
Weekend (Saturday)	55·75	4·85	50	72	50·90–60·60

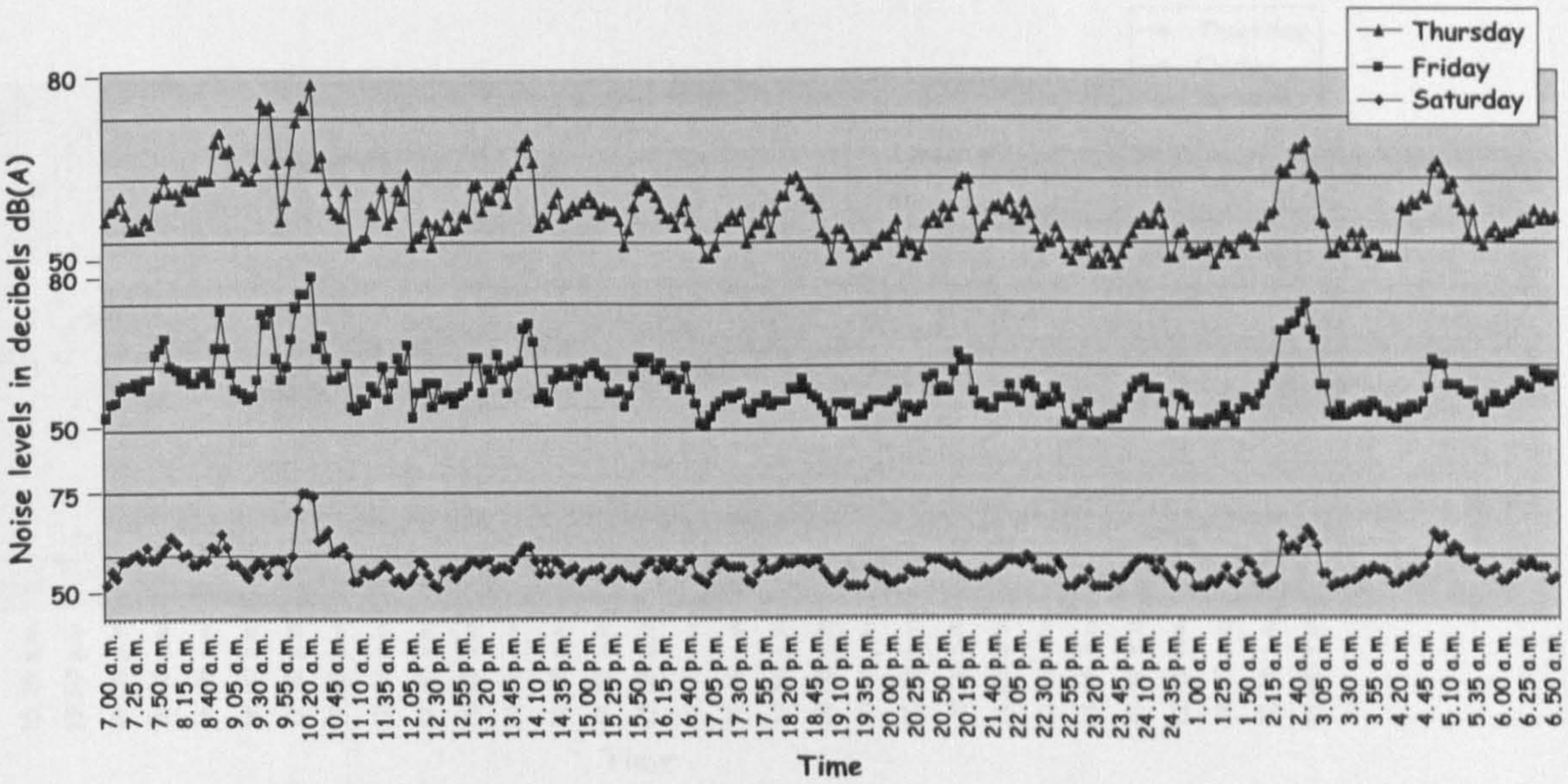

Figure 1 Pooled noise distribution over 3 days (measured at 5- min intervals over 3 consecutive days).

Where significant differences were obtained in the three-way comparisons, Scheffe test showed statistical differences between Friday and Saturday ($p \geq 0{\cdot}05$) but no significant differences were observed between the weekdays (Thursday versus Friday) and Thursday versus Saturday even though analysis of the means (Table 3) and ANOVA confirmed that one particular weekday was noisier than the other (Friday versus Thursday). Post hoc analysis also confirmed significant differences between morning shifts in particular the morning shifts of Friday and Saturday ($p = 0{\cdot}005$); however, again there were no statistical differences between any other nursing shifts.

DISCUSSION

The aim of this study was to measure, analyse and compare levels of acoustic noise in a nine-bedded, open-planned general ICU in a regional teaching hospital. More specifically to ascertain if there was a fluctuation in noise levels over a 24-h period within the ICU, if there was a difference in noise levels over 3 days of the week, if there was a difference in noise levels over the three different nursing shifts in a 24-h period and finally if the overall mean noise level measured in the ICU did conform to the WHO (2002)–recommended maximum permitted noise level in hospitals. In summary, the noise levels experienced

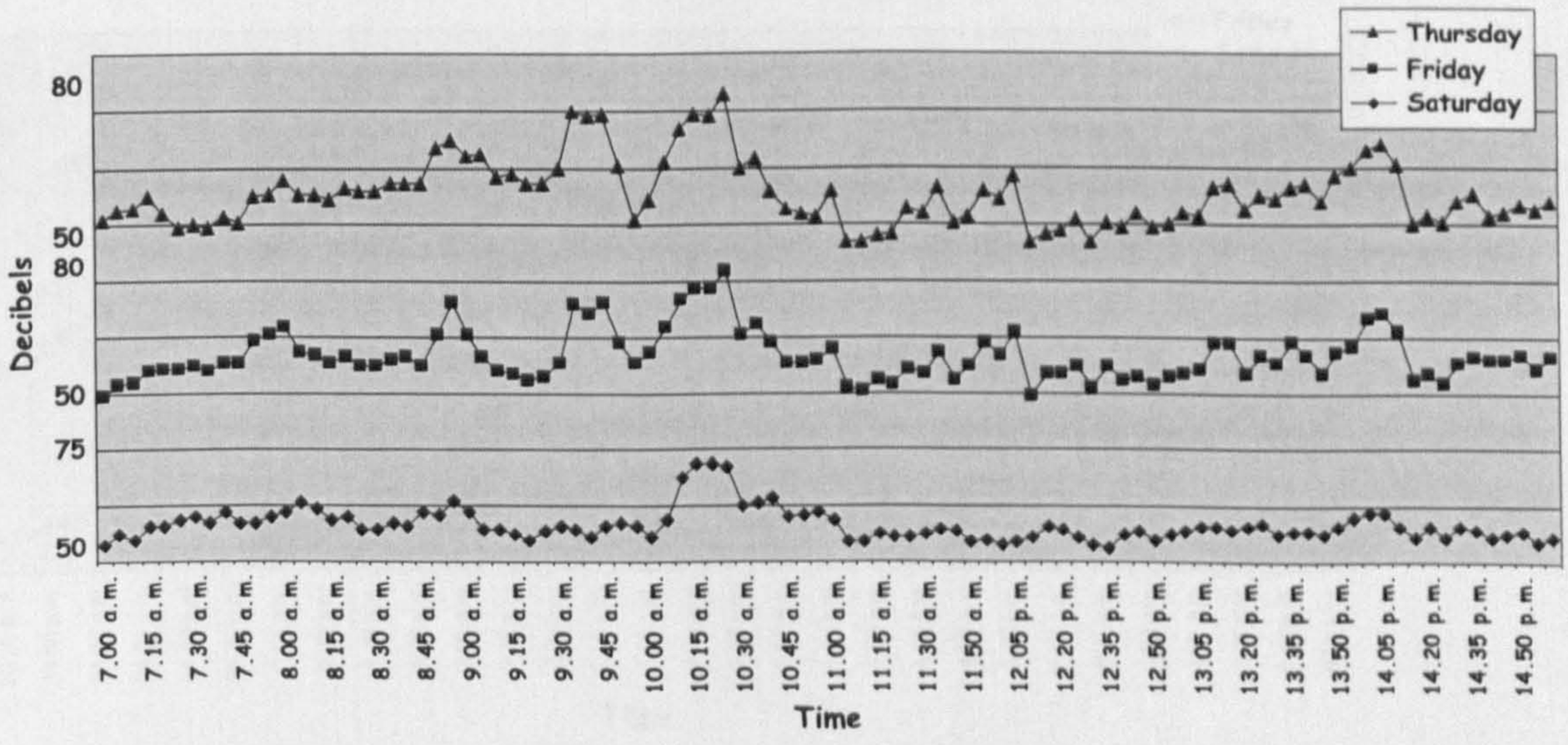

Figure 2 Pooled noise levels over the morning shift (measured at 5-min intervals over consecutive days).

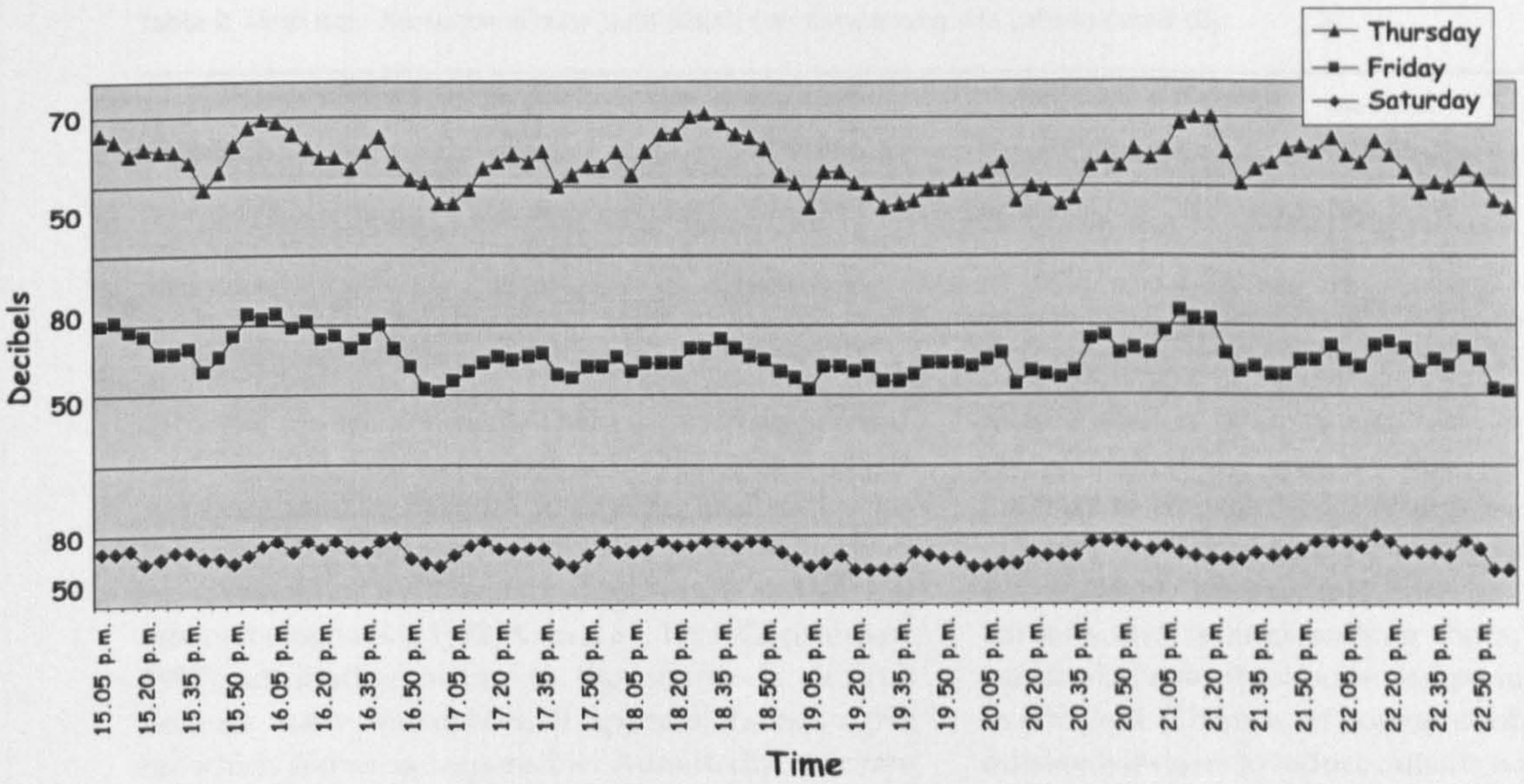

Figure 3 Pooled noise levels over the afternoon shift (measured at 5-min intervals over consecutive days).

within this ICU did not conform to the maximum permitted level as designated by WHO (2002). Plus there were significant fluctuations in noise levels throughout a 24-h period. However, with the exception of the morning shift, there was little/no significant difference in noise levels between the afternoon shift and the night shift, although the night shift did show more recorded levels of noise greater than 60 dB(A) than the afternoon shift. This study found that noise levels during the period of observation were constantly above 40 dB(A), the lowest noise level recorded being 50 dB(A), 25% higher than the recommended maximum as set down by WHO (2002). Further analysis indicated that the constant background noise in the ICU is similar during the day and night [mean 56·42 dB(A)], with peaks reaching in some instances 80 dB(A) at irregular intervals. It also found that there were significant differences in the noise levels measured between nursing shift patterns, with the morning shift being considered the noisiest and days of the week in this case weekdays noisier than weekends.

While it can be seen from the results that the level of noise did not drop below 50 dB(A) throughout the study period, this can be best explained by the very

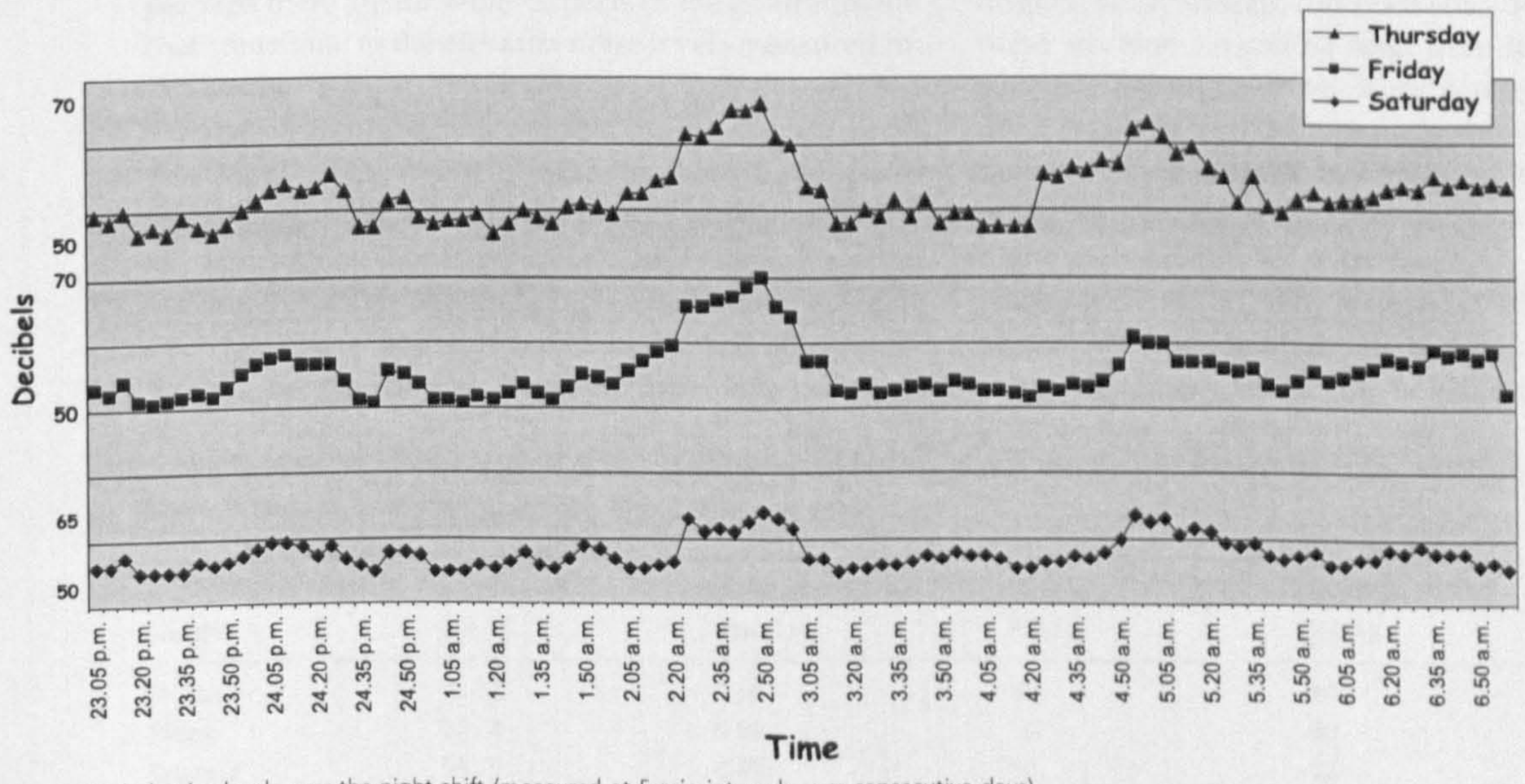

Figure 4 Pooled noise levels over the night shift (measured at 5-min intervals over consecutive days).

Table 2 Mean score distribution of noise levels [dB(A)] over three nursing shift patterns over 3 days

Variable	Mean [dB(A)]	Standard deviation	Minimum [dB(A)]	Maximum [dB(A)]	Confidence limit (99%)
Morning shift	58·70	5·95	50	80	52·75–64·65
Afternoon shift	55·50	3·98	50	80	51·52–59·48
Night shift	55·05	2·34	50	71	50·28–59·82

nature of the environment. There is increasing conjecture about the origins of noise in the ICU and to which source is actually harmful to patients and staff alike. While it can be agreed that the ICU is indeed a noisy environment as evidenced by this study and that of others (Balogh *et al.*, 1993; Kam *et al.*, 1994; Christensen, 1997), attributing blame to the source is difficult because many researchers, it appears, cannot agree on which source is responsible. Admittedly, mechanical noise immediately springs to mind, however, in the absence of mechanical alarms, machinery such as ventilators, run reasonably quietly and smoothly to which some consider to be cognizant to continuous back ground noise of a low frequency, a term Baker (1993) refers to as 'white noise'. Therefore, there is the likelihood that patients continually exposed to low-level white noise, comparable with that experienced in the ICU, do not necessarily exhibit the telltale signs of ICU delirium, instead patients become 'used to' the noise (Falk and Woods, 1973; Helton *et al.*, 1980; Baker, 1993), similar in some respects to people living under an airport flight path or near railway lines. However, they do contend that sharp high-pitched irregular sound, similar to that of staff conversations and mechanical alarms, can lead to ICU delirium and perhaps there are far wider aspects of the environment that contribute to the elevated noise levels measured in this study.

For example, it became evident during the course of this study that the ICU was of potentially poor acoustical design, reminiscent of first-generation ICUs as depicted by Fontaine *et al.* (2001) that possibly accounted for the relatively high baseline noise level. Each bed space was relatively close to each other, with little or no partitioning between them and with the nurse's station open to all areas of the ICU, which meant that there was, in this particular case, an inability to control the level of noise. Although some attention was paid to the general visual effect of the environment, for example, the colours of the walls, curtains and ceilings making the area pleasant and practical, the need for noise dampening was somehow overlooked. There is of course double glazing of all outside windows to reduce outside noise; however, the situation is complicated by hard, reflective walls that contribute to the long reverberation time of noise. Therefore, this made the ICU rather like an 'echo chamber', where noise had become a mixture of the original sound and reverberant sound that compounded the overall problem of noise excesses in the ICU. While ICU design was not within the remit of this study, it does raise some interesting possibilities as to potential modifications to the original layout of this ICU to reduce excessive noise exposure. This is not a new concept in that creating a healing environment such as views of nature, natural lighting and soothing colours can enhance the healing process, an important consideration in reducing ICU length of stay for many patients (Stichler, 2001).

