

**Determining Differences Between Novice and Expert
Physiotherapists in the Emergency
On-call Environment:
A Vignette-Based Study.**

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Dedication

This thesis is dedicated to my husband Bruce and parents Shirley and Leslie, without whom this journey would not have been possible. Thank you for your endless support, encouragement and kindness.

A special thank you to friends Lee, Jenny and Jane who provided empathetic inspiration at just the right times.

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Attestation of Authorship

“I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the qualification of any other degree or diploma of a university or any institution of higher learning, except where due acknowledgement is made in the acknowledgments.”

Signed _____ Fiona Dunford. MHSoc. Candidate.

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Abstract

Emergency on-call duties have been highlighted as a key stress factor in newly qualified physiotherapists whose job performance may be affected. The concept of stress relating to on-call work, the general lack of interest or confidence in the respiratory on-call field, and subsequent difficulties with recruitment and retention, pose a difficult problem for managers of services responsible for the maintenance of a competent workforce and a high standard of service provision.

Differences in novice and expert physiotherapists' patient management and clinical reasoning strategies have been previously examined in orthopaedic, neurology, domiciliary and cardiorespiratory fields. However, no such investigations have been undertaken in the field of emergency on-call.

The purpose of this study was to determine if differences existed between novice and expert physiotherapists who had by definition differing levels of context-related experience within the emergency on-call environment. This study also aimed to consider what factors may influence their physiotherapy intervention for an acute cardiorespiratory patient. A purpose-designed vignette-based postal questionnaire was administered to 26 emergency on-call providers in New Zealand. The questionnaire sought demographic data, investigated participants' attitudes towards emergency on-call service provision and presented a vignette-based clinical scenario which asked questions throughout an evolving clinical case scenario. Analysis was performed using the computer software package for social sciences, SPSS for Windows (version 14), results were analysed using descriptive statistics, and significance testing was performed using non-parametric methods.

A good response rate was achieved (78.8%; n = 56). Statistically significant differences between novices and experts were determined in scores for confidence, stress, and support required, also in the factors affecting stress levels. Novices are less confident ($p = < .0001$), more stressed ($p = < .001$) and require more support than experts ($p = < .001$). Factors which influenced both novice, and to a lesser extent, expert stress levels when working as emergency on-call physiotherapists, were established. A relationship was determined between confidence and level of support required ($r = -.65$; $p = < .001$); confidence and amount of stress felt

($r = -.58$; $p = < .001$); and support required and stress felt ($r = .47$; $p = < .001$). Some differences were demonstrated between novice and expert physiotherapists in their answers to a clinical case scenario. Although these were not statistically significant, a trend was noted which may reflect the different clinical reasoning strategies of these physiotherapists.

There is a need for novices to gain the type of experience which includes independent problem solving and guided reflection; the use of vignette-based case studies may be one method which could be further exploited. The profession is responsible for the provision of better ways to meet the needs of our future emergency on-call workforce. If this is not achieved, other professional groups will be required to fill the gaps and physiotherapy, particularly cardiorespiratory physiotherapy will lose out.

1.0 Introduction

1.01 *Rationale*

Emergency on-call physiotherapy has been defined as “the provision of respiratory/cardiorespiratory/cardiothoracic physiotherapy or combinations of respiratory and orthopaedic physiotherapy, out of normal working hours” (Gough & Doherty, 2007). Cardiorespiratory on-call work will tend to be of a high priority where the impact of the condition is such that the patient is, or has the potential to rapidly become acutely unwell. The types of patients placed on a roster or referred to an on-call physiotherapist are varied, the common criterion for on-call work being that the condition or problem cannot wait until normal working hours resume. The acute problems are of varying importance and the on-call therapist must prioritise well to complete their caseloads appropriately. Appropriate treatment within a short time frame is considered essential; outcome measurement is a priority to ensure that the treatment is having the desired effect, or that further help needs to be sought. On-call physiotherapists are challenged to assess, diagnose, problem solve, plan, implement and evaluate their care in a shorter time frame than that which is usual for them.

An emergency on-call physiotherapist is an individual who is expected to be available at any time during their rostered on-call shift. An on-call physiotherapist may be expected to work in isolation covering all areas of a hospital, ranging from a highly intensive interaction with a ventilated patient to an urgent community case.

Alternatively, the physiotherapist may be part of an on-call team where they may have responsibility for one area only and be supervised throughout their shift. Many hospitals support on-call workers with a buddy system of peer supported on-call work; alternatively they may have a telephone support system in place.

Emergency on-call duties have been highlighted as a key stress factor in newly qualified physiotherapists, whose job performance may be altered as a result (Mottram & Flin, 1988). Existing literature presents a number of problems surrounding on-call or emergency service delivery, such as the maintenance of competency levels and adequate training (Bott, 2000, 2002; Dixon & Reeve, 2003; Roskell & Cross, 2003). Reeve (2003) describes the challenge of acutely compromised patients being managed by therapists who are working largely in isolation, where accurate problem recognition

and choice of interventions are crucial. To add to their challenge, the majority of newly qualified staff are providing emergency on-call duties without any direct senior supervision (Gough & Doherty, 2007).

Potter (2001) reports on a congressional speech about emergency on-call duties in the United Kingdom (UK) which highlighted the significant impact of on-call work on all physiotherapists who are expected to provide the service and where the ongoing debate about emergency on-call duties and service provision is described as 'notoriously tiresome'. Bott (2000) cites 'scaremongering' of potential life-threatening situations and highly technical intensive care facilities as the cause of an apparent lack of interest in managing respiratory problems. The author asks, "Why is it that our profession has many in it who embrace a new millennium with no on-call or emergency work?" (p.2). Bott describes her puzzlement at the lack of apparent interest in such an area, which can have dramatic and potentially life-saving effects and warns that roles in intensive care units remain for physiotherapists on the basis that they are ever proactive and flexible – easily lost if services are reduced or withdrawn. Bott challenges all physiotherapists to be flexible to meet consumer requirements, noting that shorter theatre times, improved medication programmes and reduction of length-of-stay goals have all increased the demands on physiotherapy on-call services.

In the UK, emergency duty guidelines have been developed and are utilised nationally to support on-call staff by enabling them to self assess learning needs and develop skills specific to on-call work (Chartered Society of Physiotherapy (CSP), 2002). Audits of the UK on-call service provision have identified a number of ongoing problems such as staff training and resource management which are being addressed at national and local levels (CSP, 2004; Dixon & Reeve, 2003; Gough & Doherty, 2007; Harden, Cross & Thomas, 2005). It is known that the level of physiotherapy on-call training and provision in New Zealand varies widely (Reeve, 2003). It is possible that a variety of factors could influence practice in New Zealand and that these factors differ between hospitals. For example, contractual obligations and available resources (i.e. equipment and staff) may have an effect on physiotherapy on-call practice, as well as knowledge and comprehension of available literature.