Unstructured observations, although not part of the original study design, did elicit some key points about noise sources. As can be seen from the pooled noise sources (Figure 1), there were acute fluctuations in noise levels at sporadic periods throughout the 24-h periods. Some of these incidents can be explained by acute admissions to the unit, as can been seen on the night shift (Figure 4) with increases in noise levels reaching 65 dB(A), which quickly subsided once the patient had been 'settled' into the unit. However, there were sustained levels of noise especially in the

Table 3 Mean score distribution of noise levels [dB(A)] of 3 days

Variable	Mean [dB(A)]	Standard deviation	Minimum [dB(A)]	Maximum [dB(A)]	Confidence limit (99%)
Thursday	56·22	4·68	50	80	51·54–60·90
Friday	57·28	5·94	50	80	51·34–63·22
Saturday	55·75	4·85	50	72	50·90–60·60

morning shift [80 dB(A)] lasting anywhere from 10 to 15 min in duration (Figure 2). It is at these elevated levels that the startle reflex is initiated especially if the noise being generated is a sudden high-impact sound for which the patient is not familiar, similar to that of alarms or staff conversations. This has its importance in that it is at noise levels greater than 70 dB(A) that the physiological effects become more pronounced. For example, Minckley (1968), Woods and Falk (1974), Seidlitz (1981), and Kryter (1994) showed that levels of 70 dB(A) and above were consistent in disturbing patient sleep, increasing the need for pain relief and elevating cardiovascular functioning that included peripheral vasoconstriction and tachycardia. Indeed, Andren (1980) found that on exposure to noise levels of 85–95 dB(A), normal individuals showed elevations in cardiac functioning (increases in diastolic blood pressure, increased systemic vascular resistance and various changes in heart rate), and when using normal healthy individuals, Snyder-Halpern (1985) found increases in heart rate when these individuals were exposed to audiotaped coronary care unit noise while sleeping.

What these observations also elicited is that the noise source differed significantly from the type of patient being cared for, that is, the difference between a level 2 patient, those patients requiring more detailed observation including support for a single failing organ system, and a level 3 patient, who requires advanced respiratory support and in some cases needing support for two or more failing organ systems (Department of Health, 2001). It appeared that staff conversations tended to be more noticeable from those individuals caring for level 3 patients as opposed to the level 2 patients where the noise source seemed to be from equipment such as CPAP/BIPAP machines and oxygen therapy. What is of interest is that this phenomenon of staff conversations influencing the noise levels within the ICU has been reported in earlier studies yet appears to be an ongoing problem within this environment (Bentley *et al.*, 1977; Hilton, 1985; Kam *et al.*, 1994; Meyer-Falcke *et al.*, 1994; Christensen, 1997; Kahn *et al.*, 1998; Chmiel *et al.*, 2004). Some of these studies identified that the noise level within the ICU was never below 45 dB(A), 5 dB(A) lower than that recorded in this study, which they attributed to the low-level background noise caused by machinery and a more sustained elevated level of noise as a result of staff conversations particularly at the patient's bedside. Disturbingly, the conversations observed at the bedside were at times unrelated to patient care and conducted directly over the patient and as such there appeared to be no recourse for the patient in this instance because in the main they were sedated.

Limitations of the Study

It became apparent during the course of the study that there was a problem of staff members influencing measurements primarily through the Hawthorne effect as mentioned previously. While there was a 5-day acclimatization period before actual recording took place, there was some difficulty in the nursing staff performing normal patient care when calibration of the SLM was being undertaken, for example, conversation would cease and would recommence when calibration was complete. Although the calibration took less than 90 s to perform and was carried out 18 times during the actual study, this still does raise some concerns as to whether noise levels measured during these periods were a true depiction of the overall noise in the unit even though measuring was done at 5-min intervals.

The impression concluded from this behaviour was that nursing staff were seen to be assisting the researcher in obtaining only specific results, such as mechanical alarm noise and procedures that produced considerably high levels of noise. Others, it appeared, were concerned that they (nursing staff) would be labelled as the products of the noise measured during the study. It was, however, reiterated that the objective of this study was to evaluate the total noise generated within the ICU. It was not the author's intention, in this instance, to single out and report individual staff members who may be considered perpetrators of noise.

Recommendations for Future Research

The results of this study have highlighted a number of interesting areas that would be worthy of further examination. Unstructured observations identified that noise levels differed significantly as a result of staff presence between patient severity as identified by the Comprehensive Critical Care (Department of Health, 2001). Therefore, it could be prudent to conduct studies on those that are seen to be the major cause of excessive noise levels within the hospital environment. For example:

- Does test-retest education of critical care staff reduce the level of noise within the ICU?
- to identify, measure and analyse the noise levels and noise sources that level 2 patients are exposed to
- to identify, measure and analyse the noise levels and noise sources that level 3 patients are exposed to.

CONCLUSIONS

The results of this study, small as it maybe, echo many of the findings produced by other studies (Falk and

Woods, 1973; Bentley *et al.*, 1977; Aitken, 1982; Meyer-Falcke *et al.*, 1993; Kam *et al.*, 1994; Christensen, 1997). The overall aim was to examine the noise being produced in a nine-bedded general ICU. The work of Hilton (1985) clearly showed that even office noise [mean 54·35 dB(A)] can reach the proportions that were experienced in this ICU. Therefore, it could be suggested that the noise produced in this ICU could be typical of a busy office, heavy traffic and even at times a pneumatic drill (Falk and Woods, 1973). Whatever the cause, this study has showed that ICU is indeed a noisy environment for patients and that this study may make for future strategic planning possible.

WHAT IS KNOWN ABOUT THIS TOPIC

- Excessive noise exposure in the ICU can have a deleterious effect on both patients and staff alike, notably delirium and burnout.
- Physiologically, excessive noise exposure can reduce the immune response to infection, and can increase the release of the stress hormones and cardiovascular stimulation.
- Recent work has identified that ICU nurses have a poor knowledge base as to the effects of excessive noise on individuals.

WHAT THIS PAPER ADDS

- This paper examines whether noise levels in the ICU have decreased in line with universally accepted guidelines on noise control in the hospital.
- It also identifies that noise levels remained higher than those recommended regardless of the time of day or the day of the week.

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ORIGINAL ARTICLE

Patient empowerment: Does it still occur in the ICU?

Martin Christensen*, Jaqui Hewitt-Taylor

Bournemouth University, Bournemouth House, Christchurch Road, Bournemouth BH1 3LT, United Kingdom

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KEYWORDS
Empowerment;
Patient care;
Choice

Summary The theoretical underpinnings of patient empowerment were developed through the work of educators and community psychologists, working primarily with the socially disadvantaged. Empowerment is seen as a philosophy based upon the belief of the inherent worth and creative potential of each individual. Therefore, the aim of this paper is to explore whether this creative potential associated with patient choice that encapsulates empowerment is applicable to the Intensive Care Unit.

Introduction

The Royal College of Nursing's (2003) definition of nursing includes the clear intention for nurses to play a central part in facilitating patient empowerment. This is congruent with current national healthcare policy which aims to shift the balance of power from healthcare staff to patients (Department of Health (DoH), 2001). Although the phrase ''patient empowerment'' has become popular, and an almost mandatory aim of every area of healthcare, it is not an easy goal to achieve. It involves those who hold power being willing to redress the balance of power in favour of others, those who are to become empowered being ready and willing to accept this, and those seeking to empower patients being in a position to do so.

In the Intensive Care Unit (ICU), additional challenges exist in achieving the ideal of patient empowerment. Most patients in ICU are critically ill, many are unable to communicate verbally and are, or appear to be, unresponsive either due to their physical condition or because of the interventions which they are receiving. Rather than paying lip-service to ''empowering patients'' in this situation it is worthwhile to consider the limits of empowerment in the ICU, how patient power can be promoted within the constraints of critical illness, and control returned to patients following critical illness. This paper, therefore, explores the concept of empowerment, how this relates to patients, nurses and finally to the ICU setting.

Empowerment

Empowerment has been defined as: to give power to, or to make able (Soanes and Stevenson, 2005).

* Corresponding author.
E-mail address: mchristensen@bournemouth.ac.uk (M. Christensen).

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However, Gibson (1991) suggests that the meaning of empowerment depends on the situation and context in question and the individuals involved. One central theme of empowerment is nevertheless that it concerns power (Gilbert, 1995). Rogers (1979, as cited in Gilbert, 1995) claims that empowerment occurs when an individual gains increased personal power. The intention of patient empowerment is, therefore, to increase the personal power which patients have in relation to their health and healthcare. This includes issues of control and choice, such as increasing the control which patients have over their health, the choices which they can make, and the power which they hold in relation to decision making. This necesitates a change in the power differential which has traditionally existed between patients and professionals.

Patient empowerment

The concept of patient empowerment represents a reversal of the paternalistic approach which has traditionally dominated healthcare (Hewitt-Taylor, 2004). Until relatively recently, healthcare staff, and in particular medical staff, were considered to know what was in a patient's best interests and thus able to make decisions on patients behalf (Kennedy, 2003). Historically this was seen as both appropriate and in the patients' best interests, with it being considered unreasonable and even uncaring to impose the burden of decision-making on patients (Kennedy, 2003). Hewitt (2002) suggested that this view was allowed to persist and was considered justified because the tradition of paternalism meant that patients were unused to, felt disinclined and unequal to questioning medical decision making. This in turn perpetrated the view that patients were unable to make decisions regarding their health and should rely on professionals for this.

However, Chavasse (1992) suggested that the more an individual is encouraged and enabled to do, the more their abilities and self-reliance increases. In contrast, the less an individual is encouraged or permitted to do, the less they feel able to do. Thus, the more patients are involved in their care and decision making, the greater their ability and inclination to take control of their health will be. The trend in healthcare is now away from paternalism, towards a culture of power sharing (Coulter, 1999; DoH, 2000a) and to respecting, valuing and using the patient's ability to self-manage.

The benefits of empowerment for the patient are said to include encouraging individuals to take personal responsibility for their health, to make choices which best suit their personal needs and circumstances, and increase their feelings of personal autonomy. Gaining this level of control is said to increase self-esteem, therefore, influencing the individual's overall sense of well being as well as making specific aspects of healthcare provision more appropriate for them personally (Gibson, 1991).

The recognition of the benefits of patient empowerment is usually cited as the reason for the shift from paternalism over recent years (Wilmot, 2003; Hewitt-Taylor, 2004). However, Gallant et al. (2002) suggested that an increase in democratic thinking in society as a whole has contributed significantly to this. In British culture individuals are now generally more aware of their rights and expect to have choices (Kennedy, 2003). In addition, deference is no longer unquestioningly given to professionals, including health care staff (Wilmot, 2003). A further factor which may have contributed to the demise of paternalism is a loss of trust in healthcare staff as a result of well publicised cases of misconduct, and instances where healthcare professionals and organisations have fallen short of the standards expected of them (Canter, 2001). These views have been accompanied by more general concerns over standards of healthcare, for example, rates of hospital acquired infection (McCulloch, 1998; Wallis, 2005) and the legal right of healthcare professionals to decide about the care of individual patients such as those seen in breaching the individuals human rights (Dyer, 2004). This combination of events mean that many patients may no longer feel able to unquestioningly accept the views of health care professionals. Thus, the move towards patient empowerment is in part due to changes in the dominant views of society, and a loss of confidence in healthcare professionals, not simply because health care professionals have adapted their thinking to be more respectful of patients' rights.

Empowering patients

If knowledge is a tool of power, then the knowledge or information that patients have will affect their power. Therefore, patients being empowered means them having information, so as to know enough about health and disease to make decisions about the variety of options available to them (Feste and Anderson, 1995). However, information giving by healthcare staff is not, in itself, enough to achieve patient empowerment. The quality of this information and the context in which it is given and received will influence how far it empowers individuals. Although discussions, and patient decision making may move from a situation in which med-

ical staff openly make decisions for patients, such decision making usually occurs on unfamiliar territory for patients, with information presented from a biomedical perspective which remains unquestioned (Canter, 2001). True empowerment means patients being able to access and discuss a range of information, options and views, and to discuss this in an unbiased milieu, or at least where biases are acknowledged.

In addition to the complexity of patients being able to gain unbiased information, attitudes and beliefs of healthcare staff and patients may not be easily altered to embrace empowerment. Tweedale (2002) argues that medicine's culture of paternalism is difficult to alter and may surface when staff are asked by patients to follow a course of action which is in conflict with their own perspective. It is relatively easy to ''allow'' a patient to choose a course of action which accords with one's own standpoint. The skill required in patient empowerment is to enable patients to make informed choices which accord with what they, not healthcare staff, want and see as important.

Although it is often suggested that medical paternalism has been the main hinderance to empowering patients, this may not be the case. Salvage (1990) argued that nurses are more likely to exhibit maternalism behaviors towards their patients than empowering behaviors. Malin and Teasdale (1991) believed that nurses view caring as doing things for the patient including protecting them from harm or worry. The power relationship in this case is similar to that of a parent and child relationship (Hewison, 1995). This suggests that despite their differences in values and roles, nurses may be no more likely than medical staff to empower patients. They may simply disempower them in a different way.

It may not only be healthcare professionals who find moving from paternalism difficult. Waterworth and Luker (1990) found that some patients were reluctant to participate in the decision making process and would rather leave healthcare decisions to 'those who know best'. One difficulty in such situations is determining how far the relinquishing of their autonomy was viewed as a necessary part of their role in hospitalisation, or a sign of disempowerment by health service processes, rather than a gennuine disinclination to make decisions. An autonomous person can choose to defer decision making to others, but if autonomy and empowerment rather than imposed paternalism is the aim, this must be their choice, as opposed to having deferral forced upon them or being coerced to accept a passive role by individuals or institutions (Lowden, 2002). Kendrick (1994) identified that patients often see their role as subservient and passive recipients of care.

This view may have changed over time, however, for many patients who were brought up in the tradition of medical paternalism, a shift towards empowerment is unthinkable. The key to patient empowerment is to ascertain the level of decision making at which each individual wishes to be involved in each situation (Kaplan, 2002). Forcing empowerment upon an individual is something of a contradiction in terms, but the challenge is to ascertain for each person whether they really wish to be passive recipients of care, and take responsibility for the effects of this, or whether they simply see this as their ''role'' as patients and feel that they should not challenge professionals.

Central to the achievement of patient empowerment is, therefore, the formation of a partnership between healthcare staff and patients, which involves a mutual commitment to giving, facilitating access to, and receiving comprensible, unbiased information. It requires healthcare staff to acknowledge patient's rights to self-determination and patients accepting responsibility for their choices.

Empowerment in intensive care

While there appears to be general acceptance that empowerment is a 'good thing', nurses need to be wary that it does not become 'the in word', to which much lip service is paid with little action in reality (Wright, 1994). Although, this is a poignant statement, empowering patients in the ICU presents specific challenges due to the nature of their clinical condition. Many patients in ICU are unable to respond verbally or otherwise, and their level of comprehension may be in doubt, either due to their illness, injury, or the interventions they are receiving. Giving information to and ascertaining the wishes of a person who is receiving sedative medicines is a difficult task and it is in many respects unwise to suggest that true patient empowerment can occur in this situation. What is perhaps more appropriate is for intensive care nurses to have a belief in the value of restoring control and choices to patients as rapidly and effectively as soon as the acuity of their condition permits. This, therefore, allows nursing staff to be able to provide patients with the type of information and opportunities which will maximise their sense of control. Rather than paying lip-service to empowerment of a patient who cannot realistically control even the most basic aspects of their life, and cannot access information

or articulate choices, it is more appropriate to consider how beliefs about patient dignity and respect for humanity can be used to create an empowering environment as the patient recovers.

Skelton (1994) asserted that medical staff rely on technological instrumentation to provide answers to the problems they encounter and view their patients as objects rather than thinking, emotive and communicating subjects. Although some might dispute this, the suggestion that technology can detract from humanity is relevant to the intensive care unit (Carnevale, 1991; Barnard and Sandelowski, 2001; Musk, 2004; Johns, 2005). Thinking of a patient as an object is unacceptable, even where it may be impossible to ascertain their views. Respect for patients as humans who would normally be able and desirous of making their own decisions should be the central focus to the returning of power and control to them as soon as is possible.

Unsurprisingly, feelings of powerlessness for the critically ill patient are common. Boeing and Mongera (1989) suggest that powerlessness may be a 'maladaptive response mechanism' to situations over which the individual has little or no control. It is certainly true that critically ill patients have or will have little or no control in the critical stage of their illness. Once a patient becomes less critically ill, the usual routes in which humans orientate themselves with the real world, namely sight; touch; hearing; taste and smell, are often impaired. Disruption of these senses through disease and sedative/amnesiac medicines may reduce or distort any information that is received and sensory deprivation and overload, and fear may reduce the patients ability to become autonomous (Jones and O'Donnell, 1994). Physical frailty and exhaustion from illness, treatment and the effects of their environment further confounds the individual's ability to regain control. Many patients have little or no recollection of their ICU admission or of the severity of their illness (Jones and O'Donnell, 1994).

The role of intensive care staff in establishing patient empowerment is likely to begin with assisting individuals to overcome those factors previously mentioned and so regain a sense of control and the ability to exercise personal choice. For a person who has effectively lost control of any aspect of their life for some time, before empowerment regarding healthcare choices can occur, it may be necessary to assist them to regain a sense of control of their lives. This may include explaining and discussing events around their critical illness and hospitalisation so that these become less threatening for individuals, and creates an environment in which they feel valued as humans, not objects.

This notion has led to the development of the ICU follow-up clinic, in which patients and relatives alike are provided support and information following discharge from the ICU (Hall-Smith et al., 1997; Audit Commission, 1999; DoH, 2000b; Crocker, 2003; Cutler et al., 2003). Whilst not a new concept, follow-up support has demonstrated its effectiveness in not only being able to change practice (Sawdon et al., 1995; Waldmann and Gaine, 1996; Hall-Smith et al., 1997; Wesson, 1997; Audit Commission, 1999; DoH, 2000b), but has allowed patients to access services that might not have been available to them previously (Strahan et al., 2003). Indeed, follow-up services have also identified some key psychophysiological problems that patients discharged from ICU commonly experience. Problems such as peripheral neuropathy, appetite disorders, muscle weakness, mood swings, depression/anxiety, flashbacks and nightmares reminiscent of those symptoms best described as post-traumatic stress disorder (Hall-Smith et al., 1997; Giffiths and Jones, 1999; Russell, 1999; Robson, 2003; Strahan et al., 2003; Young et al., 2005; Lof et al., 2006).

Yet, what this has led to is a recognition that patients require support far beyond the ICU when it come to their long term rehabillitation from a critical illness, one of the key concepts identifed in Comprehensive Critical Care (DoH, 2000b), 'critical care without walls'. With this recognition has developed a revision of the way nursing care planning is prescribed. For example the work of Hall-Smith et al. (1997), Wesson (1997) and Chaboyer et al. (2005) described how the inception of follow-up clinics readdressed discharge planning in their particular units. This then meant that better preparation for the patient and relatives prior to ICU discharge not only promoted continuity of care between ICU and ward based nursing staff but also reduced readmission to the ICU. Whilst others have commented that as a result of follow-up clinic interviews a change to the existing sedation policy may reduce many of the problems associated with long-term sedation seen in this patient group (Strahan et al., 2003).

Moreover, there is growing interest in the development of patient diaries to allow patients to piece together or reconstruct fragmented memories (Hall-Smith et al., 1997; Bergbom et al., 1999; Backman and Walther, 2001; Combe, 2005) especially important for those individuals where their ICU admission is not planned. Indeed the percieved benefits of patient diaries have been shown to alleviate the distress caused by not knowing what has occurred to them as well as helping

the patient to ''move on'' from the experience (Bergbom et al., 1999; Combe, 2005). Together with follow-up support, this may enable the patient to form some understanding of their illness and subsequent admission to the ICU (Giffiths and Jones, 2001) and therefore may hasten recovery. Yet, it remains questionable as to whether this is empowerment in the context of the ICU patient.