The CSP published a guideline document entitled *Emergency respiratory on-call working: guidance for physiotherapists* in response to ongoing concerns about the

delivery of care to patients at risk of compromised respiratory function (CSP, 2002). This document was piloted successfully in January and March 2002 using eight hospitals within the UK. The on-call project leader and public relations officer of the Association of Chartered Physiotherapists in Respiratory Care (ACPRC) highlighted the importance of this for the support of on-call staff, as well as facilitating better management of on-call services at a management level (Byrne, 2002). The ACPRC is a national clinical interest group recognised as an expert body in cardiorespiratory physiotherapy by the CSP and is committed to the development, maintenance and promotion of high standards of respiratory care.

With the CSP guideline document in place for qualified staff, the problem of training and providing quality clinical placements for student physiotherapists remained a key issue for physiotherapy in the UK. Williams (2002) makes specific reference to the difficulty of providing UK undergraduates with enough appropriate clinical practice within respiratory care and called on all respiratory physiotherapists who did not offer clinical placements to reconsider and offer the kind of experiences that prepare staff for the on-call induction process. In response to this Bott (2002) described a universal acknowledgement by a CSP working party who were redefining physiotherapy core skills that respiratory care was being somewhat sidelined. Bott (2002) states that junior physiotherapists were

frequently ill-prepared for and, equally importantly often unhappy about the respiratory on-call and weekend work that is not only one of our core skills, but which these hard-pressed therapists have to be able to carry out competently shortly after qualifying (p.28).

The management of some specialist services which require emergency on-call coverage has been demonstrated to be so challenging that those responsible for the training of physiotherapists involved in these areas have advocated the use of other professional groups such as nursing staff rather than untrained physiotherapists. This point is highlighted within the UK paediatric field. A nation-wide audit of paediatric and neonatal services was conducted by a respiratory specialist at Birmingham Children's Hospital in the UK. The findings were presented at the Chartered Society of Physiotherapy 2003 Congress, where on-call physiotherapy services to this group

were described as ‘patchy’, the biggest problem being that therapists lacked confidence in treating a client group they were not familiar with, and as a result intubated patients were often treated by doctors and nurses instead (Burr, 2003). This issue has been reported on recently by Harden et al. (2005), who performed a postal survey discussed in greater detail at a later stage (page 33). In their discussion on training they report that the Neonatal Physiotherapy Clinical Interest Group advise that out of hours physiotherapy to neonates be undertaken only by experienced staff who were fully competent to do so, and recommended trained nursing staff be used in place of on-call physiotherapists.

Most staff members employed in a hospital which provides an emergency on-call service are contractually bound to be part of the emergency on-call service.

Physiotherapists who work for the emergency on-call service are often working in an area that is not their chosen specialty. This means that both senior and junior staff grades perform emergency on-call duties. A senior member of staff with much experience within their chosen field is often referred to as an expert; likewise a junior staff member with minimal experience of a particular area may be referred to as a novice. When working in the emergency on-call environment the grading of senior or junior staff member does not represent the physiotherapist’s level of emergency on-call (or context-related) experience. Differences have been described between novice and expert physiotherapists within orthopaedic, neurological, domiciliary and cardiorespiratory fields (Doody & McAteer, 2002; Jensen, Shepard & Hack, 1990). There is no standardised definition of what constitutes a novice or an expert in the emergency on-call environment.

1.02 *Statement of the Problem*

The identification of differences between physiotherapists working in the emergency on-call environment has not yet been researched. The purpose of this study is to determine if differences exist between novice and expert physiotherapists who have by definition differing levels of context-related experience within the emergency on-call environment and to consider what factors may influence their physiotherapy intervention for an acute cardiorespiratory patient. The study will focus on levels of emergency on-call experience as it is anticipated that this factor will have the greatest influence in determining a difference.

1.03 *Significance of the Problem*

This study is of interest to all those involved in the provision of emergency on-call physiotherapy. Literature presented suggests that emergency on-call working involves high priority work which can be stressful. It is possible that stress levels are influenced by a number of factors, including context-related experience. Guidelines to direct on-call service provision and training exist in the UK where issues about standardised levels of training and audit persist; no such guidelines exist in New Zealand. The inability to adequately staff paediatric emergency on-call commitments has had significant consequences to the profession in the UK and New Zealand. It is possible that an inability to match demand for emergency on-call services with the supply of trained staff could result in a similar loss of service requirement for these physiotherapy services. Cardiorespiratory skills are required when working in the emergency on-call environment. Available literature suggests a lack of interest in undertaking cardiorespiratory-based work also that resources become stretched and training costs escalate when staff turnover is raised. This investigation is therefore important to both physiotherapists, physiotherapy managers, and for emergency on-call service provision of the future.

In the following chapter a literature review is presented which focusses on studies involving physiotherapists working in the cardiorespiratory and emergency on-call environments. First, theories of social research are explored followed by a discussion about survey research and the use of vignettes. Next, questionnaire design principles are analysed and synthesised to inform the design of a survey tool and facilitate data analysis. Finally, the research aims and research questions are described.

2.0 Literature Review

2.01 *Introduction*

In this chapter a literature review is presented. Quantitative design and survey methods in social research are first discussed, followed by the theory behind questionnaire development. Vignette-based research will be examined and clinical examples presented. The concept of occupational stress will be identified and its association with physiotherapy and the on-call environment will be investigated. Definitions of novice and expert practitioners will be considered and models shown. The clinical reasoning processes of novice and expert physiotherapists will also be discussed. Finally, as a result of the literature discussion, the research aims and questions will be detailed.

2.02 *Social research*

Social research has been used widely for over 2000 years (Sarantakos, 1994) and there are many types of social research methods. The quantitative research methodology is based upon positivist and neopositivist methodological principles, and it demands strict research design adherence prior to undertaking the research. Sarantakos states that analysis of quantitative measures then serves to determine explanations for and predictions of a social event. The principal opposing methodology to quantitative is qualitative research, which refers to a variety of methodologies such as phenomenology, hermeneutics and social interactionism. Data is collected and analysed using qualitative methods that serve to investigate relationships and better understand reality as experienced by the people under investigation: in other words from their perspectives. Sarantakos notes that quantitative principles directing the research are precision in measures, replication, validity, reliability, objectivity ethics and representativeness. Quantitative measurement is a common procedure in social research and is identified by Sarantakos as more accurate, valid, reliable and objective than qualitative measurement.

Any social research requires a philosophical framework to supply a frame of reference for selecting research designs, forming analyses and making generalisations.

Employing a research model results in more successful planning and an improved execution of research. Researchers may employ more than one type of research in their study. It is up to the researcher to determine which combination will best serve the goals of their study (Dillman, 2000; Sarantakos, 1994). There are clear differences in the process of theory building between quantitative and qualitative research. The theoretical frameworks that direct the research as well as the research processes vary and can be summarised in the table below.

Table 1.