In some cases, where admission to ICU is anticipated, for example following elective surgery, it is possible to prepare patients for this period of their hospitalisation. It allows for an opportunity to discuss with patients their choices and what limits ICU admission will place on them prior to the event so that they have as much choice and control over subsequent procedures as is possible. Even where actual empowerment is not likely to be possible, the beginning of creating an environment in which patients have as much information and as little oppressive influences is desirable. For example by giving explanations about the surroundings, sounds, what is being done and information about their condition and care (Oberle, 1991). This may not actually empower individuals, but it may lessen the sense of loss of control that they experience.

Another way in which intensive care staff can begin to restore power to their patients is to be aware of signs and symptoms which indicate feelings of powerlessness. Oberle (1991) describes such feelings as including apathy, withdrawal, passivity and indecisiveness. Carey et al. (1990) suggest that patient frustration was identified as the primary emotion noted by nursing staff. Frustration may lead to anger and a patient who appears angry or frustrated may be experiencing feelings of disempowerment. However, these may be complicated in intensive care by physical illness, exhaustion and the life changes to which an individual has to adapt. As in many instances in ICU, nurses will have to use their skills and judgement to determine the cause of patient responses. In the same way that changes in vital signs may be due to a variety of factors, so too may changes in emotional state be due to a range of causes.

Conclusion

The Royal College of Nursing (2003) places patient empowerment centrally within nursings' remit. Although medical paternalism is often cited as the major detractor from empowerment, nursing maternalism may in fact be an equally strong force, and nurses in the ICU, where patients are physically very dependent may need to exercise more caution than other areas of practice that this is not their approach.

The ICU environment is often seen as one that disempowers patients yet within this environment there are many facets of patient empowerment. One is to create an environment in which restoring control to patients is seen as important. Although in the critical stages of illness, empowerment may not be possible, it is desirable firstly to take measures to reduce disempowerment by giving explanations and information even when patients are unresponsive, and secondly to reduce the helplessness felt by previous illness as soon as the patient condition allows. Offering an opportunity for patients to understand events, which they cannot recall, or to discuss those over which they had no control may assist in their regaining a sense of control. Addressing these specific issues enable staff to move on to the more usually described aspects of patient empowerment, such as information giving, discussion of the available options and facilitating the process of informed choice. However, with increased awareness of factors that limit patient empowerment, nurses can actively change what was once seen as a paternalistic/maternalistic environment to one that increases respect toward patients and enhances patients' personal power.

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ORIGINAL ARTICLE

The implementation of a guideline of care for patients with a Sengstaken–Blakemore tube in situ in a general intensive care unit using transitional change theory

Teresa Christensen[a], Martin Christensen[b,*]

[a] *General Intensive Care Unit, Southampton General Hospital, Tremona Road, Southampton, United Kingdom*
[b] *Bournemouth University, Bournemouth House, Christchurch Road, Bournemouth BH1 3LT, England*

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KEYWORDS
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Summary The use of the Sengstaken–Blakemore tube as a life-saving treatment for bleeding oesophageal varices is slowly becoming the least preferred method possibly due to the potential complications associated with its placement. Nursing practice pertaining to the care of this patient group appears ad hoc and reliant on local knowledge and experience as opposed to recognised evidence of best practice. Therefore, this paper focuses on the application of Lewin's transitional change theory used to introduce a change in nursing practice with the application of a guideline to enhance the care of patients with a Sengstaken–Blakemore tube in situ within a general intensive care unit. This method identified some of the complexities surrounding the change process including the driving and restraining forces that must be harnessed and minimised in order for the adoption of change to be successful.

Introduction

Clinical guidelines in the promotion of evidence-based practice are an important tool in the quest to improve patient care (Richens et al., 2004). The United Kingdom's Government white paper 'A First Class Service: Quality in the New National Health Service (NHS) (Department of Health (DoH), 1998) established the need to move away from counting numbers to ensuring quality resumes its rightful place at the heart of the NHS. The key principle, combined with the clinical governance framework (Department of Health, (DoH) 1999), is the need for care to be patient focused. All the

* Corresponding author.
E-mail addresses: tezzatopcat@z6.com (T. Christensen), mchristensen@bournemouth.ac.uk (M. Christensen).

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elements of clinical governance must be focused on improving the quality of patient care (Royal College of Nursing, 2003).

It is within this setting of organizational change that the development and implementation of a guideline for the safe and effective care of patients admitted to our Intensive Care Unit experiencing bleeding oesophageal varices was introduced.

Limitations of current practice

Direct compression from balloon tamponade to control bleeding from oesophageal varices is achieved by the placement of a Sengstaken–Blakemore tube (SBT) (Burroughs, 1992). Yet, the placement of Sengstaken–Blakemore tubes is becoming less common due to the potential for active rebleeding once balloon deflation and tube removal had occurred (Burroughs, 1992) and the high incidence of complications such as aspiration pneumonia, airway obstruction, tube migration and oesophageal ulceration and rupture (McCormick et al., 1990). This technique has been superseded in most cases with the advent of newer and possibly less problematic treatment techniques such as sclerosing, banding and pharmacological management (Burroughs, 1992). However, it still remains a life-saving treatment and an adjunct to the aforementioned techniques (Jalan and Hayes, 2000), particularly in those situations where bleeding is difficult to control such as that seen in patients with alcoholic liver disease (Pasquale and Cerra, 1992).

Clinical evidence at a local level suggested caring for patients with a SBT lacks formal guidelines/protocols. Clinical practice was based upon individual experience and expertise whereby the care of these patients was not standardised or even evidence based. Anecdotally, the care given appeared to have some commonalties between specialties, for example ICU and the hepato-biliary wards. There appeared to be no uniformity across the hospital and hands on care of the SBT tube itself appeared to be somewhat ad hoc. Moreover, procedures and care were based on instructions from the consulting gastroenterologist (this being the case in our ICU). Again whilst this may be deemed adequate, it is questionable as to whether nurses within this organisation were able to ask the appropriate questions of specialist medical practitioners if they themselves did not have a sound knowledge base to inform their practice (Christensen, 2004). The Nursing and Midwifery Council NMC (2004) states that nursing staff should provide patient care based on current evidence and best practice.

It was imperative that an awareness of the assessment and prevention of potential complications, emergency situations and the action to be taken should these occur needed to be at the forefront of any knowledge base. Nurses working with these patients should have an understanding of the care required (McEwen, 1996) in order to be accountable practitioners (NMC, 2004). There are serious shortfalls when trying to address the supposed knowledge deficit because the implications of this are two-fold. Firstly the reduction in the number of medical practitioners skilled in the techniques of SBT placement (Sherlock and Dooley, 1997). Secondly, a reduction in the total number of patients admitted to the ICU with a SBT in situ because of alternative treatment options. Consequently, nurses working within this ICU had little opportunity to practice these skills and in some case were being advised by junior doctors who had little experience of the techniques (Christensen, 2004).

Proposed change to practice

It was therefore proposed that the introduction of a guideline for care for those patients with a Sengstaken–Blakemore tube in situ within the ICU could be implemented on a pilot basis with continual assessment and peer review, thereby allowing refinements to practice to be made. The added advantage being that the current nurse/patient ratio of 1:1 in our ICU would permit the easy implementation of this guideline. Therefore, to accomplish this proposed restructuring to patient care the following aims and objectives were formulated:

- Identify and diagnose the current problems associated with patient care with regard to the nursing management of patients with Sengstaken–Blakemore tubes in situ.
- Scope current nursing practice within our ICU and the hospital.
- Identify the method by which the assessment and provision of nursing care is delivered in our ICU.
- Introduce an interventional model relevant to the change proposal.
- Identify the stakeholders involved in the change proposal.
- Identify key learning points of the change proposal.

An overview of the literature

As a continuation of previous work (Christensen, 2004) an overview of the literature reiterated

those issues already identified within this ICU (Christensen, 2004). There were discrepancies as to whether low pressure continuous or intermittent suctioning needed to be applied to the oesophageal and gastric ports, what suction pressure was deemed appropriate and the frequency of when this task should be undertaken (McCaffery, 1991; Pasquale and Cerra, 1992; McEwen, 1996; Huston, 1996; Kelly et al., 1997; Sherlock and Dooley, 1997; Casey, 1999; McArdle, 1999; Zeigler, 2000; Jalan and Hayes, 2000; Adam and Osborne, 2005). Others, failed to reach a consensus as to those measures needed to prevent tube migration (Vlavianos et al., 1989; McCaffery, 1991; Pasquale and Cerra, 1992; Kelly et al., 1997; Casey, 1999) and as to what filling agent was required; either air or sterile water (McCormick et al., 1990; McCaffery, 1991; Goff, 1993; Sarwal and Goenka, 1996; Casey, 1999).

It can be seen that what may be deemed as ''best practice'' was decision making and care provision based on personal experience. In some cases there appeared to be little rationale for the care prescribed, for example suctioning pressures and filling volumes of the respective balloons. This called into question the current initiatives for best or evidenced based practice when clearly these were not being adhered to.

Based on an appraisal of the available literature, a key feature of this guideline (Diagram 1) for practice identified that:

> The use of the Sengstaken–Blakemore tube (SBT) is a short-term treatment for uncontrolled variceal bleeding and is a life-saving adjunct to more long-term treatment techniques. The SBT should remain in place for the shortest period of time possible. There is a high incidence of complications for example aspiration pneumonia, airway obstruction, tube migration and oesophageal ulceration and rupture. The guidelines were meant to inform and not prescribe care. There will be individual variation in the management of patients with a SBT but it was hoped that these guidelines would inform practice (Guideline for the Care of a Patient in the General Intensive Care Unit with a Sengstaken–Blakemore tube in situ; Christensen, 2004).

Theoretical framework

Lewin's (1951) theory of transitional change was used as the theoretical framework for this project. Lewin's (1951) transitional change theory is the most used form of change implementation strategy, and appeared to address many aspects of this proposed change, for example the mechanism for identifying the social system within an organisation and as a means for selecting and developing innovations to serve as a solution (Tiffany et al., 1994). Fundamental to transitional change is that change is characterised as a state of imbalance between driving forces and restraining forces (Tiffany and Lutjens, 1998). However, it has been suggested that this theory is incomplete as it refers to change event evaluation only in the context of re-planning strategy (Tiffany et al., 1994).

Lewin (1951) suggests that the introduction of change should adopt three steps; unfreezing, movement and refreezing. Unfreezing in this context, is when the motivation to create some form of change occurs, for example realising that a change is needed. In this case the advent of a guideline for the improvement of patient care. Secondly moving, when change is planned and initiated, re-thinking over what is agreed which leads finally to refreezing, when the proposed change is integrated and established or stabilised into the new equilibrium.

Key to the success of a change proposal is the identification of key individuals who will have a direct impact on the success or failure of the project. After the stakeholders had been identified, it was recommended that as part of the unfreezing process, the research findings and the change proposal be discussed with peers, in this case the professional development team. A normative–re-educative strategy was utilised which incorporated a participative and delegative focus for effective change management (Gerry and Edwards, 2003).

By adopting this strategy it became primarily a ''bottom up'' approach. This stressed collaboration and interpersonal relationships as a means to acceptance of the changes to be made. Therefore, an empirical–rational strategy could be used to unfreeze current practice, assuming that the proposal would be adopted, could be rationally justified and gains and benefits to current practice can be demonstrated (Bennis et al., 1985; Cahill, 1995; Ywye and McClenahan, 2000).

The stakeholders

It was anticipated there would be some concerns about the change to current nursing practice from some staff members within the ICU. It was proposed an attempt would be made to identify their concerns prior to the introduction of the change proposal. Combined with this was the likely number of stakeholders involved. Therefore a domainal map (Diagram 2) was used to allow a visual representa-

Action	Rationale
• Record on observation chart the amount of air/water used to inflate the gastric balloon, this should be documented in the medical notes on tube insertion *(McCormick et al, 1990; McCaffery, 1991; Pasquale and Cerra, 1991; Goff, 1993, Sarwal and Gaenka, 1996; Casey, 1999).*	• As a reference. • Adequate inflation of the gastric balloon ensures the secure placement of the SBT, as well as provides pressure on bleeding varices, thus preventing tube migration and possible airway obstruction.
• Pressure in the oesophageal balloon must not exceed 40 mmHg measured with a pressure manometer or something similar and should be documented in the medical notes on tube insertion *(McCaffrey, 1991; Huston, 1996; Royal Free Hospital, 2001).*	• Risk of oesophageal rupture and ischemic damage to the oesophageal wall.
• Ensure secure position of SBT by taping to the side of face (skin traction). Observe and record on observation chart the position of SBT at the lips or nostril. This should be undertaken on patient assessment then 1 hourly and after the patient has been move *(McCaffery, 1991; Casey, 1999).*	• Taping to the face provides some skin traction thus putting tension on the gastric balloon and prevents dislodgement and migration into oesophagus and pharynx causing oesophageal rupture and possible airway occlusion.
• Monitor patient for acute sign of respiratory distress or sudden changes in respiratory status. If ocurs call for urgent assistance from a senior nurse or anesthetist. If deemed necessary cut the SBT (deflating the balloon(s)) and remove • If intubated observe for signs of ETT displacement. • If self-ventilating observe for signs of respiratory distress and/or obstruction.	• SBT migration into the pharynx occluding the airway *(Pasquale and Cerra 1992).*
• The gastric aspiration port should be aspirated 1 hourly if actively bleeding, using a catheter tip syringe and recording amount of aspirate on the observation chart. If NOT actively bleeding or the gastric port is on free drainage, aspirate 4 hourly and record amount on observation chart *(Casey, 1999).*	• Enables assessment of quantity and nature of stomach contents, present of active bleeding, and the removal of blood. Preventing the digestion of haemoglobin resulting in raised serum ammonia levels *(Huston 1996).* • Minimizes the risk of aspiration.
• Post aspiration of the gastric port or after giving medication; flush the lumen with 30mls of sterile water *(McArdle, 1999).*	• Prevent blockages occurring in the aspiration lumen.
• If the oesophageal balloon is inflated, aspirate the oesophageal aspiration port 1-2 hourly, to remove blood and/or oropharyngeal secretions, using a catheter-tipped syringe. Record amount on observation chart *(Sherlock and Dooley, 1997; Zeigler, 2000).* • The use of continuous low-pressure suctioning (<120mmHg) is at the discretion of the consulting gastroenterology team.	• Reduces the incidence of aspiration pneumonia, the presence of an endotracheal tube helps minimize this risk. • Evidence suggests that excessive suctioning can cause localized trauma and exacerbate bleeding.
• If skin traction is inadequate to stop bleeding then further traction can be applied to the SBT at the direction of the gastroenterology team or ICU consultant. • The gastric balloon should be adequately inflated with of air/water. (See patient's medical notes for volume instilled) *(McCormick et al, 1990; McCaffery, 1991; Pasquale and Cerra, 1991; Goff, 1993, Sarwal and Gaenka, 1996; Casey, 1999).* • A 500ml bag of intravenous fluid may be attached to the tube providing traction, and hung off the head of the bed. Caution is required *(McCaffery, 1991; Casey, 1999).*	• A greater tension applied to the SBT increases the pressure the gastric balloon has on the gastro-oesophageal junction thereby reducing oesophageal bleeding. • Weighted traction increases the risk of tube migration
• The position of the SBT should be checked hourly and after moving the patient. • Care should be taken when moving the patient to maintain traction. • The need for weighted traction should be reassessed after 12-hours or before if bleeding has subsided.	• Risk of dislodgement of SBT. • To reduce the development gastro-oesophageal ulceration.
• The oesophageal balloon should be deflated periodically; the frequency and length of deflation will be determined by the condition of the patient i.e. actively bleeding and instructions from the consulting team, which should be documented *(Matloff, 1992; Pasquale and Cerra, 1993; McEwen, 1996; McArdle, 1999; Zeigler, 2000).* • Aspirate oesophageal port prior to deflation.	• To alleviate and reduce the risk of mucosal ischaemia and prevent ulceration. • Assess bleeding.
• Observe patient's mouth and lips for signs of ulceration. If present document in nursing care plan.	• To maintain patient comfort and reduce the risk of infection, pain and tissue damage.

Diagram 1 Guideline for the care of a patient in the general intensive care unit with a Sengstaken–Blakemore tube in situ.

Stakeholders:	Patients.	Junior and Intermediate Nursing Staff.	Senior Nursing Staff.	Medical Staff
Present Involvement:	Possible lack of nursing continuity and trust.	Uncertainty of care required.	Uncertainty of care required.	Day to day patient allocation for junior doctors.
Future Benefit:	Individualised, best-practice nursing care.	Sense of involvement, professional accountability, increased confidence & self esteem, continuity of care, increased knowledge, increased assessment skills.	Better inter-professional communication, more patient contact, direct and plan nursing care, increased skills in teaching and assessment.	Increase skills in teaching, increased clinical role.
Potential Costs:	Emotional dependence, noncompliance with treatment/care from nursing team.	Lack of patient variety, monotonous work if patient is long stay, loss of confidence, lack of interest, increased assessment.	Increased managerial/clinical responsibilities.	Cost expenditure, preference for status quo, loss of patient contact, decreased job satisfaction, less patient accountability.
Unaware Wrecking Power:	Patient dependence, demanding unnecessary care, noncompliance with treatment/care.	Resort to original patterns of nursing care.	Lack of trust, ineffective communication, resort to original patterns of nursing care.	Lack of trust, interfere with planned care.

Diagram 2 Domainal map of stakeholders (Spiegal et al., 1992).

tion of each groups likely perceptions, influences, costs and benefits regarding the proposal (Spiegal et al., 1992). This anticipation of possible objections enabled prepared solutions to be considered prior to them being raised by the stakeholders in an attempt to ensure that they remained positive to the scheme.

More importantly was the prospect that senior people, with legitimate power, within the group had the power to promote or obstruct the proposal. Even people with little power or low status could wield obstructive power (Spiegal et al., 1992). The early identification of key people built ownership and commitment to the scheme, enabled involvement of everyone that may be affected and allowed effective negotiation to take place. It was at this stage that the first step to acceptance of the proposal was encouraged.

After identifying the key stakeholders it was suggested each group be approached separately, to discuss the proposal, its benefits and advantages for patient care, the benefits for nursing staff, and the potential disadvantages that may have affected both groups. In this instance, Lewin's (1951) force-field analysis also served as an assessment of the driving and restraining forces that

DRIVING FORCES:		RESTRAINING FORCES:
• Increased continuity of care, skills and assessment: • Increased staff confidence and self-esteem: • Professional accountability: • Individualised patient care: • Department of Health guidelines: • Decreased frustration: • Professional autonomy: • Greater professional communication: • Clinical Governance:	**EQUILIBRIUM**	• Fear of change: • Increased responsibility: • Increased accountability: • Maintenance of status quo: • Increased assessment: • Increased workload: • Sporacity of patient group: • Ineffective medical input:

Diagram 3 Force-field analysis of the proposed change (Lewin, 1951).

may well have impacted on the implementation of this guideline for care in the unit (Diagram 3). Additionally, the change agent was able to assess their response to the proposal and to identify benefits and objections that had not already been considered. By adopting this method it did not allow the formation of sub groups, which could foster grievances and dissension.

Unfreezing

It was here that the ''unfreezing'' of 'old group identifications' and 'territorial attitudes' took place with movement of the group members to a stage of ''refreezing''. Of benefit in this transition was the contact made with other clinical areas, for example hepatology wards and the emergency medical admission unit, to find out if a similar scheme of nursing practice was running and how they were progressing with this type of care. If the success of other clinical areas in developing care guidelines could be demonstrated, it may allay some of the fears expressed by stakeholders, such as nursing staffs ability to change nursing practice and their fears of patient neglect and the lack of quality care. However, it was suggested that if these fears were not realised in other clinical areas and the nurse/patient relationship flourished, it could be argued that by not introducing this type of nursing practice in the ICU, patient care may not have been optimised. Therefore, the 'fear of not changing' rather than the fear of changing was seen as a motivating factor (Diagram 2) for some stakeholders in this instance (Wright, 1989; Manley, 1989; Clark, 1994).

The NMC Code of Professional Practice (2004) also acted as a motivating force for change, as nursing staff would not be able to justify their failure to provide appropriate nursing care in the face of both government legislation and professional accountability (Diagram 2). Furthermore, the fear of changing nursing practice for the benefit of patient care (a restraining force) to a fear of not adhering to their professional responsibilities (a driving force) could result in a moral and ethical dilemma (Cahill, 1995). Nevertheless, any nursing staff within the group unwilling to accept this guideline as the accepted norm risked alienation thereby increasing negativity to the change proposal, and as such shift the balance towards the restraining side of the force-field analysis (Lewin, 1951). Any reduction in restraining forces thereby increasing driving forces was vital to be able to move onto the next stage of Lewin's (1951) transitional theory of change. It was during the 'moving stage' Lewin (1951) suggested, that the need for change became recognised enabling solutions to be sought and implemented.

Movement

The use of a power-coercive approach or suggesting that practitioners were currently inadequate in their practice could have alienated the change agent from those individuals to whom the change proposal was aimed (Stephenson, 1987; Guy and

Gibbons, 2003). Therefore, involvement of all participants at an early stage was central to the normative–re-educative approach as it helped limit resistance during implementation (Plant, 1987). Furthermore, participation fostered a sense of ownership of the change proposal and aided development of the interventions. Central to this aim was the need for ongoing education, if the scheme was to succeed. Availability of literature, seminars and attendance at study sessions during ''team days'', were all planned in an attempt to allay the inevitable fears that change brings (Wilkinson, 1994; Turvil, 1996).

It was also emphasised that communication with all group members was vital if the proposal was to succeed (Baulcomb, 2003). However, this posed the problem of gathering all staff members together in order for debate to take place. This was difficult to achieve due to shift work patterns and family commitments. To overcome these potential problems Manthey (1992) identified the use of a planning group for the dispersal of information. Such a group in this instance needed to be small enough to be effective while large enough to represent all staff nurse grades on the ICU. Within this ICU it is accepted practice that each team of nurses, made up of 'D', 'E' and 'F' grade nurses ($n = 10–12$) and led by a senior sister would be responsible for the development of educational packages, inception of guidelines and other in-house training activities within a defined specialty of critical care nursing. For this particular group the focus was the hepato-bilary system. Whilst individuals within this team are charged with developing guidelines either within a group or solely, it was the responsibility of the team as a whole to disseminate this information to the other nursing teams within the ICU. The team then served as a two-way channel of communication between the rest of the staff and the planning group, thereby speeding up the process.

A pilot scheme was initially proposed in order to implement the change gradually over a period of time. New admissions to the ICU would be allocated to nursing staff who felt comfortable and competent to care for these patients having first attended the ''team-teaching'' sessions. It must reiterated that because of the sporadic nature of patient admission teaching was carried out quickly and efficiently to enable staff to be up-to-date with the guideline. Support was available from the hepato-bilary team when required. Potential key learning from this approach was that gradual implementation resulted in a permanent partial implementation. This arose due to short stay patients admitted to the ICU for less than 24 h being transferred back to their respective ward or dying due to the severity of the bleeding. This led to fragmented implementation and considerable confusion for the nursing staff. Therefore, a smooth introduction into the scheme with constructive feedback and early identification of potential problems occurring during the pilot scheme helped rectify problems at a later stage.

Evaluation of the change proposal

Throughout the change process, which included the pilot scheme and full implementation, strict monitoring took place to ensure that standards were being maintained. Ongoing formative evaluation of the change proposal allowed judgments to be made about how the scheme was progressing (Cork, 2005). This approach aided identification of problem areas, highlighting where increased effort and resources needed to be targeted (Stephenson, 1987). Evaluation protocols were devised prior to implementation of the change proposal, as this helped focus on both the change process and the goals of the scheme (Wilkinson, 1994).

Clearly the evaluation process was undertaken as a joint venture, involving each and every group member. Validity in this case may have been an issue due to bias if the implementers of the change were to undertake the evaluation themselves. Therefore, joint internal evaluation was seen as more desirable, as this reinforced the new pattern of practice (Cahill, 1995). To this end the evaluation process included; a semi-structured interview format for staff, internal auditing of standards and an anonymous survey of nursing staff. The results demonstrated that continuity of care was maintained for the majority of patients admitted to the unit during the pilot study period. There were favourable comments as to the layout and rationale of the guideline with some individuals highlighting the importance of the information in guiding their practice. However, there were problems in terms of both staff sickness and those nursing staff who worked part-time. The problem encountered with part-time staff meant that continuity of care may have been compromised during some shifts with patients sometimes being cared for by nursing staff not familiar with the guideline and/or Sengstaken–Blakemore tubes.

Yet, despite these set-backs the responses from the evaluations appeared very positive in terms of the professional worth that the nursing staff gained as a result of undertaking this change in practice. That is to say they (the overall nursing team) felt a sense of teamwork, shared goals and values in terms of the delivery of patient care, better communica-

tion not only with colleagues but with other health professionals as well and an increase in autonomous practice. A view which is evident in the work of Wright and McCormack (2001) and Workman (2002).

Refreezing

The refreezing stage of the change process is seen as one of consolidation (Wright, 1989) and one in which stabilisation occurs (Lancaster, 1999) or the reaching of a new equilibrium (Lewin, 1951). In this case, the Sengstaken–Blakemore Guideline has become accepted practice. However, the full implementation of this guideline was slow due to the sporadic nature of patient admission. As such the nursing team felt that some nursing staff would potentially miss out on the experience of caring for a patient with a Sengstaken–Blakemore tube in situ. The evaluation supported these concerns. However despite the set-backs the advantages of this guideline namely the increased continuity of care, an increase in the therapeutic relationship and adherence to government social policy still remained. Moreover, the general consensus from the hepato-bilary team was that although there were some issues, these could be overcome by reallocation of the nursing resource.

Conclusion

Change would appear to be an irrevocable fact of life within western society (Stephenson, 1987) and is ever more prominent within the health service. The change process is greatly enhanced by the application of a logical process through the identification of a problem, development of an implementation plan and clear monitoring and evaluation at all stages. Furthermore, the selection of an appropriate change model aids this process, something clearly demonstrated in this project with use of Lewin's (1951) theory of transitional change.

However, it is the experience of these authors that change is difficult, sometimes fraught with unsuspecting problems and sometimes demoralising. Overall the change process was successful with some early resistance evident from the senior nursing management who felt that junior nursing staff would be disadvantaged in their development. Although the pilot study did identify two key problems that of sickness and part-time staff and their influence on the continuity of care, it did also identify some very positive aspects with regard to professional development and team working.

Within the nursing profession we need to learn to adopt a proactive role in change management and continue to offer a valuable and viable contribution to patient care; a key focus of the NHS Modernisation Agency's (2004) ''10 High Impact Changes'' document. Health professionals working in the NHS have a duty to provide better care for patients, which requires the accommodation of change within practice. This change must be evidence based. Making a Difference (1999) suggests that ''the NHS needs a modern and responsive workforce of well motivated, well-trained professionals equipped to respond to the challenge of change.''

By allowing other groups or individuals to impose change upon us, we are in danger of being left behind and ignored (Haynes, 1992). Therefore, the process of change must be mastered. There will be some inevitable disruption and discomfort to the status quo when change is introduced, but when the motivating force for change is the improvement of patient care, as nurses we should rise to the challenge of change innovation through the ongoing acquisition of knowledge and skills (Stephenson, 1987).

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Sedation breaks: are they good for the critically ill patient? A review

Sally Pinder and Martin Christensen

ABSTRACT

Background: Tradition has led us to believe that a heavily sedated patient is a comfortable, settled, compliant patient for whom sedation will improve outcome. The current move witnessed in clinical practice today of limiting sedation has led health care in recent years to question the benefit and necessity of routine, continuous sedation for all patients requiring mechanical ventilation. However, as a result there has been a rise in the amount of agitation being reported as being experienced by patients with the daily withdrawal of sedation.

Aims: The purpose of this paper is to review current arguments for and against perserving with agitation versus re-sedating, when it presents during the daily sedation breaks.

Findings: Of the literature reviewed, the question to re-sedate the mechanically ventilated agitated patient during sedation breaks remains an issue of contention. Although there is evidence focusing on the psychological effects of long-term sedation and sedation breaks specifically, the complex nature of critical illness in some cases means that individualized care is of paramount importance and in-depth assessment is crucial when deciding to re-sedate in the face of undetermined agitation. Agitation has been closely linked with several incidents that can be detrimental to patient safety, such as removal of lines and unplanned self-extubation.

Conclusion: The recommendations of this review are that nurses should re-commence sedation if the patient becomes agitated following a sedation break.

Key words: Agitation • Sedation • Sedation breaks

INTRODUCTION

A focus of research in the area of critical care since the 1990s has been that of sedation practices, finding widespread inconsistency in terms of the pharmacology, the assessment tool used alongside the aims for sedation. For example, only 43% of UK Intensive Care Units (ICU) used a sedation policy/scale in 1999 (Walder and Tramer, 2004) for the treatment of agitation and anxiety (Hansen-Flaschen *et al.*, 1991; Dasta *et al.*, 1994; Soliman *et al.*, 2001; Egerod *et al.*, 2006). Several studies since 1998, have concentrated their focus specifically on the benefit of a daily sedation break, finding very significant results when comparing it to continuous sedation (Kollef *et al.*, 1998; Kress *et al.*, 2000). In view of the National Health Service (NHS) constant financial constraints, thriving to improve efficacy of care and clinical outcomes, these findings have caused much discussion involving ethics versus best interest.

Authors: S Pinder, RGN, DipHE, Staff Nurse, Intensive Care Unit, Queen Alexandra Hospital NHS Trust, Portsmouth, UK; M Christensen, RGN, DipHE, PGCert (ICU), BSc (Hons), MSc, MA (Ed), Senior Lecturer, Bournemouth University, Bournemouth, UK

Address for correspondence: M Christensen, RGN, DipHE, PGCert (ICU), BSc (Hons), MSc, MA (Ed), Senior Lecturer, Bournemouth University, Christchurch Road, Bournemouth BH1 3LT, UK

E-mail: mchristensen@bournemouth.ac.uk

Previous recognition of the potential for post-ICU recollection distress, contributed to the clinician's desire to over-sedate; however, the publication of research related to this has prompted questions of concern as to the unknown psychological effect of daily sedation breaks (Heffner, 2000). Over the past 4 years, studies have been undertaken to ascertain validity of this practice, concluding that there is no psychological impact as a result of daily cessation of sedative infusions (Kress *et al.*, 2003); in fact, several papers indicate the contrary, that delusional memories are significantly associated with a higher prevalence of post-traumatic stress disorder (PTSD) in comparison to factual memories from an increased level of consciousness (Samuelson *et al.*, 2003; Capuzzo *et al.*, 2004; Van de Leur *et al.*, 2004). However, whilst this is an important consideration, it is questionable as to the reliability of this premise for assessing the rates of agitation associated with PTSD because of the retrospective nature of the work presented and clearly identifying the nature of the distress.

It is apparent that patient outcomes both long and short terms are influenced by the manner in which agitation is managed. Research indicates that polypharmacy and failure to appreciate that the prolonged residual effects of sedative drugs are a common cause of cerebral dysfunction, agitation and confusion in this situation (Cardy and Matta, 1997). It could be argued

that placing patients in a position where they are distressed or agitated in order to reduce length of stay is unethical and the benefits of sedation breaks should be looked at more closely.

AGITATION DEFINED

Doherty (1991) defines agitation as

> ...a syndrome of altered cognitive function and confusion that is demonstrated in restless behaviour (p. 748).

This definition is perhaps the most precise as it encompasses both the psychological and physical elements of this symptom. Tietze and Wittbrodt (2005) define it in a way that is easily related to the agitation seen during waking from a period of sedation in the ICU environment:

> ...a sustained state of apprehension and autonomic arousal in response to real or perceived threats (p. 228).

However, the exact pathophysiology of agitation is unknown, although presumed to be related to imbalances in neurotransmitters that modulate the control of cognitive function behaviour and mood (Pun and Ely, 2004). The stress response, automatically triggered as a result of any insult leading to a stay in ICU, initially involves the sympathetic division of the nervous symptom, causing vast neurohumoral elevations of plasma catecholamines. Severe stress results in hormonal responses involving cortisol, anti-diuretic hormone and acute phase plasma proteins. The symptoms of stress are tachycardia, hypertension, vasoconstriction, increased myocardial oxygen (O_2) demand and general O_2 consumption, sodium and water retention and dulling of the immune response (Blanchard, 2002). During waking, a number of factors can lead to agitation; the increase in peripheral metabolism alongside the increased O_2 demand already on the body, causes an increase in lactate and carbon dioxide (CO_2) production. Hypercapnia stimulates the sympathetic centres, producing further tachycardia, hypertension, panic and production of more endogenous catecholamines. In turn, this excitation leads to a reduction in β_2 adrenergic receptor sensitivity leading to further anxiety. These physiological reactions, which are normally beneficial responses, are maladaptive in the artificial ICU environment and it is sometimes necessary to block them out as selectively as possible as an increase in CO_2 (and lactate) across the blood brain barrier causes increased panic. Hyperventilation at this point causes hypocapnia, cerebral constriction and therefore reduced cerebral blood flow and mild cerebral hypoxia, resulting in confusion, reduced ability for oxidative metabolism and therefore a worsened lactate acidosis (Cardy and Matta, 1997).

The ICU environment provides a repository of typical predisposing factors of a haemodynamic/metabolic nature alongside a delusional, unfamiliar environment. The reasons for a patient presenting as agitated at any point during their stay including during waking from sedation, are often multi-factorial, e.g. pain alongside disorientation (Table 1).

ARGUMENTS FOR RE-SEDATION

Studies have suggested that daily sedation breaks result in a decrease in total number of mechanically ventilated days by 30–50%, and a reduction in days

Table 1 Proposed causes of agitation in critically ill patients

Internal – associated with illness or physiology	External – associated with physical environment	Caused by treatment
Infection (3,10)	Sleep deprivation (2,3,8,10,13,15)	Withdrawal from sedatives (1,3,5,7,13,14)
Sepsis (1,2,5)	Pain (1,2,4,10,15) – Surgical + less overt causes, e.g. ETT, IDC, Position	Anxiety + disorientation (2,12)
Fever (1,2,10)	Fear + Disorientation (15)	Alcohol + drug withdrawal (2)
Encephalopathy (1,12)		Medication side-effects (1,2,5)
Hypoxaemia (2,10)		
Hypoglycaemia (2,12)		
Arterial hypotension (1,10)		
Inflammation (2,12)		
Brain injury (2)		
Acute Renal failure + Uraemia (2,4)		
Metabolic disturbance (11,14)		

(1) Kress *et al.* (2002), (2) Walder and Tramer (2004), (3) Capuzzo *et al.* (2004), (4) Cohen *et al.* (2002), (5) Singer and Webb (2005), (6) Dubois *et al.* (2001), (7) Cammarano *et al.* (1998), (8) Hansen-Flaschen (1994), (9) Cardy and Matta (1997), (10) Jacobi *et al.* (2002), (11) Barr *et al.* (2001), (12) Jones *et al.* (2000), (13) Crippen (1999) and (14) Hines (2007).

spent on ICU by 40% (Kollef *et al.*, 1998; Kress *et al.*, 2000). Other positive benefits included the reduction in the amount of sedative drugs used, an increased reliability of neurological assessment tools as well as less need for diagnostic tests to identify reasons for slow waking (Kollef *et al.*, 1998; Kress *et al.*, 2000). In addition, Rello *et al.* (1999) argued that less sedation was associated with a reduced prevalence of the following: rate of ventilator-associated pneumonia, barotrauma, bacteraemia, upper gastrointestinal bleeding and organ failure, and therefore resulting in an increased rate of recovery. Daily sedation breaks can reduce drug tolerance and also enable the lowest amount of sedation to be administered, some patients requiring none at all (Schweickert *et al.*, 2004).

There has been no research to date exploring the effects of agitation during waking. Studies into the area of sedation cessation, have used agitation as an endpoint to the sedation break, e.g. Kress *et al.* (2002) state that '...excessive agitation should lead to cessation of the wake-up attempt....and tried on subsequent days' (p. 1026). Barr *et al.* (2001) also used this endpoint in their study involving 30 medical and surgical patients in which they re-sedated to obtain an extremely heavily sedated Ramsay score of 5–6, a score agreed by Boulain (1998) concluding that agitation can prevent successful waking and that agitated patients should not be considered fit for weaning from mechanical ventilation. A small-scale randomized controlled trial (RCT) in 128 mechanically ventilated patients in a medical ICU found 32% of the experimental group required re-sedating as a result of agitation, confirming concerns of agitation during waking from sedation (Kress *et al.*, 2000).

The findings of Kress *et al.* (2000) and others strongly indicate that heavy sedation can be both detrimental and unnecessary for the patient. The aetiology does, however, provide a fairly strong argument for re-sedating the agitated patient during daily sedation cessation. Clinical experience shows that the agitated patients frequently present with clinical signs of tachycardia and hypertension; these, alongside the hyperadrenergic stress response that can be attenuated by sedatives, can lead to excessive O_2 consumption (VO_2), which can be detrimental in patients with respiratory failure or shock. The earlier work of Kress *et al.* (1996) found that the VO_2 is reduced from an initial stage by an average of 15% post-infusing sedative and analgesia. Furthermore, Heffner (2000) and Kress *et al.* (2002) also point out that with the distress of waking there is a considerable risk of myocardial ischaemia in certain patient groups. Whilst the problems associated with hyperadrenergic stimulation can lead to myocardial insufficiency in a prospective cohort study investigating frequency and complications of severe agitation in mechanically ventilated patients, Woods *et al.* (2004) found that the agitated patient had a significantly lower pH and P_aO_2:F_iO_2 ratio, again highlighting areas of concern for this patient group in terms of their readiness to wean from mechanical ventilation. Furthermore, they also found that 16% of the study group displayed severe agitation. The results of this found that agitated patients were significantly more likely to unplanned self-extubation (UEX).

It is this increased risk of UEX that causes some concern, especially in patients not ready to be weaned (Birkett *et al.*, 2004). In a large prospective study Boulain (1998) reported that 61% of patients experiencing UEX (10.8%) were considered agitated at the time of extubation. This finding is consistent with the findings of Walder and Tramer (2004) in which the high number of UEX occurred despite the nursing staff being aware that the study was taking place, which clearly has implications for nursing practice, responsibility and accountability. However, Kress *et al.* (2000) did not find any significant difference in the percentage of UEX or removal of invasive lines between the control group on continuous sedation and the intervention group with daily sedation breaks, although there is no documented relevance or relation to agitation. Yet, clinical experience confirms the increase in self-removal of invasive devices by agitated patients. Boulain (1998) acknowledges the issue of physical restraint and its place as an alternative for heavy sedation in caring for the agitated mechanically ventilated patient; however, clinical experience finds that a determined agitated patient will find some way to self-UEX or remove an invasive line even when restrained. The rate of re-intubation post-UEX in French and American studies has been found to be 61–86% (Boulain, 1998; Woods *et al.*, 2004), leading one to question whether patients are being assessed for readiness for weaning/extubation early enough.

There is current concern as to whether waking patients on a daily basis and then re-sedating them could increase their risk of developing PTSD. Kress *et al.* (2003) found that an inability to recall memories was not harmful and therefore concluded that re-sedating agitated patients may not cause negative psychological effects. Van de Leur *et al.* (2004) makes an assumption from clinical opinion and the findings of a fairly small cohort study (n = 123) that when sedatives are reduced below effective levels, patients tend to remember negative experiences in the ICU. Although there is no mention as to the sedation scores of patients in this study, this would support the

traditional view that it is kinder to re-sedate the agitated patient. Minnick *et al.* (2001) supported these findings during a study of recollections of agitated elderly ICU patients requiring physical restraint. It is important to note from this study that 40% of patients remembered being restrained and persistently 'told to stop pulling at everything'.