A Summary of the Differences between Quantitative and Qualitative Methodology Research - adapted from Sarantakos (1994)

Feature	Quantitative Research	Qualitative Research
Logic of theory	Deductive	Inductive
Concepts	Clearly defined and available pre-research commencing	Developed during research process
Methodology	Mathematical; extensive statistical reliance	Less statistical reliance; verbal and qualitative analysis used
Reality	Objective, simple, tangible	Subjective, holistic
Direction of theory building	Begins from theory	Begins from reality
Links between causes and effects	Links apparent	No links apparent
Role of values	Value-free inquiry	Value-bound inquiry
Verification	Determined once theory building completed	Concurrent data generation and verification processing
Researchers role	Passive; separate from subject	Active, interactive and inseparable

Theory construction and theory testing are the two key processes required to be able to develop and refine research. de Vaus (1995) recognises the logic of observation-based grounded theory developing initial theories which are then tested, but notes in reality that there is a constant interplay between theory construction and theory testing.

This is described as a ‘shuttling back and forth’ between theory and observation, producing new theory and improved testable propositions leading to more sound theory construction. Social research aims to describe and understand society (de Vaus) and surveys are a method of social research.

2.03 The use of survey research

Survey research seeks to understand the cause of a phenomenon by studying variations in the causative variable across cases and determining other systematically linked characteristics (de Vaus, 1995). Causal inferences can be drawn when comparing characteristics although caution is used to avoid inappropriate attribution (Dillman, 2000). Surveys provide a relatively simple approach to the study of knowledge, attitudes, values, beliefs and motives (de Vaus, 1995; Robson, 2002; Rubenfield, 2004). de Vaus and Robson note that criticisms of surveys include that they are unable to establish adequate causal variables as only certain aspects of beliefs and actions without context are viewed. Other criticisms are that human consciousness, goals, intentions and values are neglected in a process that involves no imagination or creative thinking; furthermore that surveys are empiricist, collecting only a mass of facts and figures but providing nothing of theoretical value (de Vaus). The technical aspect of the survey research approach is criticised for being limited with highly structured questionnaires where any interesting answers are reduced to incomprehensible numbers (Robson). Surveys are also seen as potentially manipulative and open to an abuse of power where the researcher gains knowledge about the population under scrutiny and uses that knowledge to further some ideological view (de Vaus).

de Vaus (1995) discusses these criticisms and reminds us that theory and interpretation are fundamental components of survey research and analysis. He further acknowledges the limitations of surveys, stating that to an extent, survey analysis can overcome the philosophical, technique-based and political criticisms and agrees that

surveys should be used only when appropriate. de Vaus advises that researchers need to be conscious of the problem of context; they can improve interpretation by watching methods of collection carefully and, in the analysis, use appropriate techniques to provide the very context which surveys are accused of ignoring. Essentially, the course of a research programme is individual, affected by the topic, data collection techniques, bias of investigator, politics, sampling, funding and many other factors (Sarantakos, 1994; Dillman, 2000). Techniques of elaboration analysis and multivariate analysis are designed to avoid drawing incorrect conclusions of causal links from data (de Vaus). They are also used to compensate for the lack of randomisation and control groups by using statistical simulation. Survey research historically has been unreliable in making sense of social actions but by adding meaningful dimensions to the design this can be improved. de Vaus states that “good surveys require creative imagination, reflection, puzzling, interpretation and insight” (p.355).

2.04 *Vignettes in Survey Research*

One method of survey research can be found in the use of vignettes. A vignette is a written narrative, description or video of an event, case, or situation in which the reader is given sufficient information to begin to form an opinion and be expected to react (Polit, Beck & Hungler, 2001). Vignettes measure attitudes and behaviours and ask pertinent questions about the case. Bowling (2002) considers the need for researchers to ensure that no bias is created in poor question response formatting. As a technique, vignettes have been used predominantly in clinical psychology, gaining insights into individual patients. They are described by Bowling and Polit et al. as complex and time-consuming to administer; furthermore the authors state vignettes are difficult techniques with which to establish reliability and validity.

On the other hand de Vaus (1995) advocates the use of vignettes, noting that a significant problem with surveys is measuring attitudes where responses can be too abstract or vague. In such cases each participant reading a question interprets it within a different context resulting in varied responses to essentially what have become varied questions. He suggests that vignettes can minimise this variability by standardising the context. A further benefit of vignettes is the ability of researchers to be able to look for causal analysis where a set of related vignettes are presented, using

a number of standard features in the story but with systematic variation of a several of the features in each one. Alexander and Becker (1978) referred to this methodology as fractional factorial design which maximises the number of factors which can be systematically manipulated without losing information which can occur when designs change. Analysis is then able to focus on which parts of the vignette influenced respondents and in which way. The process is time-consuming and requires a standardised grid on which to ensure all possible permutations of the story are made available. Alexander and Becker state that if vignettes have been constructed according to this methodology the ensuing investigations are more efficient.

Cook et al. (1995) utilised a vignette in their cross-sectional survey of health care workers in the intensive care environment. Little was known about how health care workers made their decisions to withdraw life support and the survey aimed to examine nursing and physicians' attitudes concerning this issue. Thirty-seven Canadian University-affiliated hospitals were involved in this large survey of 1361 respondents. The response rate was high (82%). A series of 17 factors used in the decision making process of life support withdrawal and five levels of care were considered, utilising 12 different clinical scenarios. The authors discerned that potential confounding problems of the opinions, values and preferences of patients and their families were highly influential in how the respondent might react in a real-life clinical situation. They controlled for this factor by creating scenarios in which the patient could not help with decision making and in which no family members or friends were available to consult with. Questions were formed using a seven-point Likert scale and five alternative management strategies or levels of care were also provided to choose from. To ensure validity, pre-testing was performed using semi-structured interviews on twenty individuals. The pre-testing was performed on occupational groups being surveyed which included attending staff, house staff, and nursing staff and was able to establish that questions were unambiguous and that the scenario was clear and credible. Post test alterations are described as a result of these interviews.

The reliability was high in this study. The investigators established the reliability by administering the questionnaire twice, two weeks apart to 25 health care workers. Two factors were determined redundant as almost all respondents rated them similarly and as such they were deleted. The Intraclass Correlation for the rest of the factors

ranged from 0.68 – 0.96. Further testing of the instrument was performed by 41 health care workers from four hospitals and 34 methodologists who rated the tool's ability to discriminate amongst respondents. Ratings also included clarity, face validity and comprehensiveness. There was perhaps potential for bias as the delivery of questionnaires was by the intensive care unit director or a head nurse who handed them out during staff meetings. Another potential limitation was the problem of response recall in the second test.

The results using regression analysis showed that the differences between nurses and physicians were largely to do with professional issues rather than to other causes such as gender. In terms of responses to level of care in the scenario the investigators describe the variability as “striking” noting a relatively small variability in the importance ratings of determinants of life support withdrawal. These indicated that idiosyncrasies of health care providers were major determinants to withdraw care. This finding prompted a call for more standardised means of dealing with real-life scenarios. The vignette was able to successfully probe into sensitive issues such as ethnicity, colour, socio-economic status and family pressure, which should not have, but actually did appear to have effect on this decision making process.