ARGUMENTS NOT TO RE-SEDATE

The different drugs used in sedation are potentially dangerous; not only do they act on the central nervous system to reduce pain and suffering, but they also have many side-effects and associated complications, frequently respiratory depression, hypotension and amnesia. The pharmacokinetics/dynamics of these drugs on ICU patients is unknown because of altered metabolism, storage and tendency to build tolerance (Crippen, 1999). Most research into their effects has been carried out on healthy individuals in the anaesthetic room; however, it is clear that if overused, or used carelessly, these drugs are a cause of morbidity, mortality and increased cost (Park, 2001).

Some studies have described the discomfort remembered by patients from the presence of the endotracheal tube, to sleeplessness, dyspnoea, disorientation and the inability to communicate (Turner *et al.*, 1990; Van de Leur *et al.*, 2004); however, none looks into the effect of agitation. The argument of re-sedating to prevent psychological stress does not appear to fit with recent theories concerning the memory of ICU experiences. Jones *et al.* (2000) discuss the theory that the body has a natural defence mechanism, which affects memory negatively for external events, but enhances memory for internal events; this may explain why patients often cannot remember much of the external environment, but vividly remember the dreams/hallucinations. The presumption frequently heard that naturally occurring amnesia protects patients from the discomforts of ICU is not supported by any data (Heffner, 2000; Capuzzo *et al.*, 2004; Van de Leur *et al.*, 2004). Authors of recent studies into the recollection of ICU experiences propose similar theories that factual recollections as opposed to delusional memories help to offset the emotional, adverse psychological outcomes of the ICU patient. Samuelson *et al.* (2003) found that the presence of factual memories significantly reduces symptoms of PTSD and as such it could be anticipated that this was a result of increased level of consciousness presumably from less sedation. In more recent work 54% of patients recalled experiencing discomfort. (Capuzzo *et al.*, 2004; Van de Leur *et al.*, 2004). Clinical experience indicates that re-sedating agitated patients during a sedation break can cause further disorientation and cognitive impairment at the time and the build-up of sedative drugs in the tissues, causing a similar problem during the following wake-up attempt.

However, another reason not to re-sedate the agitated patient is that once sedated the underlying causes of agitation may be obscured, e.g. organ damage that may be occurring either directly from the effects of the agitation itself or as a result of not relieving the underlying pathology. Several authors suggest the importance of identifying and correcting the suspected underlying cause before re-sedating (Cohen *et al.*, 2002; Jacobi *et al.*, 2002; Maccioli *et al.*, 2003; Wood and McCartney, 2004; Tietze and Wilttbrodt, 2005). One of the most frequently documented causes of agitation in the ICU is untreated pain (Cohen *et al.*, 2002). Kress *et al.* (2002) states that sedatives must never be given as a substitute for analgesia. Clinical experience shows many causes of pain when no surgical site is present, such as backache from one position, the presence of an indwelling catheter, central venous catheter and other invasive lines and endotracheal tubes. This then begs the question as to whether an agitated patient unable to communicate on waking may well benefit from a bolus of analgesia in order to rule out pain and to aid in preventing unnecessary polypharmacy, which can in turn worsen agitation. During patient assessment, it is vital where possible to discriminate between agitation and delirium, which is associated with a poor prognosis and requiring different treatment (Cardy and Matta, 1997; Bergeron *et al.*, 2005) and also to rule out opiate/sedative drug withdrawal.

NON-PHARMACOLOGICAL ALTERNATIVES TO RE-SEDATION

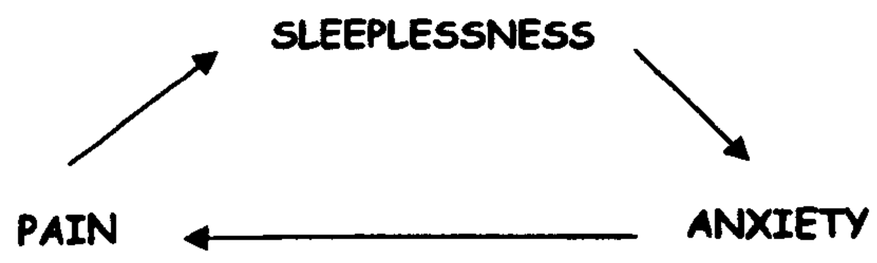
Bizek (1995) informs of the necessity of making an assessment of the metabolic and haemodynamic stability of the patient as to whether immediate pharmacological therapy is necessary until the cause has been reversed, or whether non-pharmacological strategies could be tried first. Physical restraint, which is used widely in USA as an alternative to sedation with agitation in ICU, raises conflict between respect for patient dignity and autonomy, preventing harm and promoting the most positive outcomes for the patient (Hines, 2007). Research also has shown that physical restraints are not successful in the prevention of some adverse events because of agitation such as catheter and endotracheal tube removal and that on occasions restraint may aggravate the agitation (Boulain, 1998; Hines, 2007). The challenge therefore of practitioners today is to establish a more humane and dignified way to manage these behavioural problems.

Restraint, both chemical and physical, must be a last resort and should only be considered when alternative methods of therapeutic behaviour management have failed.

On some occasions when re-sedation is not the desired treatment, the use of physical restraint should not necessarily be ruled out, as long as it is in the patient's best interest/safety and all other methods have been explored. One study in comparing the nursing care of conscious mechanically ventilated patients in the UK and Sweden described how Swedish patients who are confused after discontinuing initial sedation, are physically restrained with loose wrist ties in order for them to 'work through the often unpleasant transition between sedation and lucidity' (p. 141) (Monger, 1995); it was observed in these patients that the ties seemed to calm the patient.

The traditional thought of 'prevention is better than cure' remains true in the ICU environment, but with multifaceted causes of agitation, this is not always simple. There are certain causes that can be reduced and certain causes that can be corrected once presentation has been noted, but still the role of non-pharmacological management is vital (Yagan *et al.*, 2000). Research looking into the psychological effects of ICU on 10 healthy subjects (not mechanically ventilated) showed a significant increase in fatigue, confusion and depression (Tanimoto *et al.*, 1999), leading one to presume that the effect on a critically ill mechanically ventilated patient to be at least 10-fold.

The cycle of the mechanically ventilated patient at the best of times is often described as



This cycle can cause agitation when combined with other causative factors (Table 1).

The nurse is in a unique position to some extent, to manipulate the close environment to ensure that it is a healthy one; many of which can be ascertained during patient assessment and can then be acted upon. Music therapy, which achieves its relaxing effects through stimulation of the parasympathetic and limbic system, from clinical experience can be extremely successful in relaxation, as long as the music is selected specific to the patient's taste (not that of the nurse). A large study (n = 464) undertaken in Portugal, found very surprising results that in 88% of patients: music therapy in the ICU was associated with stress (with no mention of the sedation level of these patients) (Granja *et al.*, 2005). Moreover, the use of complementary therapies are used widely in American ICUs; however, specialists in this field are limited in the NHS and many of the therapies can have incompatibilities with conventional medicine.

Communication is a skill held by many nurses; however, clinical experience shows that certain nurses are better caring for an agitated patient than others; one can assume because of the different approaches to communication. Several authors acknowledge the importance of maximizing communication and by ensuring that glasses and hearing aids are worn immediately on waking (Fontaine, 1994; Johnson, 2001; Walder and Tramer, 2004; Hines, 2007).

Family visiting can be a double-edged sword; sometimes family members can aggravate agitation, other times they can improve it and create a calm, familiar environment; the nurse is the patient's advocate and must initiate alterations in visiting suggestions for the patient's benefit. In the technicalities of the ICU environment, it is all too easy to forget the traditional compassionate nursing care set out by Florence Nightingale, but in this area in particular, the non-pharmacological strategies will aid in both the prevention and management of agitation during sedation breaks in order to persevere with waking the patient safely.

CONCLUSION

From the literature reviewed, the debate of whether to re-sedate the mechanically ventilated, agitated patient during sedation breaks remains unanswered. The lack of RCTs with adequate numbers and transferability is a common problem in ICU, and although there is some strong research into the area of sedation breaks and the psychological effects, there remains insufficient research into this specific area in relation to agitation. It has become evident that the research currently available on this subject has been undertaken in varying patient groups. As a result of the complex patients commonly seen in ICU, it is obvious that all patients will need to be treated individually depending on their needs, both medically and psychologically. It is vital that all practitioners remember that the optimum necessary sedation level will be influenced by the patient's illness and the supportive treatments they require. This assessment is of considerable importance in the decision whether to re-sedate when the patient is agitated. The fact that discomfort is not always remembered does not imply that the patient has not suffered during his/her stay in ICU, therefore whichever management of agitation is chosen a reduction in discomfort should remain a focus of our care.

Of importance is that the use of physical restraint on a patient without consent, according to Human Rights Act (1998), is abuse of their right to freedom. However, the Nursing Midwifery Council Code of Professional Conduct (2004) states that a duty of care of the nurse requires 'clients to be safe and respected as individuals whose interest and dignity is protected'; therefore physical restraint must always be performed in accordance with the ethical principles of beneficence and non-maleficence. The Royal College of Nursing clearly condones the documented use of physical restraint in USA in relation to inadequate staffing levels (Royal College of Nursing, 2004; Martin, 2005). Therefore, in view of this, it is vital that the use of sedatives and neuroleptics in the agitated, waking ICU patient are only used to mitigate the need for restraining therapies and are not overused as a method of chemical restraint.

WHAT IS KNOWN ABOUT THIS TOPIC

- There is debate about the appropriateness of long-term sedation in the critically ill patient and that this may lead to PTSD.
- Sedation breaks can reduce the incidence of PTSD, drug tolerance and the amount of sedation required.

WHAT THIS PAPER ADDS

- This paper examines the incidence of agitation in relation to the inception of sedation breaks and questions as to whether nurses perceive this as delirium and therefore re-sedate patients unnecessarily.
- It also identifies that agitation is a poorly understood phenomena within the critical care.

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A dedicated retrieval and transfer service: The QUARTS Project

Sue Andrews, Sue Catlin, Nikki Lamb and Martin Christensen

ABSTRACT

Background: The transfer and/or retrieval of a critically patient is inherently dangerous not only for the patient but for staff as well. The quality and experience of unplanned transfers can influence patient mortality and morbidity. However, international evidence suggests that dedicated transfer/retrieval teams can improve mortality and morbidity outcomes.

Aims: The initial aim of this paper is to describe an in-house competency-based training programme, which encompasses the STaR approach to develop members of our existing nursing team to be part of the dedicated transfer/retrieval service. The paper also presents audit data findings which examined the source of referrals, number of patients actually transferred and clinical status of those being transferred.

Results: Audit data illustrate that the most frequent source of referrals comes from Accident and Emergency and the Surgical Directorate with the most common presenting condition being cardio-respiratory failure or arrest. Audit data reveal that the number of patients actually transferred or retrieved is relatively small (33%) compared with the overall number of requests for assistance. However, 36% of those patients transferred had a level 2 or level 3 acuity status that necessitated the admission to a critical care area.

Conclusions: A number of studies have concluded that the ill-experienced and ill-equipped transfer team can place patients' at serious risk of harm. Whether planned or unplanned, dedicated critical care transfer/retrieval teams have been shown to reduce patient mortality and morbidity.

Key words: Patient retrieval • Patient transfer • STaR • Transport

INTRODUCTION

Undoubtedly, the purpose of a retrieval and transfer service is to provide a safe and effective means of transporting seriously and critically ill patients to continuing critical care facilities and also for investigation in other departments. Yet, this has not always been the case. The media has reported in recent years the plight of critically ill patients being transferred to hospitals up to 200 miles away, and worse still, where patients have died because of the lack of available critical care beds (Dickson, 1999; Wells, 1999; BBC News, 2000, 2003a, 2003b; Marsh, 2003; Hawkes, 2004; Carvel, 2005). However, despite improvements in the provision of critical care facilities as a result of such documents as the Comprehensive Critical Care review (Department of Health, 2000, 2001), the literature continues to raise concerns about the quality, competence and experience of the staff undertaking transfer or retrieval (Bannell *et al.*, 1997; Mackenzie *et al.*, 1997; Wallace and Lawler, 1997; Bellingan *et al.*, 2000; Gray *et al.*, 2003, 2004; Stevenson *et al.*, 2005).

The Intensive Care Society (2002) and Comprehensive Critical Care (Department of Health, 2000) identify the need for transfer staff to be adequately trained and competent in order to undertake the transfer safely. While these two documents set out clearly the expected norms in terms of staff competency and the number of escorts, there may appear to be little structured training available to those responsible for patient safety during this process. Although the Advanced Life Support Group (2002) has developed the Safe Transfer and Retrieval (STaR) programme in order to meet this shortcoming, the question still remains as to whether those transfer teams who have not signed up to this or other programmes can be considered competent in light of recent work (Gray *et al.*, 2003, 2004; Stevenson *et al.*, 2005). Just as important, the adoption of these programmes also comes at a cost. This is even more relevant in the current climate of economic health reform where bed closures and staff redundancies may be seen by some financially constrained National Health Service hospitals to not being financially viable. However, there is evidence from

Authors: S Andrews, RGN, RSCN, DipHE (ICU), DipHE (Child), BSc (Hons), Sister, Department of Critical Care, Portsmouth Hospitals NHS Trust, Portsmouth, UK; S Catlin, RGN, DipHE, ENB 100, Sister, Department of Critical Care, Portsmouth Hospitals NHS Trust, Portsmouth, UK; N Lamb, RN, DipHE, ENB 100, Senior Staff Nurse, Department of Critical Care, Portsmouth Hospitals NHS Trust, Portsmouth, UK; M Christensen, RGN, DipHE, PGCert (ICU), BSc (Hons), MSc, MA (Ed), Senior Lecturer, Bournemouth University, Bournemouth, UK

Address for correspondence: M Christensen, Bouremouth University, Royal London House, Christchurch Road, Bournemouth BH1 3LT, UK

E-mail: mchristensen@bournemouth.ac.uk

overseas and within this country to suggest that specialist transfer/retrieval teams do make a difference to patient outcome (Bannell *et al.*, 1997; Wallace and Lawler, 1997; Anderson, 1998; Holleran, 2002; Diefenbach, 2003; Gray *et al.*, 2003; Leslie and Stephenson, 2003; Whitelaw *et al.*, 2006). Therefore, this paper will discuss how we prepare our staff with an in-house competency-based programme to undertake safe, effective transfer and retrieval of critically ill patients.

THE QUEEN ALEXANDRA RETRIEVAL TRANSFER SERVICE PROJECT

Background

The Queen Alexandra Retrieval Transfer Service (QUARTS) Project was developed in the mid-1990s to meet the needs of patients requiring specialist critical care services from outlying district hospitals and the transfer of critically ill patients, especially paediatric cases, to tertiary facilities. The team on average gets 1800 referrals per year although only a small percentage of these actually involve patient movement. A continuous database of transfers and retrievals is collated and updated after completion of the transfer. Data collected includes, e.g. the patient name, age, admission diagnosis, reason for transfer, referring team and whether admission to intensive care unit (ICU) was required.

The Queen Alexandra transfer and retrieval service covers within its catchment area three District General Hospitals; however, the service is not confined only to interhospital transfers or retrievals. The role of the transfer and retrieval team also plays a major part in transporting critically ill patients throughout the hospital itself, whether they require ICU admission or are level 2 or 3 patients needing to go to other hospital departments such as radiology. The uniqueness of this service is the rostering of specially trained, competent ICU nurses supernumerary to existing ICU staff numbers allocated for transfers and retrievals only. However, to be eligible to undertake this role, applicants must have extensive critical care nursing knowledge and experience, which is reliant on successful completion of a recognized ICU nursing course and a minimum of 2 years postqualifying experience. The team often involves a medical practitioner and nurse; yet, the calibre of the medical staff is sometimes dependent on the severity of the patient's illness, but more often or not is a Senior House Officer (typically year 3 postqualifying) who has also attended the transfer study days, has been deemed competent and has current experience in ICU medicine. There is, however, no technician support; therefore, greater emphasis is placed upon the transfer nurse to be responsible for and to be completely familiar with their transfer packs and equipment.

AIMS AND OBJECTIVES

The aim of QUARTS was to rapidly and methodically take a specialist retrieval and transfer team to a patient to stabilize and later transport them so that appropriate ongoing care can be facilitated.

The objectives of QUARTS are as follows:

- Ensure evidence-based care is at the forefront of care delivered through standardized and integrated critical care services.
- Ensure ongoing education and training of appropriate staff is in line with current government and professional recommendations (Department of Health, 2000; Intensive Care Society, 2002).
- Ensure users receive a first-class, best practice service that is efficient, effective and maximizes patient safety (Department of Health, 2005).

EDUCATION AND TRAINING

At its inception, education and training was based loosely on personal experience in undertaking patient transfers. It has, however, become more prominent as the need to ensure competency in safely moving critically ill patients between and within the hospital has become of considerable significance. To ensure consistency in the information being delivered, a dedicated teaching team was established to bring clinical expertise and experience to the programme. Yet, there was no formally designed programme that met universal standards of patient transfer; therefore, this meant that education and training was solely a local effort.

Currently, educating staff to fulfil the role of transfer nurse is undertaken using the STaR (Advanced Life Support Group, 2002) programme as its basis together with the ACCEPT (Assess, Control, Communication, Evaluate, Prepare & Package, Transport) (Advanced Life Support Group, 2002) approach as one of the guiding principles for safe transfer. The STaR programme was developed to meet the difficulties experienced by health care professionals in the transportation of critically ill patients. Its guiding principles ensure that the right personnel take the right patient at the right time, to the right place and use the right form of transport (Advanced Life Support Group, 2002). Central to this is the ACCEPT approach that entails 'assessing' and 'controlling' the situation, providing effective channels of 'communication', 'evaluating' the appropriateness and urgency of the transfer, 'preparing' and 'packaging' the patient for transfer and finally ensuring the appropriate choice of 'transport'. This format has also been embraced by the Southern Central Critical Care Network, a network of Critical Care Units within

the Wessex region, as being the mainstay in training of a competent Transfer and Retrieval team. To this end, members of the QUARTS teaching team are then employed throughout the network to provide education and training to hospitals requiring and wanting this knowledge and support – similar to a 'train the trainers' type programme with ongoing advice and support available as and when needed.

Eligible staff are brought together for one of the ongoing study days specially designed to encompass the theoretical and practical knowledge of transfer and retrieval care. Once trained and having successfully completed the StaR course, staff are then allocated to the transfer team where they remain supernumerary for a set period of time before being assessed competent to undertake the role independently. It is during the supernumerary time that our trainee staff work closely with a certified member of the transfer team accompanying them on transfers and/or retrievals until such time that they feel comfortable in the role, in this case a minimum of three intrahospital and interhospital transfers/retrievals. Once deemed able to undertake the role independently, the trainee is then allowed to embark only on intrahospital transfers/retrievals independently. Thereafter, as their skills and experience improve, they are then able to take on full transfer/retrieval duties. The whole process of becoming an independent member of the transfer takes a minimum of 3 months. However, this training programme is not merely 'hands-on'; the trainee has to also complete an extensive competency document, which forms an integral part of their final assessment.

The role of the mentor is central to the trainee being successful in the completion of the competency document and being eligible to be an independent practitioner within the transfer team. One of the key aspects of the role is setting the ideal teaching–learning environment. While the majority of the learning is primarily 'hands-on', accompanying the transfer nurse in a shadowing role assists in relating theoretical knowledge gleaned from the study days into practice. Moreover, the role itself is seen more as a facilitator of learning where the mentor is responsible for ensuring that the trainee is in a position to best develop their decision-making and problem-solving skills and allow opportunities for additional learning to take place as well as being a clinical role model. Although we have adopted a semiformal approach to the role of the mentor, a less-structured approach is provided for the junior medical staff primarily through the registrar grades and on occasions consultant input.