Vignettes are described as economical and useful in gleaning information about how someone might behave in a situation that is difficult to observe in daily life (Polit, Beck & Hungler, 2001). In reiterating validity concerns Polit et al (2001) note the particular risks of obtaining accurate attitude and behaviour responses when the limitations of bias, particularly social response bias (where there is a need to avoid being judged as controversial by peers) apply in self-administered vignettes. Vignette use in probing sensitive issues is further demonstrated in a study by Helmes & Gee (2003) who investigated the attitudes of Australian therapists toward older clients using a postal vignette-based survey of Australian psychologists and counsellors. Their aim was to ascertain if older patients were less likely to be diagnosed with depression than younger patients, and if older patients were generally regarded less favourably because of their age.

Two versions of a vignette were used, the variable of age being the sole difference between each version. The response rate was low (38%) which can be a problem with postal surveys (Dillman, 2000; de Vaus, 1995). However in total there were 707

responses. Of interest in this study, most respondents correctly identified depression regardless of the age of the patient; however, the general attitude towards treatment of the older patient was described as consistently less favourable than to the younger one. Therapists felt less competent in treating the older patient and the investigators concluded an age bias had significant influences on the potential care of the patient and that specific education and training of such therapists was needed.

Hughes (1998) investigated the value of vignettes and associated difficulties whilst examining the habits and behaviour of intravenous drug users, their attitudes towards Human Immunodeficiency Virus (HIV) risk and adoption of 'safe behaviours'. The author affirms that observations from the practical use of the vignette helped to contextualise pre-survey theories. Hughes discusses the difficulty of self-reported behaviour differing from actual behaviour but notes that this is not new in the social science field referring to La Pierre (1934) who stated that "the very process of questioning demand(s) [*sic*] a verbal adjustment to an entirely symbolic situation" (p.383). Hughes suggests that in being too selective, vignette respondents are given sufficient distance and space such that they can provide a response based upon 'it depends'. However a vignette with context could be used to explore primary influencing factors, particularly when dealing with potentially sensitive issues. The opportunity to react from a non-personal perspective could be seen as less threatening and therefore advantageous. The author states that the use of vignettes in studies of pain, suicide, sexual standards, relationship violence, rape, drug use and deviance, are useful techniques to encourage discussion and a means to introduce personal experiences. Hughes accepts that the technique could be described as neglecting real life interactions where results could be deemed unrealistic due to a lack of real-life comparability. He also counters that no research tool can be totally reflective, nor totally capture reality. By interpreting the real world and presenting it in an appropriately contextualised scenario Hughes suggests that respondents can make useful contributions to research methodology. He also states "vignette data can complement other forms of data collection to provide a more balanced picture of the social world which researchers seek to understand" (p.384).

Hughes (1998) notes the importance of relevance and credibility of scenarios to participants. Finch (1987) recommends that mundane scenarios with no 'eccentric characters' or 'disastrous events' should be used in vignettes in order to seem real.

Hughes suggests that some participants could respond to third person scenarios as they would follow a similar action; alternatively some could respond by describing what they ought to do rather than what they would actually do. A further difficulty involves the effects of the story-line taking a different course than the respondents expected which may result in respondents interpreting the change as if they had given a 'wrong' answer. Finch suggests that a serial-style vignette that changes respondents' direction can in fact provide the opportunity to investigate issues further.

The study by Hughes (1998) interviewed intravenous drug users with prison experience from two cities in the UK about their prison experiences, HIV risk and attitudes towards 'safe' behaviour. A combined approach of vignette-based interviewing was used and a progressive or 'continuous' vignette utilised. This is described as a series of stages that build upon previous events, seen as timesaving and able to generate more interest in the respondents. Hughes recognises weaknesses of this technique in that there is only partial exploration of contextual features as it is not possible to explore all of the potential options at each stage of the vignette. The interview-based technique was appropriate as literacy amongst respondents was not guaranteed; likewise the use of appropriate wording in framing the scenario was necessary during the vignette to keep it real to participants. Social desirability bias was demonstrated when participants discussed 'should behaviours' and would then report what they thought would realistically occur with prompting. The importance of a realistic story line is highlighted by the respondent's ability to relate and feel empathy for the characters within the story. The author recognises the need for adequate depth to avoid frustration and gain interest, respondents' interpretation of the scenario being improved if they have had similar experiences. Hughes concludes that this type of vignette was advantageous in its ability to recognise the nature of behaviours and in giving sufficient opportunity to discuss these and therefore they have a real value.

This provision of sufficient opportunity and other environmental factors which could influence responses was examined by Stolte (1994). As stated previously, vignettes have been used widely by social psychologists to study the cognitive aspects of social interaction. Stolte considered the context of satisficing in vignette research using a fractional factorial design on a sample of American college students. The study was of value to vignette-based research as it demonstrated how factors can be manipulated in an attempt to improve the reliability of participants' responses. Satisficing is defined

by Stolte as a tendency for subjects to process vignette information less carefully than they would if it were a real life situation. It is suggested that factors such as interview setting; mode of tool administration; tool attributes; and respondent incentives could all encourage satisficing. This research was designed to test what factors or conditions actually did influence respondents.

The sample (n=72) of students were taken from one university and randomly assigned to a cell. In total there were six cells in a 3 x 2 complete factorial design. Two experimental factors were investigated; the first was vignette-induced structural power where high, medium and low options were available. This factor was used to examine the dependent variable of self-efficacy. The second related to context where two conditions, 'satismin' and 'satismax' were created. The 'satismin' condition was designed to minimise the possibility of satisficing. In this case participants were told to take as much time as they needed to complete the vignette, left alone in a quiet room with no distractions, and were given a financial reward. The implication of this being that participants ought to be more careful and effective in their responses than the 'satismax' group. The 'satismax' condition was designed to maximise the possibility of satisficing whereby the vignette was administered in a classroom setting, for no financial gain and under a time constraint. Interruptions and noise as people moved and whispered were further distractions. The investigator defends the cost to participants of a fairly lengthy and abstract vignette, noting that the cognitive demands placed on participants with such a tool were constant across all participants. Stolte (1994) notes the positive influence of complex and long vignettes on the concept of satisficing.

Predictions made were that structural power manipulation was positively related to self-efficacy and that the 'satismin' condition would show a more reliable and accurate vignette-induced effect; further, that the 'satismin' condition was expected to have a more easily observable influence on participants' measures of self-efficacy than the 'satismax' condition. The results of this study supported these predictions. Furthermore the context was found to have had a significant main effect ($p < .05$) on self-efficacy, which had not been predicted. It is suggested that the relatively lower sense of self-efficacy expressed by 'satismin' participants could be due to a sense of obligation through receiving payment compared to those who merely agreed to a request.