The outline of the study days is to focus on the key aspects that are recommended by the ACCEPT principle (Advanced Life Support Group, 2002). Theoretical topics such as the legal responsibilities of patient transfer and transport, professional responsibilities of team members and communication then set the scene for the practical work, which involves the hands-on use of the equipment. The use of case studies to underpin the theoretical components is integral in making the trainee more receptive to the real life problems that may and often are experienced while on transfer or retrieval duty.

The 28-page competency document contains five separate competencies, which range from familiarity with the equipment to reflective pieces using a modified Driscoll (1994) framework of reflection. However, interspersed within these competencies, our trainees are encouraged to complete case studies pertinent to each competency to reinforce learning both theoretically and practically as well as construct a logbook of transfers identifying what went well and what did not. For example, one case study focuses on the transfer of a patient to a regional liver unit. The trainee is then asked to undergo a problem-solving exercise related to that patient condition and the type of transfer that this patient may undergo identifying actual and potential problems that may occur on route. These case studies are then discussed between trainee and their assigned mentor to confirm understanding. Three reflective pieces also reinforce learning but more importantly identify future training needs to ensure poor performance does not become an issue and forms part of the appraisal system.

The education programme together with the unit's appraisal system meets the requirements of the core dimensions and the General, Information and Knowledge specific dimensions of the Knowledge and Skills Framework (KSF) (Department of Health, 2004). The KSF is seen as part of the necessary skills and knowledge that practitioners need to deliver quality services and as such is central to QUARTS aims and objectives. Because of the close collaboration with medical colleagues, the training programme focuses on interprofessional team working both theoretically and practically. In the practical setting, this is often accomplished through guidance and support from both experienced medical and nursing staff for those new to the transfer team; in some cases, it may well be the experienced transfer nurse who directs the transfer. It is through this support network that the basis is set for autonomous practice and which encourages the individual nurse to reflect upon their professional responsibilities as outlined by our Code of Professional Conduct (Nursing and Midwifery Council, 2004). Moreover, recent developments in nursing career structure and development has meant that we are

constantly improving the programme to take into account these changing roles (Department of Health, 2006), e.g. our vision of a nurse-led retrieval and transfer service for level 2 patients.

EQUIPMENT

Since its commencement 10 years ago, the transfer team has undergone four equipment upgrades as medical equipment has developed. Originally the team had its own specialist mobile ICU ambulance; however, increasing running costs and the age of the ambulance has meant that we now use frontline ambulances for interhospital transfers or retrievals. Initially, we were confined to one adapted stretcher to transfer/retrieve both adult and paediatric patients which proved cumbersome, especially when there was more than one transfer/retrieval to be undertaken. Currently, we have three specially constructed stretchers to ICU standards; two adult and one paediatric, all equipped with a ventilator (Oxylog 2000 & Brease), multichannel monitoring (Seimens SC7000), suctioning equipment, a defibrillator (Phillips Heartstart), infusion and volumetric pumps and an independent oxygen supply. These stretchers have the ability to be connected to the ambulances oxygen and power supply to reduce the drain on the equipment batteries as well as reducing the need to use the stretchers limited oxygen.

TRANSFER/RETRIEVAL TEAM AUDIT

Because of the confidential nature of the information, permission was sought and granted to access the QUARTS database. To maintain patient confidentiality and anonymity, all personal patient details were removed during the compiling of the data. Within a 12-month (April 2004 to March 2005) period, the transfer team had 1968 referrals, whereas the first 6 months of 2006 saw 1171 referrals. While this may appear to be significant in terms of patient movement, 33% of patients were transferred or retrieved with the majority (90%) being intrahospital transfers or retrievals (Table 1). In most cases, the transfer team was present onsite to offer and provide advice and support to the referring team. By far, the biggest referral areas are the Surgical Directorate and Accident and Emergency (A&E), accounting for nearly 60% of the patients seen. A&E is of particular interest because the patients are nearly always community admissions with a level 2 or level 3 status, and often require transfer to critical care areas or for investigational procedures. Of note is the small amount of referrals from the Outreach Team considering the large number of patients transferred and retrieved yearly. Unlike some hospitals where Outreach provides the transfer support especially where an admission to ICU is likely, the Outreach team here provides an advisory role, whereby they will advise the attending medical team to use the services of QUARTS instead. It is then up to the transfer service to provide the medical and nursing expertise to safely transfer that patient to wherever they need to go with the referring team providing specialist advice as is needed.

However, when the need arises that our ICU patients require transferring to other departments, the patients' nurse accompanies the transfer team because of the impracticality of handing the patient over to the transfer team for only a short period of time. Although it does raise the question of de-skilling the bedside nurse, to date we have not seen this as a problem for two reasons. First, there are a large number of nurses on the unit who are competent in transfers already, and secondly, for the more junior nursing staff, the chance of assisting on a transfer allows for a unique learning opportunity.

Table 1 Intrahospital adult transfer/retrievals undertaken between April 2004 and March 2005

Referring ward	Number of patients	Average patient age	Outreach involvement	Level 2 status*	Level 3 status*	Average time on transfer/retrieval (min)	Admission to ICU
A&E	466	70	No	53	76	48	129
Surgical	483	75	Yes (>1%)	97	32	31	169
Medical	231	69	Yes (>1%)	94	18	40	34
CCU	32	67	No	15	4	45	4
Theatres	125	68	No	7	7	21	34
ICU	94	59	No	38	56	54	—
MAU	218	70	No	93	18	46	43
Paediatric	53	9	No	12	7	55	11

A&E, accident and emergency; CCU, coronary care unit; ICU, intensive care unit; MAU, medical assessment unit.
*Level 2 status is defined as those individual patients that require support for the failure of one organ system and level 3 status are those patients that require advanced respiratory support or basic respiratory support with the support of two or more organ systems (Department of Health, 2000).

Table 2 Common conditions requiring transfer or retrieval team intervention between April 2004 and March 2005 (intrahospital)

Causes	Sepsis	AAA	Diagnostic investigations	Cardiopulmonary arrest/failure	Head injury	Postsurgical complications
No. of patients	95	86	181	376	43	169

AAA, Abdominal aortic aneurysm.

As can be seen from Table 2, the more common conditions often encountered necessitate the transfer of these patients to a level 2 or 3 area of care. In some cases, these transfers, as in the case of cardiopulmonary arrest or failure, may in fact require diagnostic investigation prior to being admitted to high-dependency or intensive care areas, which explains in these particular cases the average time spent on the transfer or retrieval being relatively high (Table 1). That said, from our experience, it is not necessarily the patients' condition that contributes to the average time spent away but more likely the length of time in other departments, remembering of course the patient would have been stabilized prior to the transfer either by the referring team or with assistance from the transfer team.

Interhospital transfers/retrievals make up the remaining 10% of the transfer teams time. The number of paediatric cases that are referred to the team (Table 1), although small in number, pose specific challenges in terms of the care that they require. While our unit is equipped to care for paediatric patients, our status as a district general hospital means we are limited to the severity of the presenting illness. For example, our formal remit prevents us looking after paediatric patients with more than one system failure and under 1 year old. Therefore, the central focus of the team in this instance, again depending on the severity of the illness, is to stabilize the child prior to more specialist help arriving from the regional paediatric ICU. It is rare on these occasions that we would transfer paediatric patients ourselves because the regional unit has its own specialist retrieval service that is more acquainted with transferring critically ill children. Because of the very nature of paediatric patients in terms of their age and acuity, these are always attended to by a consultant and ideally a registered sick children's nurse. Of the adult cases, a small number of these are often repatriations to their home hospitals or in some cases, similar to that of the paediatric patients, the transfer is to a regional ICU, e.g. Neuro ICU.

CLINICAL GOVERNANCE

While the team does enjoy relative success in its ability to transfer patients safely and efficiently, this has not always been the case. Transferring or retrieving patients does put, not only the patient but also the transferring team at risk (Wallace and Lawler, 1997). While no serious harm has befallen any of the patients transferred, there have been a number of adverse events that have occurred during the transfer itself. For example, Table 3 highlights some of the difficulties that individual team members have experienced. These adverse events are fed through critical incident reporting into the quality assurance and clinical governance mechanism to ensure that these problems are highlighted and dealt with appropriately (Department of Health, 2005). One mechanism for the dissemination of incident reporting is the transfer teams' —six to eight weekly team meetings where issues are discussed and an action plan developed to address these issues; this process is ongoing.

However, lessons learnt as a result of adverse incident reporting has meant that we are continually striving to improve the service and as a result patient safety. For example, the team is equipped with a designated lift-key allowing them control of the lift they are travelling in. Also, modifications to the transport stretchers has meant that the equipment is carried beneath the patient thereby reducing the centre of gravity and allowing easy access to the patient, and the development of a modified crash trolley with all the necessary transfer equipment allowing for freedom of movement within the hospital without the need for taking a stretcher.

FUTURE PRACTICE

As the need for a dedicated transfer/retrieval team grows, there are good opportunities for the nursing element of the team to expand. With the advent of the critical care practitioner slowly becoming a reality

Table 3 Adverse events problems encountered during transfer/retrieval

Adverse events
Grades 3 and 4 intubations while in transit
Infusions dislodged
Ambulance delay
Batteries running out
ET tube displacement
Trapped in a lift
Cardiac arrest while in transit

(Department of Health, 2005), there would be scope for the team to be wholly nurse led, similar to that currently being developed elsewhere in the UK where Critical Care and Anaesthetic Practitioners play lead roles in cardiac arrest teams (Thomas, 2005; Mackintosh, 2006). Our plan for continuing education especially within the study days is to use the purpose built simulation laboratories currently used within the hospital for basic and advanced life support training, to further reenact transfer and retrieval scenarios as an adjunct to the case studies already undertaken.

CONCLUSION

Various studies have highlighted the shortcomings in the quality and experience of medical and nursing escorts in transferring critically ill patients, which range from the use of junior medical and nursing staff to an increase in patient morbidity and mortality (Bellingan *et al.*, 2000; Gray *et al.*, 2003, 2004; Stevenson *et al.*, 2005). The development of a dedicated transfer team ensures the provision of safe, efficient and good quality care to critically ill patients being transferred or retrieved.

WHAT IS KNOWN ABOUT THIS TOPIC?

- The quality and experience of some hastily put together transfer escorts can have an effect on patient mortality and morbidity.
- Evidence from overseas suggests that dedicated transfer/retrieval teams can reduce patient mortality and morbidity.

WHAT THIS PAPER ADDS

- Encourages the development of network wide educational programmes in the safe transfer and retrieval of adult critically ill patients
- Demonstrates the development of a step-wise competency-based programme that may contribute to continuing professional development

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CHAPTER THREE

THE WAY FORWARD:

Conclusions, Recommendations and Implications for Practice

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The Way Forward: Conclusions, Recommendations and Implications for Practice

It is evident to me that a dichotomy exists in terms of defining advanced and advancing practice and whether there is a discernable change in the advancement and expansion of existing knowledge within the nursing team – the move from 'knowing-how' to 'knowing-that' (Schon, 1983; Polkinghorne, 2004) – or is it simply the improvement of different skill sets in delivering patient care? Advancing practice from the individual nurse's perspective is more concerned with knowledge acquisition and integration as opposed to skill and task acquisition alone, even though the two are inextricably linked. Of course it could be argued that practice development initiatives are central to providing safe and quality evidenced-based care. This is evident in the ICU with the advent of comprehensive critical care (Department of Health, 2000, 2001). Yet, essential to this development is the retention, development and role expansion of critical care nursing staff which underpins the philosophy of a comprehensive critical care service (Department of Health, 2001). Many would agree that a career framework that advances the total professional role and a career progression from within the existing nursing structure is vital for the service (Rempusheski, 1990).

Therefore, what is emerging for me is an understanding and appreciation that advancing practice requires an eclectic approach to knowledge acquisition that can be conceptualised and integrated by practitioners. It is noticeable within existing frameworks, similar to those discussed in Chapter 1 that theoretical knowledge combined with reflective practice appears to be the cornerstone of professional development. However, I would contend that this is but a small part because I believe that, for these two facets to be fully appreciated in terms of advancing practice, a more rounded approach is needed to encapsulate both theoretical and practical knowing.

This is where the challenge lies in developing a model of integration specifically for individuals which will support and contribute to the overall

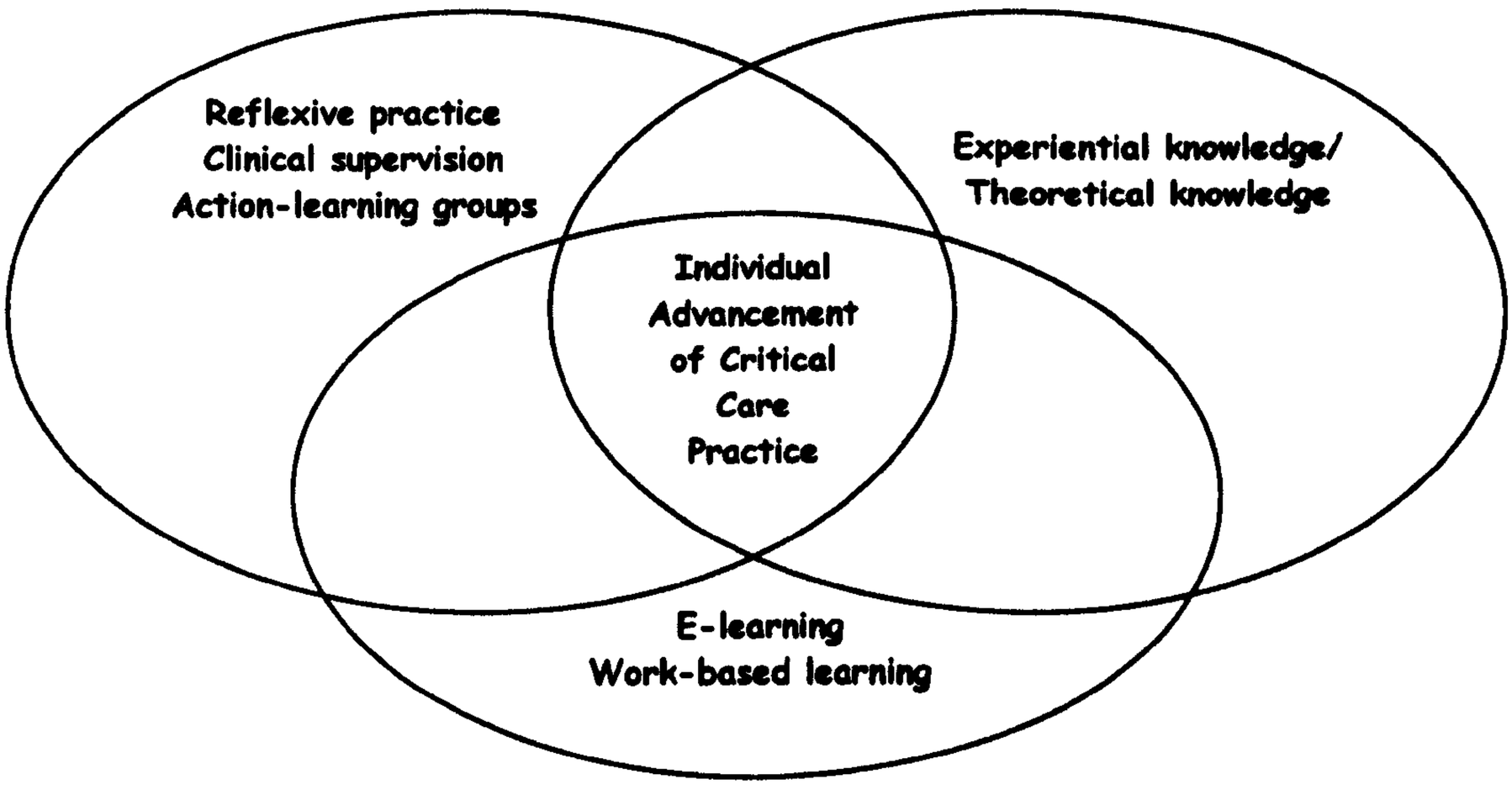
nursing care within the critical care environment. Scholes (2006), for example, has used the novice to expert model to develop the experiential learning of novice practitioners new to critical care nursing, whilst more experienced staff are encouraged to develop through the use of reflective practice, clinical supervision and action learning groups. This is a novel idea especially to newcomers to the ICU because it means that their progress can be mapped against existing unit competencies and it also identifies strengths and weaknesses in their practice. It is assumed, however, that more experienced staff have attained a competent level of practice and are working towards higher levels of learning and practice. These individuals require a different kind of input to their learning simply because of their status within the unit, and many may well be engaged in further or higher education. Therefore, what is proposed here is a model that incorporates both the experiential learning that has already taken place with academic programmes or units of study that are designed to integrate more fully the theoretical and practical elements of ICU nursing, with the end result being a practitioner who is able to advance their own practice (Figure 3).

This model centres around my definition of advancing practice, alluded to in Chapter 2, in that it allows a deeper understanding of the intricacies of critical care nursing by allowing practitioners to critically analyse and evaluate as well as actively reflect on issues of practice pertinent to them, what Schon (1987, p.22) terms professional artistry:

> [Professional artistry] *refers to the kinds of competence practitioners sometimes display in unique, uncertain and conflicted situations of practice.*

Moreover, the type of competence displayed is not always dependent on the practitioners' ability to describe what is known. Instead, it is often associated with meaningful questioning of the situation which can only be derived from a deep immersion in critical care nursing theory and practice. Key to this is reflection and reflexivity.

Figure 3: Proposed critical care knowledge integration model.



Reflexivity has various meanings in the literature, often being associated with reflection and more commonly related to qualitative research methodologies whereby it is seen as an analytical self and relational awareness within the research environment (Finlay & Gough, 2003). However, for others it forms the basis of critical reflection, critical analysis and reflectivity (Rolfe et al., 2001). It is here that confusion of its meaning gives rise to its application and seeming interchangeability with reflection. It must be remembered that reflection tends to be conducted in the past tense, reflecting-on-action (Schon, 1983), which is evident in some contemporary reflective models, for example the work of Gibbs (1988), Driscoll (1994) and Johns (1995). As a model, reflection does allow the integration of thoughts and actions; the essential components include thinking about and critically analysing one's professional practice (Imel, 1992). In doing so, it brings together the art and science of nursing (Saylor, 1990) as well as bridging the well-documented theory and practice gap (Burton, 2000).

In their review of the term reflexivity, D'Cruz et al. (2006) identified three different variations in the way that reflexivity is used. The first variation focuses on the individual's response to a given situation in terms of self-development and the choices available for future decision making. The

second variation defines how knowledge is generated within the professional practice setting and this knowledge is then subjected to critical analysis as opposed to being simply a resource to be used. The third variation, similar in many respects to the second, looks at the factors which influence knowledge creation, for example the dynamic relationship between thoughts and feelings. Whilst this review goes some way towards identifying the key attributes that define reflexivity, the overriding theme throughout is reflection-in-action (Schon, 1987).

Reflection-in-action, as its name implies, is seated in practice, yet its difference to reflection-on-action is that it occurs in the here and now as practice is taking place and evolving. But this isn't simply thinking in action; it involves two separate processes which require a reanalysis of action and the knowing implicit in that action (Rolfe et al., 2001). It is this notion of knowing-in-action or tacit knowing, what Polkinghorne (2004) refers to as reflective-understanding, which sets the basis for reflection-in-action because this type of knowledge is considered to be more in tune with practical, experiential and common-sense knowledge – the knowing how that forms Schon's (1983) on-the-spot experimentation. In his experimentation model, Schon (1983) suggested that practitioners will use, in conjunction with each other or separately, a series of practical experiments to ascertain consequences of actions or, in some cases, inactions. First, exploratory experiments are undertaken when an action takes place without any accompanying predictions or expectations. Rolfe et al. (2001) likened this to trial and error exploration similar to that of a car mechanic when faced with a problem but having no clear idea of what the problem actually is. The mechanic may 'tinker' in the hope that his action will rectify the problem. Clinically, take the problem discussed in the practical domain (p36) where the critical care nurse is initially faced with a patient who is exhibiting a number of different signs and symptoms associated with hypotension. The nurse may have a number of different diagnoses but as yet has little information to guide their decision.