This study offers a practical solution to improve confidence in the internal validity of results whereby contextual conditions can be utilised which will minimise the tendency for satisficing. Providing incentives which influence participants towards careful, deliberate thought is expected to produce more reliable data. Stolte (1994) accepts that these results are applicable to the specific sample used and states that the generalisability of these findings to other populations remains to be demonstrated. Stolte concludes vignette experiments and sample survey research methodologies can be used together and can complement each other, optimising both internal and external validity in doing so.

Vignette-based research has also been used to study those in the physiotherapy profession. Examples of these can be seen in a vignette which investigates the treatment behaviours of therapists involved with acute ankle sprains (Larmer, Robb, Hing, Reid & McNair, 2002). This investigation was commissioned and fully funded by the Accident Compensation Corporation (ACC). The aim was to review all physiotherapists on the ACC physiotherapy treatment provider database and investigate their clinical practice. The interest of ACC in this project is declared; as consumers of a physiotherapy service they were keen to determine effective and efficient services for ACC clients. The investigating team were all physiotherapists who clearly identified the need to establish that these injuries were being managed appropriately. The concerns raised at the start of the investigation were that significant variation in physiotherapy treatment profiles was thought to be occurring within New Zealand. The injury under investigation was deemed as one of the most common injuries to present in clinics. This factor, together with the typical characteristics of the patient, i.e. young age, loss of time from work, financial burden and high individual costs associated with ACC claims, would be likely to improve credibility of the vignette scenario and maintain respondent interest (Finch, 1987).

The methodology was chosen for its ability to adequately reflect the quality and quantity of treatments in a non-threatening way. Questionnaire construction appropriately sought specific treatment information using closed and partially closed questions for some data, and where little information was known, open-ended questions were used to avoid bias or prompting. The tool was pre-tested on experienced physiotherapists who gave feedback on credibility, clarity, content and

face validity which determined the final questionnaire version. As a large population was being investigated (n = 1900) a postal survey was most appropriate methodology (de Vaus, 1995; Dillman, 2000). Follow-up phone calls were made to non-responders. Dillman suggests that up to five contacts may be required for some individuals when using mail surveys. It is not clear why from the study however, in this case not all non-responders were contacted. Dillman recommends the use of postcards when telephones are unavailable, but this adds time, which in this case may not have been an option.

The response rate was low (n=324; 17%) which could affect the external validity. In accounting for this the authors suggest an over-estimation of numbers from the sampling frame used (ACC providers' database). Each set of responses to the questionnaire is presented in table or figure format clearly demonstrating where variation was significant. Results are discussed in more detail and cross-referenced with current literature to provide clear indication where, and in what way, some therapists might be less aware of recommended practice and therefore incurring greater costs to ACC. The investigators were able to compare clinical practice with treatment profiles and, reflecting on their outcomes, concluded that physiotherapy treatments in New Zealand for this particular injury generally followed current evidence. Larmer et al. (2002) also determined wide variation in treatment frequency, time management and total number of treatments.

The last study to be considered in this section mirrors that of Larmer et al.(2002), utilising the same research group and commissioned by the ACC. Reid, Larmer, Robb, Hing, and McNair (2002) used a vignette to investigate New Zealand physiotherapy clinical practice in the management of low back pain. An identical methodology is used with a non-dramatic but relevant vignette-based questionnaire being mailed to all physiotherapists on the ACC provider database. Pre-testing was performed as before; there is no mention of follow up contacts being made to non-responders. As with the previous study the response rate was low (n=324; 17%). Demographic data was slightly different indicating that a different group of people responded to this questionnaire.

Given that both surveys were similarly resourced, designed, implemented and targeted, the potential influence of order effect may be seen in the result of one study

influencing responses to similar questions in the second study (Dillman, 2000). No mention of steps taken to avoid this (e.g. gap time between administrations) is made. This potential confounding factor may have been negated as the investigators contextualised the questions with a realistic vignette; John's low back pain history was very different from Susan's sprained ankle; hence separation is possible (de Vaus, 1995). Findings from the Reid et al. (2002) study were that most respondents appeared to be adhering to recommended treatment guidelines. The goals and methods were similar to overseas recommendations. Treatment frequency was almost double the ACC benchmark guideline but again compared similarly to overseas literature. The authors suggest further research being required here.

To summarise, the strengths and weaknesses of vignettes in survey research have been discussed in this section. Examples of how vignette-based research can successfully influence and investigate attitudes and behaviours of different occupational groups in a non-threatening environment have been demonstrated. The advantages of pre-testing and importance of good tool design to limit confounding variables and order effects has been presented. Finally, the ability to manipulate conditions in order to improve returns and reduce satisficing has been discussed.

2.05 Questionnaire design and management

It has been suggested that concerns involved with surveys are less to do with the strategical design and more to do with the instrument used to gain information (Robson, 2002; Rubenfield, 2004; Stone, 1993). Self-administered surveys are recognised as one of the easiest and low cost methods of retrieving information about a large cohort which is geographically widespread (de Vaus, 1995; Dillman, 2000; Robson). When used as a sole research instrument, Boynton and Greenhalgh (2004) emphasise the importance of thoroughly scoping the subject under investigation in order to clarify research goals. Stone notes that a well-structured questionnaire can offer an objective measure of knowledge, beliefs, attitudes and behaviours, but only if participants can give meaningful answers to appropriate questions. Some authors advocate the use of an existing instrument which maintains its validity, so long as it reflects the full range of potential responses that the proposed sampling frame may have, in the absence of which one has to be developed for the purpose (Boynton & Greenhalgh, 2004; Robson, 2002).

Boynton, Wood and Greenhalgh (2004) note of the importance of maintaining a clear understanding of the questions, avoiding complex re-routing, avoiding the use of jargon, and piloting the tool well. Questionnaire layout, types of questions, response options, guiding instructions to improve flow, and order of questions are also relevant aspects of the design de Vaus (1995) and Dillman (2000). Essentially, any measure which can be taken to reduce the costs associated with responding; increase the rewards obtained by the responding; and establish trust between investigator and participant, relates to the social exchange theory described earlier by Dillman, and should improve response rates and accuracy. A reliable questionnaire will yield consistent results where differences in the results can be said to be totally due to differences in participant responses. Reliability is further improved if the questionnaire is standardised and all who undertake it receive the same tool administered in the same way. A valid questionnaire measures what it intends to measure. de Vaus notes that many factors can affect the validity, such as ensuring that it is used on the participant groups for which it was designed, that the concept being investigated is well defined, and that theories used to develop the tool are well established. de Vaus and Dillman also note that despite piloting a questionnaire, reliability and validity may still be problematic for some questions even after several rewording attempts. In this case, the authors recommend dropping questions if the responses to it cannot be meaningfully analysed.

Participants must feel confident to answer questions openly without concern of retribution or embarrassment. Robson (2002) advises that questions must be correctly structured in order to achieve research goals: more specifically, to answer the specific research questions. Question design and formatting must carefully consider the issue of sensitive questions, to avoid increased cost to the participant and increase the likelihood of non-response (Dillman, 2000). Robson used a model of survey data collection demonstrating how survey questions fit into the overall survey process. The model showed clearly the importance of the tool in its ability to provide valid measures for the research questions. It did this by gaining the trust and cooperation of respondents in order to elicit 'true' information. Boynton et al. (2004) note a key principle to reducing participants' perceived threats is to assure privacy and administer the tool in a non-threatening environment.

Ethical considerations of questionnaire design and management include the concepts of beneficence and non-maleficence; respect for a subject's dignity; justice; protection for vulnerable subjects; and informed consent (Noble-Adams, 1999a). The author advises that obtaining informed consent is an essential component of conducting ethical research and was formerly defined within the first principle of the Nuremberg Code (Noble-Adams, 1999a). Voluntary participation can conflict with methodological sampling principles for example participants may decline if threats are perceived and this may affect the results. Although, statistically, adjustments can be made for sample bias, the best option is to maximise voluntary participation (de Vaus, 1995). It is essential that informed consent is gained prior to tool administration, and when assuring confidentiality or anonymity the full meaning of this concept should be understood and that it is realistic and possible (Dillman, 2000). de Vaus notes that ethical responsibilities should include making participants aware of appropriate tool storage during the study and archiving once the study has been completed; also whether in the future data may be made available to other researchers. Participant confidence can be increased if they are made aware of the tool having passed an ethics committee's approval process and that the investigator is formally registered with a research body or sponsor (Boynton & Greenhalgh, 2004).

Questionnaires can be delivered in person, electronically via the Internet or posted. Each method has weaknesses and strengths which must be considered in the design. The availability and capabilities of the target population influence the choice of delivery mode (Dillman, 2000; Polit et al., 2001). A potentially confounding factor relates to the concept of interviewer bias. Robson (2002) notes that interviewer-led surveys may be subject to the disadvantage of influencing participants by the interviewer's own levels of motivation, personality, skills and experience. This social interaction influences responses (Boynton et al., 2004; de Vaus, 1995). To reduce interviewer bias, de Vaus advises a confident approach, a neutral and standardised personal presentation, and well-rehearsed information which is delivered with written backup. Polit et al. support the interviewer-led approach to surveys suggesting that response rates are improved as interviews are harder to ignore than a mailed questionnaire. However for geographically dispersed target populations the authors recommend using the postal method. Strengths of this delivery method include a wider coverage which can be financially more efficient; the possibility of anonymity being easier to ensure; and an avoidance of the confounding interviewer bias. Both de Vaus

and Dillman note that a key limitation of the postal method is the poor response rate which can be improved upon by ensuring that all instructions are brief, unambiguous and user-friendly with some form of follow-up strategy in place.

Coding is a method of classifying research data into meaningful categories. Bowling (2002) discusses the use of coding questionnaire by either deductive (pre-administration) or inductive methods, where codes are designed after analysing a representative sample. Both closed and open question coding is possible, as is coding for non-responders or answers to the 'other – please specify' option, which ensures all data is included in the final analysis. Bowling suggests that two coders should ideally be used to independently code an entire data set, which is then checked for errors by an independent researcher. Once a computer analysis package has been identified such as SPSS, data can be entered and once checked can then be analysed.

Descriptive research provides information about a wide range of characteristics, their distribution and possible relationships. Robson (2002) describes the movement from descriptive to interpretive processing to be able to provide explanations of those characteristics and relationships. The author suggests further that sophisticated analysis of correlation patterns is required to be able to imply a cause, as mere correlations cannot do so.

In this section it is seen that surveys using questionnaires are an excellent method of obtaining objective information about beliefs, attitudes, knowledge and behaviour. The design and layout of a questionnaire is essential to ensure a meaningful result, and piloting is essential. Ethical considerations must be adhered to throughout the whole process from questionnaire design to presentation of results. Various delivery methods are considered and strategies are suggested to reduce confounding. Steps to improve reliability are encouraged when coding the results.

Questionnaire-based research provides an opportunity to determine what a physiotherapist would actually do in a best case scenario rather than follow medical preference or hospital policy.

2.06 *The association of stress and physiotherapy*

There is minimal recent literature available about this subject in physiotherapists. Occupational stress is referred to by Mottram & Flin (1988) as a 'complex psychological state' which has the key elements of a subjective awareness of an experience and a perception of the balance between work demands and coping abilities. The authors note the work of Cox (1985) who states that, "The classic stressful situation is one in which the person's resources are not well matched to the level of demand and where there are constraints in coping and little social support" (p.607). Despite several limitations there is value in reviewing this relatively early study of a relevant population as it appears to be the only study that examines the concept of stress among newly qualified physiotherapists and offers a starting point for future research into stress-relating factors in this professional group.

Mottram and Flin (1988) addressed the concept of occupational stress in recently qualified physiotherapists. An initial sample of 11 were interviewed before sending a questionnaire to a larger sample of physiotherapists who qualified in 1985 and 1986 (n=50). Only one health board in the UK was sampled; all interviewed participants were female; there was no mention of randomisation.

The authors note a lack of available research in qualified physiotherapists. An earlier study by Keenan and Newton (1987) is discussed by Mottram and Flin (1988), this study considered stress levels among newly qualified engineers. Keenan and Newton found that 'an ineffective use of time' and 'interpersonal conflicts' were the aspects of work most frequently cited by employees as sources of stress. With this awareness Mottram and Flin sought to determine if qualified physiotherapists could be affected by job pressures related to their lack of experience. They hypothesised that if found stressful, could the job performance and the ability to adjust into a professional role be affected? In order to assess the incidence and influence of occupational stress during the progression from newly qualified to professional physiotherapist, the authors used a combination of interview and questionnaire research methods. The interviews were taped and transcribed. The principal author was a senior physiotherapist within the organisation being studied and she conducted each interview. This may have biased responses from junior therapists as the investigator would be well known to them.

On the basis of the interview script analysis, a questionnaire tool was designed and administered. The questionnaire was sent out to 50 physiotherapists in one UK health board and had an 86% (n = 43) response rate. The authors comment that this reflected the importance of this topic to the subjects. The questionnaires were anonymous, which may have increased the response rate. Despite a reminder sent to all participants after two weeks, seven questionnaires were not returned. Ethical issues were considered in that assurances of confidentiality were provided at the start of all interviews and the questionnaires were anonymous. However, no mention of informed consent being obtained was provided. The questionnaire design used a mix of closed and open questions. It is not clear if there were options to add 'other' choices to the stem of closed questions, as there is no printed example of the questionnaire.