As more information becomes available and the relationship with the patient develops, the critical care nurse may change to move-testing, the second form of practical experimentation, where a deliberate action will have an

intended outcome (Schon, 1983). Here, the nurse becomes more in tune with the patient's problems and the questions asked are more focused in an attempt to discard irrelevant hypotheses, for example – is this a result of hypovolemia? Is this cardiac in nature? Has the patient recently taken hypotensive medication? As they continue to reflect on the situation, their thoughts and actions take more shape and direction (Rolfe et al., 2001). Finally, the nurse is able to fully utilise their understanding of the patient's problem and in doing so develops a personal theory of the case. It is here that interventions will start to test hypotheses (Schon, 1983). Having identified that the result of the patient's hypotension in this case is hypovolemia, the critical care nurse starts to consider causes of hypovolemia – is the patient bleeding? Are they intravascularly dry? Is the patient drinking? As a result, they may order intravenous fluids to be prescribed or increased, or may order blood tests, all the while confirming their personal theory of the case as hypotheses are proved or disproved.

However, whilst knowing-in-action accounts for the practical knowing of nursing care, the second aspect is the reflective element that integrates the knowing-in-action with advancing practice. This is not simply about applying a reflective model after the fact, although this does have merit in trying to interpret meaning from a critical scenario. Instead, the reflectivity in this case focuses on reflecting in the moment; in other words, reflecting whilst engaged in the action. What then transcends this is being able to reflect on the reflection to create new knowledge, what Rolfe et al. (2001) call meta-reflection. They refer to this type of reflection as *"thinking about thinking about doing"* (p.133), or learning to adjust in the midst of practice, a far cry from reflection where this may be considered thinking about doing.

This proposed model of advancing practice in critical care takes a global view of learning and reflection in critical care because it encompasses a number of different strategies to deepen understanding of complex situations and develop critical analytical skills from a theoretical perspective into a practical context. This way the nurse progresses from the knowledgeable doer to the knowledgeable changer of practice. What follows is an example how this model could work in clinical practice.

Exemplar 2

Clare has been working on the ICU for seven years as a Band 5 staff nurse. She considers herself to be quite senior within the unit and she believes she has extensive experience in looking after critically ill patients. Clare has acted as a mentor for third year nursing students and new starters within the unit and takes an active role in developing guidelines of nursing care. She is nearing completion of her degree at the local university and only needs another 40 credits to finish.

*New guidelines were introduced into the unit outlining the need for patients to have a sedation break at least once a day. Up until recently it was unit policy to keep patients sedated to prevent post-ICU recollection distress. However, a recent publication has suggested that providing sedation breaks does not have the serious psychological impact once thought (**Christensen** & Pinder, 2008). Casual conversations throughout the unit have led Clare to believe that sedation breaks are more an inconvenience than help because patients become agitated and 'unmanageable' and colleagues have to spend time protecting valuable lines and tubes to prevent the patient removing them. This whole scenario has left Clare bewildered and confused.*

At her next Action Learning Group (ALG) meeting she wanted to explore what others within her group understand about the need for sedation breaks and how the agitation routinely observed may be rectified. She discusses how she is confused by the need to, as she sees it, unnecessarily wake patients up just to see what they do. She has heard it discussed around the unit that some colleagues, at observing the first signs of agitation, immediately re-sedated the patient and over-dramatise the patient's behaviour. Others in the group shared similar concerns and have tried to seek an explanation from senior nursing and medical staff as to the need to provide sedation breaks. There were mixed responses from simply 'don't know' to in-depth explanations of advanced neuropathologies, which to many didn't really answer their original enquiry, so they were just as confused as before. The group's facilitator (a Band 6 sister) observed that the group might like to consider how to take this forward. The group then set in place an

action plan of how they hoped to overcome this problem or at least develop a better understanding of the implications of sedation breaks. Clare, having brought the problem originally to the group, took ownership of finding out about sedation breaks and would present her findings at the next ALG meeting in a month's time.

The group's action plan had a broad remit in terms of what they were hoping to achieve. Clare spoke to her team leader about her ALG's action plan and how she intended to undertake this project. It was during this discussion that her team leader suggested that she might want to consider doing a work-based learning unit that the local university was offering; in this way she would have a well-defined learning structure to her project as well as gaining academic credit she could put towards her degree.

*Clare started the work-based learning unit and was required to develop a personal learning development plan of what she hoped to achieve. A tripartite meeting between her specialist tutor and team leader identified some key learning opportunities for Clare, some of which included meeting and working alongside specific people; one of those individuals Clare wished to work with was the ICU nurse consultant. An overall goal and a set of objectives were then developed together with a timescale in which Clare would be able to feed back the outcomes of her learning to both her team leader and her ALG. Using the university's visual learning environment, Clare was able to discern that agitation in the ICU is due to a number of different factors, one at least she was able to sympathise with – the noise levels in the unit. A number of research articles indicated that staff were the main contributor and the levels of noise far exceeded those of a busy street (**Christensen**, 2002a; **Christensen**, 2004; **Christensen**, 2007).*

*What really caught her attention was the fact that ICU nurses knew very little about the effects of excessive noise exposure (**Christensen**, 2005c). As a result, Clare was able to piece together the fundamentals of sedation breaks and the causative factors associated with agitation. Regular meetings between Clare, her specialist tutor and her team leader were able to focus her learning into a comprehensive database of agitation and the need for*

sedation breaks. Having this basic theoretical knowledge, the nurse consultant suggested that Clare might like to reflect on the implications of sedation breaks in terms of patient empowerment. Clare had always been led to believe that empowering the ICU patient was virtually impossible because of their level of illness. However, the nurse consultant, having read ***Christensen*** *and Hewitt-Taylor's (2006a, 2007) work on patient empowerment, agreed that true patient empowerment would be difficult in this environment and instead suggested that Clare might consider patient empowerment to be about allowing the patient to regain a sense of control. Clare was encouraged to reflect on this knowledge of agitation and empowerment in a practical situation whereby she was reflexively able to make those practice–theory links. During this time, Clare was able to make those concrete connections between theory and practice – the integration of knowing-how and knowing-why into knowing-that, but more importantly was able to see first hand the effects on the patient and was therefore better able to support them.*

As a result of this experience, Clare was able to actively reflect on the events that had occurred and fed this back to her ALG, the outcome of which was that members of her group were then able to develop their own practice and were able to use Clare as a resource. When Clare then encountered a patient requiring a sedation break, she was immediately able to reflexively put into action the theoretical and practical knowledge that she had gained as a result of carrying out this project.

Whilst this is a simplified version of events from a practical perspective, it highlights a systematic approach to an individual's learning and development from the initial identification of a problem in practice to the reflection and reflexivity inherent in clinical scenarios. Despite the fact that this was done within the context of practice, the principles behind this have further generalisation and I can see opportunities in education where it might underpin the curriculum. For example, Work-based learning (WBL) offers a different approach to professional development in that a unique opportunity for a collaborative partnership to improve practice and ultimately patient care exists between health care providers and institutes of higher education. The

general aim of WBL is to develop transferable skills and knowledge in a structured and formal approach for which the work place is the centre of learning (Portwood, 2000; Rickard, 2002). As a concept WBL offers alternatives to teaching and learning as opposed to conventional didactic methods because of its flexibility and emphasis on and in practice. The lecturer's role in this case is now considered to be facilitative with the employing organisation playing an active part in providing key learning opportunities for the student.

In its simplest form, WBL is readily seen where healthcare organisations employ study days to ensure that staff have a minimum level of competence and/or knowledge to carry out their contractual obligations, for instance manual handling, basic life support and health and safety updates (Clarke & Copeland, 2003). However, personally and professionally, WBL allows a lot more. In the context of advancing critical care practice, WBL not only enhances practical and theoretical knowledge but it also meets some of the professional requirements required for re-registering as well providing the student with academic credit and creating a framework for life-long learning. For the employer in addition to meeting organisational and national strategic goals, it ensures the ongoing development of a knowledgeable and competent workforce, benefiting both parties in that it can set the foundation for further learning (Flanagan et al 2000; Birch et al, 2005).

There are of course a variety of different learning scenarios that can be adopted to increase the success of WBL. These may include reflection, secondments, practice development projects, mentoring and clinical supervision. What is important is that engagement with workplace activities requires an element of self-recognition of what has been learnt throughout the experiential process. Fundamental to this is the development of a tripartite learning contract which sets out to identify aims and objectives intrinsically designed to meet current patient or service user requirements (Clarke & Copeland, 2003; Swallow & Coates, 2004). This agreement is key in terms of dissolving the power differential that can exist within traditional teaching methods. The difference here being that the learner is central to the decision-making and learning process in that they themselves dictate, to

some degree, how and what is learnt and when learning takes place (Portwood, 2000).

The same can be said for E-learning, which is similar in some respects to work-based learning in that the student adopts an independent role in the way that learning takes place. There are differences of course in that students are expected and encouraged to engage with a prescribed curriculum of material specific to their unit of study. Many institutions such as NHS hospitals and higher education institutes are now moving towards E-learning as a flexible approach to teaching and learning. The NHS Improvement Plan (DoH, 2004b) for example outlines how the application of learning technologies as an adjunct to its modernisation programmes can support and develop the NHS workforce.

However, E-learning is not simply logging onto an internet site and working through a prescribed programme. E-learning can be accessed through a variety of different media such as CD-ROM, DVD, interactive video-conferencing, visual learning environments such as Web CT or Blackboard or most commonly as seen within the NHS the hospitals intranet site. In some cases the material presented may often involve a multitude of different medias and a blended approach incorporating classroom teaching with distance learning using distributive learning and email discussion boards to ensure engagement with the topic (Glen, 2005).

Whilst WBL and E-learning incorporates the theoretical (the knowing –what) aspect of this model, an integral part of the developing practitioner is the use of clinical supervision and action learning groups to allow open discussion about issues experienced in practice (the knowing-how and knowing-what). The Department of Health (1993) in its 'A Vision for the Future' defines clinical supervision as a formal process which individual practitioners use to develop knowledge and competence through professional support and learning. In doing so they are then able to enhance patient safety in complex clinical situations. Others have described clinical supervision as an exchange of ideas between practising professionals to enable the development of professional skills (Butterworth & Faugier, 1992; Titchen & Binne, 1995),

reflecting on practice (Kohner, 1994; Dooher et al, 1998; Driscoll, 2000), safe-guarding standards and the development of professional expertise (DoH, 1994), the advancement of clinical practice (McCallion & Baxter, 1995) and being able to identify solutions to problems (UKCC, 1996).

Clinical supervision has two approaches; individualised and group supervision (Saarikoski et al 2006). However, typically clinical supervision involves one person in a supervisory role supporting the development of another (Goorapah, 1997; Dooher et al, 2000). The most important aspect of this helping and supporting interaction is the development of the professional relationship between the two individuals. The main feature of this relationship generally focuses on the needs of one of the individuals with a particular purpose in mind. This relationship is ongoing unlike those of mentoring or preceptorship where there is a specified transitional period, in other words a start and end point whereby the supervised person is suddenly 'set-free'. An example of clinical supervision may well be the relationship and interaction between an ICU nurse consultant and a junior sister/charge nurse in which the former facilitates the latter's learning or acts as a support mechanism in helping to deal with emotional stress derived from clinical practice. Through the facilitative and reflective process central to clinical supervision, the junior sister/charge nurse is given time to explore and gain some insight into the intricacies inherent in everyday practice and as a result is better able to decipher complex situations, add deeper meaning to those experiences and develop constructive solutions (Dooher et al, 2000).

Therefore, the overriding principle of clinical supervision is a formalised, structured meeting in which two practitioners use reflection to focus on issues from clinical practice. Furthermore the purpose of clinical supervision is to provide a supportive, learning and monitoring process relative to the professional development and growth of nursing (Barber & Norman, 1987; Butterworth, 1994; Dooher et al, 1998).

Action learning groups, whilst similar in many respects to clinical supervision, are seen more as group supervision where the learning and development goes beyond the individual practitioner in that each member of the group

learns and develops from each other. Some authors have likened action learning to co-operative inquiry (Heron, 1996; Jenkins, 1998) where individuals meet to critically examine experiences from both a theoretical and practical perspective. McGill and Beaty (2002) in their original definition of action learning as an ongoing process of learning and reflection, also identify a six stage process in order to firstly identify the problem and through a step-wise approach arrive at a plan of action, similar in many respects to Kolb's (1984) learning cycle.

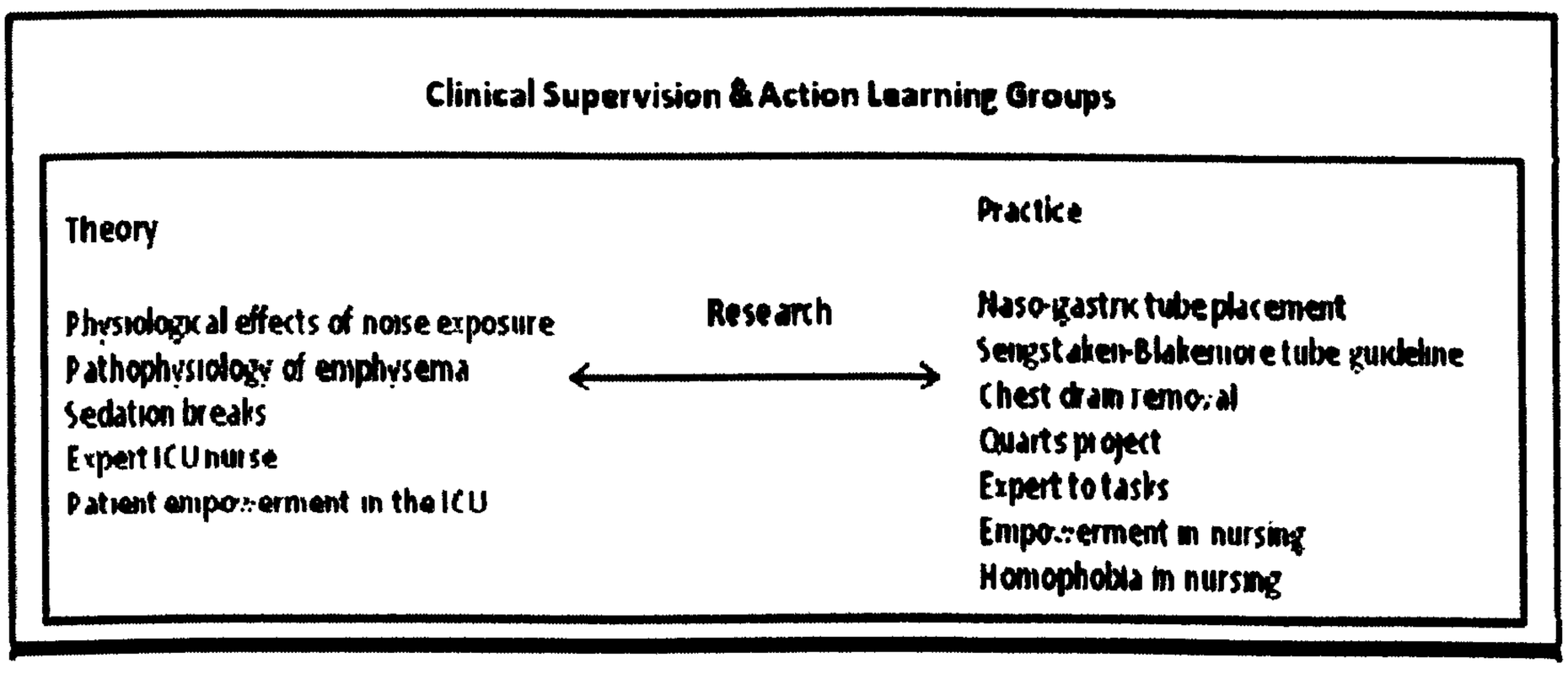
Whilst these differing teaching and learning methods contribute to the basis of the model it was originally formed through my own experience and development in critical care nursing. As I alluded to at the beginning of this thesis whereby I stated

> *"...the integration of theoretical and practical knowledge did not occur in my own practice and, therefore, advancing my own practice was little more than a collection of experiences with limited understanding."*

The assimilation of theoretical knowledge into a practical setting proved troublesome and difficult. Taking Rolfe's (1998) typology, I knew and learnt things taken from books, journals, colleagues and from life experiences but couldn't easily recognise the theoretical knowledge when looking after patients – I couldn't make that connection explicit. Whilst I was able to critically analyse information, it was the development of reflective practice that enabled some of those links to be formed albeit limitedly. As I soon discovered, reflection tended to focus on the behaviour as opposed to the knowledge and understanding inherent in that behaviour and as result I realised that my practice was becoming an amalgamation of learnt behaviours, for example I could recognise hypovolaemia from an arterial waveform trace but not the physiology associated with this. However reflection alone didn't easily solve the problem of knowledge integration. For me it was the relationships with other colleagues, more importantly medical colleagues that allowed me to assess the finer and complex aspects of clinical care and then relate this into a meaningful experience of theoretical

and practical knowledge. There was the realisation that reflective practice had progressed to a point where my thinking and practice became reflexive – I started thinking about the thinking of the doing, or in other words adopted Rolfe et al's (2001) meta-reflection, learning to adjust practice in the midst of that practice. I was beginning to analyse the behaviour and as a result develop a deeper practical and theoretical knowledge of these experiences. This entire process suggested to me that combined with my theoretical knowledge and experiential knowledge, there was a theme of reflexive practice that incorporated an impromptu form of clinical supervision and what might be referred to today as time action learning groups. As I commented in chapter two, my published works focused on three distinct domains: practice, theory and research. The theoretical knowledge and the practical knowledge formed two very succinct domains of knowledge where research appeared to overlap them both (figure 4).