Weaknesses of the study include a lack of description of the methods, a lack of data analysis, and failure to provide a copy of the questionnaire used. The use of ambiguous scales, double barrelled questions, and of long lists which were not exclusive with no room for participants to add options are criticised by many authors as reducing reliability and validity of the results (Bowling, 2002; de Vaus, 1995; Dillman, 2000). The response choices of some questions lacked homogeneity and consistency and question articulation was not maintained (for example the word 'stress' alternated with 'worries'). Both are to be avoided in order to maintain consistency in responses (de Vaus) and avoid confusion (Dillman). Validity was reduced, given the small sample size, sampling technique and potential interviewer bias. The tool was not piloted; all participants had the same exposure. There is no description of steps taken to reduce confounding factors and improve the reliability of this study. There is minimal description of the method of data collection and no mention of the data analysis methods. The results are simply presented as frequency counts according to each question in turn.

Initial questions presented to participants referred to stress; the responses offer a valuable insight into the concerns of physiotherapists commencing work for the first time. 'I was occasionally or frequently stressed in the first three months of work' (91%; n = 45); 'I am occasionally or frequently stressed now' (81%; n = 40); 'physiotherapy is moderately stressful' (68%; n = 34). Whilst those interviewed placed 'the need to be appearing to manage' as the top concern, 'being required to take clinical decisions' and 'being on call' were also noted as stress-causing factors. The

results of this study demonstrated that the following stressors were among the top ten most stressful activities taken from a list of 28 activities. These were selected by over 50% of the participants, 'being very busy' (79%; n = 39); 'working in a new ward' (72%; n = 36); 'discussing patients with doctors' (69%; n = 34); 'patients not improving' (62%; n = 31); 'being on call' (58%; n = 29); 'making decisions alone' (51%; 25) and 'working with the acutely ill' (51%; n = 25). All of these activities are most relevant to the emergency on-call situation. Of those studied, 40%; n = 20 stated that physiotherapy was significantly different from their initial impression. Of concern, 21%; n = 10 experienced feelings of having chosen the wrong job and 40%; n = 20 felt incompetent at times. In conclusion, the authors related these findings to similar studies in other professional groups and found, perhaps predictably, that some stressful situations were common across these groups.

Links can be drawn from this information with the description of the novice-to-expert role model described by Benner (1984) where there is a definable need to be guided by identifiable protocols and procedures in order to achieve a satisfactory outcome among the novice and advanced beginner steps of a five-step process. This model is discussed in more detail in section 2.09 (page 37).

In this study, participants were asked to choose from a list of physiological and emotional responses that they felt as a result of stress. The most common emotions, being 'tired' and 'irritable', were chosen by 86% (n = 43) and 63% (n = 31) respectively. From these results three themes were identified as causing stress – quantitative and qualitative overload; relationships; and setting and achieving goals. Quantitative overload was defined as having too much work to do within a given time frame and qualitative overload meant working beyond one's capabilities. The authors note that it is the individual's own perception of the level of demand placed upon them that is important here, recognising that for novice physiotherapists being able to differentiate between what could be left and what required attention was not an option – everything had a similar level of priority. Qualitatively, staff reported particular concerns toward appearing inadequate when faced with questions requiring an immediate answer.

Mottram and Flin (1988) discuss the importance of relationship building and management with patients and work colleagues in physiotherapy perceiving that there

is a transition from a cocooned student to a personally accountable professional. This transition brings with it a requirement of interpersonal skills, both psychological and social, which when lacking can cause significant problems. Good interpersonal skills are certainly not exclusive to experienced physiotherapists; however, Benner (1984) notes that recognition of situations, of the need for change and more intuitive management, is found in practitioners working beyond the novice level. If these abilities facilitate an improved psychosocial and social interaction, then it could be postulated that novices would have increased problems in forming these relationships. Participants found that being unsure of their goals or not fulfilling them was stressful. The authors acknowledge that past experience makes it easier to anticipate the outcomes and set more realistic goals. Benner describes this ability as being related to an advanced or competent practitioner and therefore unlikely to be found in novice practitioners.

This section has defined occupational stress and situations where this might be encountered. An early study which examines stress in recently qualified physiotherapists has been presented. The effect of stress in other occupational groups is mentioned and similarities of new graduates in mixed professional groups are noted. Questionnaires have been used to determine what professional groups find most stressful and links are seen with the five-step process model from novice to expert described by Benner (1984) which is to be discussed later in this chapter.

2.07 The cardiorespiratory specialty and emergency on-call work

McAuley (1999) undertook a survey of weekend physiotherapy in an acute care hospital in Canada in order to determine the appropriateness of weekend physiotherapy services. A national survey of 15 similarly sized hospitals was performed to benchmark weekend on-call inclusion criteria and a large proportion were cardiorespiratory related. A review of pertinent literature regarding weekend physiotherapy services was undertaken. A reduced average length of stay was determined in studies with increased physiotherapy input at weekends, although no specific evaluations had been performed related to cardiorespiratory conditions. The hospitals surveyed were asked to make comment on a list of 16 indications for weekend physiotherapy coverage and 44% were cardiorespiratory related. A high level of agreement amongst the hospitals was reached for the following diagnoses;

major abdominal surgery; early post-operative (100%); chest infection with sputum retention (89%); and patients with high risk of pulmonary complications (78%). While agreement varied greatly for the other on-call inclusion criteria, this study clearly showed a need for cardiorespiratory skills when working in the on-call environment.

Acquiring cardiorespiratory skills for on-call service preparation in novice physiotherapists was investigated by Thomson (2000) who was able to identify links between the amount of on-call preparation and attitudes towards service provision. The author acknowledged increasing demands for emergency on-call services and the need for provision of physiotherapy to more acutely unwell patients, noting the scarcity of undergraduate cardiorespiratory placements. Three key issues were examined to determine a difference between amounts of novice preparation: continuing professional development, clinical reasoning and the development of reflective practice. Large variances in on-call preparation were determined and the attitudes of fear and anxiety were discovered as typical features of novice on-call preparation. Thomson discussed the implications of workplace stress which lead to emotional exhaustion causing burnout and suggested this as a factor in staff retention difficulties.

This was a qualitative pilot study using a series of interviews undertaken on a convenience sample of 14 novice physiotherapists who were representatives from four different hospitals in England and Scotland. The definition of novice was time specific; i.e. they had worked for less than one year after qualification however no supporting information for this definition was provided. Interview questions for this study were developed using a focus group, and justification supporting the interview schedule and open-ended question design was given. All interviews were taped with participants being encouraged to speak freely about their experiences in a narrative style. The results were reported using frequencies and descriptive statistics which are considered appropriate for qualitative studies (Polit et al., 2001). Limitations of this study included the sample size and sampling technique. As an exploratory study, only a small sample was researched and the author suggested that a future larger study be undertaken with different recruiting processes. The convenience sample in this study was selected by different service managers whose different approaches could have affected validity.

The results of this study showed that all participants felt they had improved confidence and knowledge levels following their first year of working. Reasons provided for feelings of fear included a concern about ‘doing the wrong thing’; ‘working in isolation’ and a ‘lack of experience’. Reasons given for feeling anxious included being unfamiliar with on-call processes and being unable to justify decisions to senior medical staff. These findings clearly relate to the description of novices provided by Benner (1984). As the interview responses were discussed, themes developed linking the feeling of confidence with the attainment of context-specific knowledge and actual experience. The author cited the work of Higgs and Jones (1995) and Case Harrison and Roskell (2000) relating to the development of an individual’s clinical reasoning using time and experience, noting that time constraints within the National Health Service may have hindered this process in UK graduates. Of interest to this research, all respondents supported the concept of using case studies for on-call preparation.