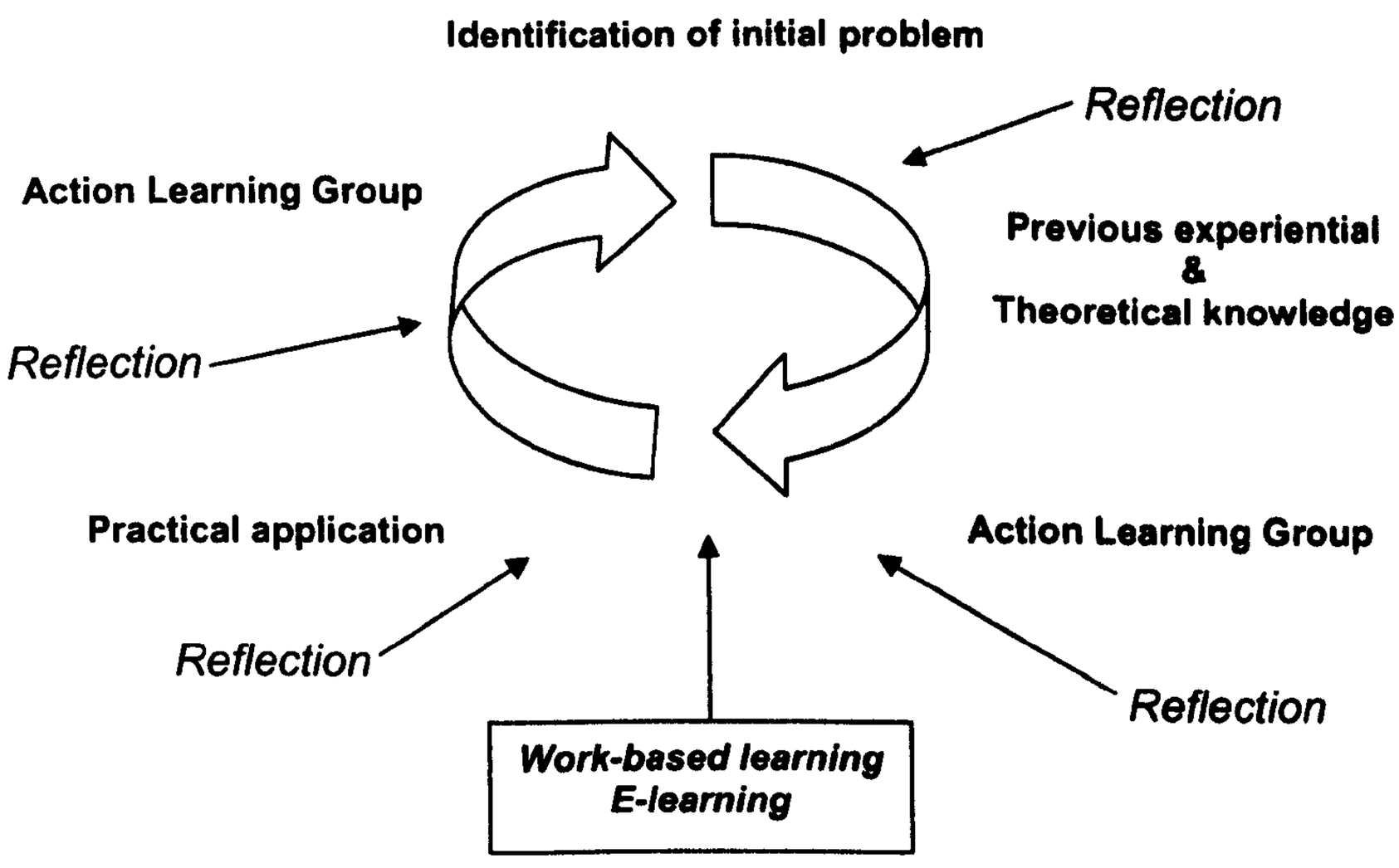
Figure 4: Relationship between Publications and Integration Model



Therefore, I saw my published works as a means of demonstrating this development of reflexive practice into a model for advancing practice, such as seen in Christensen and Mattison (2006) or Christensen and Pinder (2008). It is here that the theoretical knowledge is integrated into the practical aspect of care, but more importantly the reflexive nature by which knowledge was generated to offer further insights into the intricacies of care for a specific patient group is demonstrated in exemplar one. What was occurring for me in developing this model was that the integration of my published

works into practice had moved beyond reflection alone and that reflexivity, combined with clinical supervision and action learning groups appeared to increase the likelihood of advancing practice. To some extent this is operationalised in exemplar 2 (page 64) whereby the reflective element in this instance allowed for an analysis and strengthening of previous knowledge and experience against the exposure to new experiences and knowledge. Whereas the reflexive element is more in tune with a meta-analysis of the moment as it is occurring, the very nature of reflection-in-action (Schon, 1983) allows for refinements of practice to occur within the here and now. The strength of this model is that it offers a different approach which incorporates not only reflection and clinical supervision as part of its core but also includes prescribed work-based and e-learning strategies that have structure and form, allowing the creation of a firmer knowledge base (Figure 5). Combine these with previous tacit, experiential and theoretical knowledge, the practitioner then becomes an autonomous, responsible, accountable and self-emancipated practitioner (Graham, 1995; Daly & Carnwell, 2003), able to further develop themselves and others they engage with.

Figure 5: Proposed approach to scholarly development.



Implications for Practice

The question remains as to why there is a need to encompass different strategies when one will do, for example the sole use of reflection or work-based learning. Reflection appears to have become the panacea of advancing practice or, in some cases, professional development overall. There is evidence to suggest that the process of reflection, whether this is seen in clinical supervision or as a form of assessment to gain academic credit, is beneficial in exploring issues within practice and is therefore crucial for professional development (Graham, 1995; Booth et al., 2003; Heidari & Galvin, 2003; Saarikoski et al., 2006; Alleyne & Jumaa, 2007). But, as a strategy alone, reflection does have its drawbacks in that it is doubtful that individuals are enthusiastic about engaging with the process of reflection because of its private and personal nature. Furthermore, are they really learning or are they simply identifying problems they've encountered and therefore developing strategies to prevent them occurring again? Although some would argue that this is learning, the critical question is whether it is integrating the knowing-how to knowing-that (Schon, 1983).

The answer may be a belief that an individual's level of knowledge and understanding is the same as others and that everyone learns in the same way. This also does not withstand the assumption that practitioners are able to assimilate theoretical information into practice and vice versa (Chaboyer & Creamer, 1999). A good example of this can be seen in the discussion as to what the nature of expert nursing practice is, which would appear to some to be the cornerstone of advancing or advanced practice (Calkin, 1984; Brown, 1998). It was here that the expert nurse was able to rely on past experiences rapidly, almost subconsciously, and constantly then incorporate these experiences into a practice situation that didn't quite meet the 'norm' (Benner, 1984; **Christensen** & Hewitt-Taylor, 2006b, 2006c). The problem here was that the expert was unable or found it difficult to articulate what knowledge and previous experiences they had used in coming to a decision (Melling & Hewitt-Taylor, 2003; Dowding & Thompson, 2004; Christensen & Hewitt-Taylor, 2006b, 2006c). Further discussion on the attributes of expert practice suggested that the individual should have an extensive field of specialised

skill and knowledge and have mastery of that knowledge (Moore, 1970; Lieberman, 1981; **Christensen** & Hewitt-Taylor, 2006b, 2006c). Moreover, Rolfe et al. (2001) suggested that critical reflection then transcended expert practice because it now gave the expert a method in which they could explore deeper the thought processes needed to make 'expert' decisions.

This then means in terms of advancing practice that individuals should have a sound knowledge base on which to call and should have the requisite experiential knowledge to gauge the salient points of a given situation. This then raises questions as to the benefits of single approaches, such as reflection, in enhancing practice and knowledge if the practitioner has limited theoretical and/or experiential understanding and who may simply fall into the category of: 'Is it ten years' experience or is it one year's experience multiplied ten times?' Using multiple learning strategies linked together will allow a greater understanding of clinical practice because it guides the individual along a pathway of development. Like in the exemplar, where a problem was identified in practice, self-reflection and group supervision elicited possible alternatives but understanding was limited. Being able to use work-based learning gave structure to the learning experience in that practitioners were then able to focus their learning not only theoretically but also practically. Returning to group supervision meant that others were able to benefit from the knowledge learnt and the practitioner was able to develop reflective-understanding (Polkinghorne, 2004).

Future Dissemination and Publication

My vision for the advancement of critical care nursing practice is centred on achieving care delivery which is very much critical care nursing focused. The focal point here is the practice perspective. I firmly believe that advancing practice is just that, the advancement of nursing practice. The basis of this thesis was to develop a model of knowledge integration that would assist in this vision and my published works are an acknowledgement of this development. What is important now is the dissemination of this thesis to a wider academic and practice-based audience, which for me is the culmination of my own advancement of critical care practice. At the time of

writing this thesis the knowledge integration model has been accepted for publication into an internationally renowned critical care nursing journal and has been accepted for presentation at the annual Royal College of Nursing's Critical Care Nursing Forum conference. Aspects of the model in particular the knowing-how and knowing-that model have formed the central focus for a book on advancing practice in pain management, which exemplars from practice demonstrate the factors that identify the knowing-how and are then embodied with practical examples demonstrating the knowing-that. However, I am conscious, that whilst originally developed with critical care nursing in mind, this model has the potential for a far wider audience base and I shouldn't neglect other nursing specialism's or other health professional teams for whom this model may prove invaluable in developing other practitioners. In terms of further research and the continuation of advancing critical care practice, a pilot study is currently being undertaken to establish the workability of the knowledge integration model in particular the clinical supervision and action learning groups. An interim evaluation of the model and its effectiveness is due to be conducted in the middle stages of 2009. Other large scale work included the development of a blended critical care course which encompass the components of this model in particular those associated with work-based learning and e-learning packages, the outcomes of which could be an influential factor in curriculum design in the future.

As for my own publication strategy, I am a firm believer that given the appropriate learning environment with the right knowledge, clinical support and education the advancement of critical care practice will occur. This is where I see the focus of my publications – the development of theoretical knowledge easily transferrable into the practice domain. At present I have a number of ideas for topics, but currently am in the process of writing a number of publications looking predominately at advanced physiology and its relationship to critical care nursing practice. These will include:

- **Serum Electrolytes and the ECG**, which I explore the role some of the more notable electrolytes have on the ECG waveform and the ready identification, physiology and proposed treatment to avert unstable arrhythmias.

- **SvO^2 monitoring: the implications for critical care practice.** With the advent of continuous cardiac output monitoring using arterial waveform analysis, it precludes an assessment of oxygen consumption because this value is not measured using this method. Therefore I put forward that the notion of oxygen consumption, measured as SvO^2, gives a better indication of tissue oxygen requirements and is often overlooked because of the above mentioned method of assessment.

Other proposed publications will focus on:

- Active euthanasia in the Intensive Care Unit.
- Professional Autonomy in Critical Care: a concept analysis.
- Heart disease in women: implications for critical care nursing practice.
- The relative's experience: a nursing narrative.

Conclusion

In this thesis, I have actively engaged with a narrative framework to explore the nature of advancing practice within critical care. I have used my publications as a body of critical care nursing knowledge on which to focus this journey but also to bring into context their application in defining the process of advancement in this clinical area. As part of the discussion around their contribution to advancing practice in critical care, I have worked on three different levels: their application to practice, their expansion of the theoretical knowledge base and their contribution to research knowledge.

As a result of this ongoing voyage of knowledge and understanding, I have come to realise that the accumulation of academic awards or length of service doesn't necessarily mean the advancement of practice. It is also evident to me that there exists a dichotomy as to what the true meaning of advanced and advancing practice is. Because of this confusion over the two terms, it was necessary for me to construct a working definition of advancing practice to bring my publications into context and to focus my thinking around what the requirements for advancing practice are. Providing an alternative

approach to knowing-how and knowing-what allowed me to identify the knowledge required for advancing practice. I make the distinction that advancing practice involves a number of different facets and knowing-that is based on a choice of action which is informed from knowing-how, knowing-why and knowing-what (Figure 1); a different perspective than those of Ryle (2000) and Rolfe (1998).

Whilst this approach echoes many of the characteristics of Fulbrook's (2003) notion of pragmatic epistemology, I would suggest that there is more than simply identifying different sources of knowledge either for practice or from practice; it is how this knowledge is used and integrated into clinical practice that contributes to advancing practice. Set this alternative knowing-how knowledge within an advancing practice model (Figure 2) and the focus is more about the how of practice as opposed to the why of practice. Yet, the basis of knowing-how cannot be complete without a full understanding of the implications this has in practice. Therefore, I put forward a model of knowledge integration that uses not only knowing-how knowledge but multiple methods of learning that feed into and engage with each other. This model attempts to support this process of development, building on and enhancing the quality of the reflective experience, and therefore shifts the practitioner's level of understanding and knowledge towards knowing-that.

In summary, this thesis, presents a model of knowledge integration that advances the individual's critical care practice. It takes into account the nature of knowledge requisite in developing the individual's theoretical and practical knowledge base by providing an alternative to the recognised knowing-how and knowing-that model and combines this with an advancing practice model which incorporates specialisation, expansion and advancement. My publications give strength to this by illustrating the knowledge that contributes to advancing practice.

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Woods, L.P., 1999. The contingent nature of advanced nursing practice. *Journal of Advanced Nursing*. 30(1), 121-128.

APPENDIX ONE

COMPLETE LIST OF PUBLICATIONS

List of Publications

Publication	Declaration of Authorship
Christensen, M., 2002. Determining naso-gastric tube placement: A literature review. *Nursing in Critical Care*. 6(4), 192-199.	All my own work
Christensen, M., 2002. Nurse-led chest drain removal in a cardiac high dependency unit. *Nursing in Critical Care*. 7(2), 67-72.	All my own work
Christensen, M., 2002. The effects of noise on humans: Some considerations for intensive care. *Nursing in Critical Care*. 7(6), 300-305.	All my own work
Christensen, M., 2004. Do the numbers of personnel present in a six bedded recovery unit and a general operating theatre influence the level of noise? *Journal of Advanced Perioperative Care*. 2(1), 19-26.	All my own work
Christensen, M., 2005. Noise in a general surgical ward: A descriptive study. *Journal of Clinical Nursing*. 14(2), 156-164.	All my own work
Christensen, M., 2005. Homophobia in nursing: A concept analysis. *Nursing Forum*. 40(2), 60-71.	All my own work
Christensen, M., 2005. What knowledge do ICU nurses have with regard to noise exposure in the intensive care unit? *Intensive and Critical Care Nursing*. 21, 199-207.	All my own work
Christensen, M., 2007. Noise levels in a general intensive care unit: A descriptive study. *Nursing in Critical Care*. 12(4), 188-197.	All my own work
Christensen, M., & Hewitt-Taylor, J., 2006. Defining the expert ICU nurse. *Intensive and Critical Care Nursing*. 22, 301-307.	My contribution was 50%

Christensen, M., & Hewitt-Taylor, J., 2006. From expert to tasks: Expert nursing practice redefined? *Journal of Clinical Nursing*. 15(12), 1531-1539.	My contribution was 50%
Christensen, M., & Mattison, S., 2006. The pathophysiology of emphysema: Considerations for intensive care nursing practice. *Intensive and Critical Care Nursing*. 22, 329-337.	My contribution was 50%
Christensen, M., & Hewitt-Taylor, J., 2006. Patient empowerment: Paternalism or maternalism? *British Journal of Nursing*. 15(13), 695-699.	My contribution was 50%
Christensen, M., & Hewitt-Taylor, J., 2007. Patient empowerment: Does it occur in the ICU? *Intensive and Critical Care Nursing*. 23, 156-161.	My contribution was 50%
Christensen, M., & Christensen, T., 2007. The implementation of a guideline of care for patients with a Sengstaken-Blakemore tube in situ in a general intensive care unit using transitional change theory. *Intensive and Critical Care Nursing*. 23, 234-242.	My contribution was 70%
Christensen, M., & Pinder S., 2008. Sedation breaks: Are they good for the critically ill patient? *Nursing in Critical Care*. 13(2), 64-70.	My contribution was 50%
Christensen, M., Andrews, S., Catlin, S., & Lamb, N., 2008. A dedicated retrieval and transfer service: The Quarts project. *Nursing in Critical Care*. 13(3), 162-168.	My contribution was 80%

APPENDIX TWO

CITATIONS

What knowledge do ICU nurses have with regard to the effects of noise exposure in the intensive care unit?

- Christensen, M., 2002. The effects of noise on humans: Some considerations for intensive care. *Nursing in Critical Care*. 7(6), 300-305.

- Dawson, D. 2005. The problem of noise and the solution of sound? *Intensive and Critical Care Nursing* 21(4), 197-198.

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- Jolley, S., 2005. Single rooms and patient choice. *Nursing Standard*. 20(9), 41-48.

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- Christensen, M., 2005. Noise in a general surgical ward: A descriptive study. *Journal of Clinical Nursing.* 14(2), 156-164.

- Christensen, M., 2005. What knowledge do ICU nurses have with regard to noise exposure in the intensive care unit? *Intensive and Critical Care Nursing.* 21, 199-207.

- Bishop, L.P., & Griffin, C., 2006. Holistic healing methods positively advance patient care. *Nursing Management.* 37(7), 30-35.

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- Akansel, N., & Kaymkci, S., 2008. Effects of intensive care noise on patients: A study on coronary artery bypass graft surgery patients. *Journal of Clinical Nursing.* 17(12), 581-590.

Nurse-led chest drain removal in a cardiac high dependency unit.

- Riley, M.E., 2003. Removing chest drains – a critical reflection of a complex clinical decision. *Nursing in Critical Care.* 8(5), 212-221.

- Bruce, E.A., Richard, F., Howard, R.F., Franck, L.S., 2006. Chest drain removal pain and its management: A literature review. *Journal of Clinical Nursing.* 15(2), 145-154.

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- Protheroe, J., Bower, P., & Chew-Graham, C., 2007. The use of mixed methodology in evaluating complex interventions: Identifying patient factors that moderate the effects of a decision aid. *Family Practice.* Nov, 1-7.

- Loukanova, S.N., & Bridges, J.F.P., 2008. Empowerment in medicine: An analysis of publication trends 1980-2005. *Central European Journal of Medicine.* 3(1), 105-110.

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- Werko, S.S., 2008. *Patient Patients? Achieving Patient Empowerment through Active Participation, Increased Knowledge and Organization.* Unpublished Dissertation, Stockholm, Stockholm University.

Noise levels in a general intensive care unit: A descriptive study.

- Miranda, E.J.P., & Stancato, K., 2008. Risks to health of intensive care unity nursing staff: Proposal of integral approach of health. *Revista Brasileira de Terapia Intensiva.* 20(1), 68-78.

APPENDIX THREE

PRIMA FACIE

Bournemouth University

Postgraduate Research Application/Enrolment Form

Prima Facie Case for Submission – PhD by Publication

Your name: **Martin Christensen**

You are required to establish a prima facie case for submission. Your application will be submitted to the Research Degrees Committee for consideration. Please write a summary description (circa 300 words) of the research work and achievements which you consider is equivalent to PhD, and a list of publications to support the case.

Provisional Title: **A Study into the Advancement of Critical Care Nursing Practice.**

Advancing nursing practice is an ongoing topic of considerable debate within the UK; theoretically, politically and as well as clinically. This proposal presents a body of published works within the realm of critical care nursing that will outline the development of advancing practice in critical care.

A potential auto-ethnographic approach connecting a journey of personal discovery to the culture of critical care nursing will trace this development based on three themes – theory, education and practice.

Interwoven within these themes is the unique nature of the presented work in that it identifies key areas within critical care practice where research and knowledge appear to be lacking. For example the work on hospital noise initially focused on the impact of excessive noise exposure within the confines of critical care areas. However, there was the realisation that this phenomenon was a global problem within the hospital environment as a whole and therefore addressed the levels of noise experienced in other areas but also centred on what knowledge health care professionals knew about noise exposure and asked whether the presence of hospital staff influenced the levels of noise within this environment. Other work presented from the list below includes practice development initiatives as a means to improving patient care and influence practice through the use of clinical guidelines and change management theories. An attempt has also been made to critically discuss the philosophical underpinnings inherent in practice advancement for example those addressing the redefining of expert ICU nursing practice and patient autonomy and empowerment as well as attitudes and beliefs.

Finally, a central tenet throughout has been identifying and analysing the nature of advancing practice and the need to further clarify and understand its purpose. This has been considered from the perspective that advancing practice is not only a means of developing critical care practice generally but it is also central to the development of individual practitioners.

Signature: Date:

Sole Publications in Peer Reviewed Journals:

- Christensen, M., 2002. Determining naso-gastric tube placement: A literature review. *Nursing in Critical Care*. 6(4), 192-199.
- Christensen, M., 2002. Nurse-led chest drain removal in a cardiac high dependency unit. *Nursing in Critical Care*. 7(2), 67-72.
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- Christensen, M., 2004. Noise in a general surgical ward: A descriptive study. *Journal of Clinical Nursing*. 14(2), 156-164.
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- Christensen, M., 2007. Noise levels in a general intensive care unit: A descriptive study. *Nursing in Critical Care*. 12(4), 188-197.

Collaborative Publications in Peer Reviewed Journals:

- Christensen, M., & Hewitt-Taylor, J., 2006. Defining the expert ICU nurse. *Intensive and Critical Care Nursing*. 22, 301-307.
- Christensen, M., & Hewitt-Taylor, J., 2006. From expert to tasks: Expert nursing practice redefined? *Journal of Clinical Nursing*. 15(12), 1531-1539.
- Christensen, M., & Hewitt-Taylor, J., 2006. Patient empowerment: Paternalism or maternalism? *British Journal of Nursing*. 15(13), 695-699.
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- Christensen, M., Andrews, S., Catlin, S., & Lamb, N., 2008. A dedicated retrieval and transfer service: The Quarts project. *Nursing in Critical Care.* 13(3), 162-168.