Attitudes and beliefs of students towards the cardiorespiratory specialty in New Zealand have been examined amongst final-year students from Otago University by Dodson, Fletcher, Henzell and Spurr (2001). A questionnaire was administered midway through the final year of 79 fourth-year students. The response rate was high (93.7%; n = 74). The questionnaire was piloted appropriately and administered by post with anonymity assured and maintained. Questions were both open and closed; open responses were sub-categorised and analysed in themes. Comparing intended with current areas of physiotherapy practice, the authors found no interest for employment based within the cardiorespiratory specialty over the next ten years. Dodson et al. relate this finding to the New Zealand Health information Service survey of 1999 reporting that 3.3% of the workforce was involved in cardiorespiratory fields. Other areas in the survey included neurology (5%), paediatrics (6.3%) and musculoskeletal (45.6%).

The authors encourage physiotherapists to find causative factors for the strong inclination towards private and public musculoskeletal physiotherapy versus an almost total disinterest in cardiorespiratory physiotherapy or the profession might see its role being assumed by others. Of interest is that the prime influencing factors were geographical location, professional experience and salary; none of these factors appear to be specific to the cardiorespiratory specialty alone. The authors conclude that well-

educated and matured leadership in the cardiorespiratory field is called for to establish better balance to the workforce and determine career pathways within the specialty in order to improve and maintain interest in the field.

Roskell and Cross (2003) performed a descriptive survey on 15 final-year students from each of the 22 schools of physiotherapy within the UK (n=330). Their aim was to establish students' perceptions of cardiorespiratory physiotherapy that could be used to guide the direction of the specialty in the future. The authors acknowledged that aside from concerns previously discussed, cardiorespiratory physiotherapy was also experiencing difficulties with recruitment and retention. This posed a significant threat to cardiorespiratory role maintenance and development. The authors commented that a poor level of competence in new graduate therapists and reduced interest in the field was leading to an inability to evolve and develop specialty roles that were seen in other fields. Anecdotally the authors were aware that many students did not enjoy cardiorespiratory work. In order to explore the generalisability of this opinion a large cohort was required, hence the postal questionnaire method was most appropriate.

The questionnaire consisted of closed questions and rating scales that were generated from conference discussions and from available literature. Care was taken to ensure content validity and internal consistency of the tool. The authors acknowledge that as an exploratory study the questions were limited, as they could not explore answers in detail. Piloting was appropriately performed on physiotherapy students and modifications were made to the tool prior to national administration. Reliability was improved as the author excluded two training schools with which she had a specific association, thus minimising response bias. Limitations to validity were discussed, particularly the judgemental sampling procedure which was used to sample 15 final-year students of each school. This was not a randomised process. All participants received written and verbal information about the study and assurances of confidentiality. The response rate was 73% (n=222). The investigators used prompting and prepaid return envelopes to improve the response rate. The authors found that although most (80%; n = 178) of respondents saw value in cardiorespiratory physiotherapy, only 6%; (n = 13) intended to specialise in the field. Of interest, clinical experience positively influenced students' attitudes the most and 30% (n = 67) of participants stated that they felt less competent in cardiorespiratory than other

specialties. The authors discuss the difficulty in evaluating this information, as no comparative data from other fields existed.

An earlier study by Roskell & Cross (2001) is discussed in this paper, which demonstrated that 76% (n=66) of senior I respiratory physiotherapists felt undergraduate training inadequately prepared students for respiratory problem management. This opinion was not exclusive to physiotherapists; similar concerns in the 'theory-practice' gap being raised internationally by other allied health groups such as occupational therapists. The authors also perceived that in the training environments available to junior staff, at times a negative culture can prevail which reduces the effectiveness of learning opportunities and therefore the specialty overall becomes unattractive.

The effect on student attitudes of positive clinical experience and positive role models was discussed in a recent paper by Bennett and Hartberg (2007). These authors explored links between student physiotherapists' attainment of cardiorespiratory experience and career choices within the specialty. The findings were pertinent to this research as they highlighted continued difficulties in an area of historical concern, i.e. the lack of student cardiorespiratory placement experience which has been discussed in previous studies (Dodson et al., 2001; Roskell & Cross, 2001, 2003). Bennett and Hartberg described the potential for students without cardiorespiratory experience to be disadvantaged in their ability to transfer context-specific theory into practice possibly affecting their attitudes to work within that environment. The authors suggested that learning could not be achieved by environment participation alone and that a student's professional development relied on reflection rather than length of time spent in an area.

In this study a self-administered questionnaire was undertaken by a purposive sample (n = 59) of third-year physiotherapy students from one university in the UK. The method appears appropriate as the author's aim was to assure anonymity and reduce bias in a sample which was known to the researchers. The entire sample had completed their clinical placements. A filter question was inserted to define the groups between those who had undertaken one or more cardiorespiratory based placements (n = 45) and those who had none (n = 14). The questionnaire was appropriately designed to explore perceptions of cardiorespiratory physiotherapy using

a combination of open questions seeking in-depth views on sensitive items and closed questions which asked participants to rank and scale items. The questionnaire was piloted; these participants were then excluded from the research. Ethical approval was obtained, and consent was implied by the return of completed questionnaires.

The results found differences between groups in their perception of competency were statistically significant ($p = >0.01$); those with experience felt more competent to treat patients with respiratory problems than those without. A statistically significant difference was also found in the analysis of perceived levels of theoretical knowledge which could be incorporated into cardiorespiratory practice ($p = >0.01$). Students identified a number of factors which had a positive influence on their attitudes towards using cardiorespiratory skills. The encouragement from other physiotherapy professionals was determined as having the most significant impact. Students with no cardiorespiratory placement experience had no intention of pursuing it in their career whereas those with experience were more positive about career choices within the specialty. The results also demonstrated that opportunities were presented for students to both learn and use cardiorespiratory skills in other specialties. The authors noted the importance for students to have recognised and used a holistic approach in all areas of physiotherapy management particularly if a student had not had a specific cardiorespiratory-based placement.

Limitations of this study were that it was a small study which sampled physiotherapy students from only one location. The authors related their findings to those of Roskell and Cross (2003); however, caution is advised in relating these results as the samples are very different. It may have been useful to have repeated the study involving students from other universities, who would have undergone different experiences in the cardiorespiratory area, and then to have compared findings. A further limitation was presented as students were not asked to provide reasons for their responses about career choices which may have provided valuable insights into how the student attitudes were formed.

In conclusion the authors suggested that a shortfall of cardiorespiratory placements in the UK could have been linked to ongoing recruitment and retention problems and they warn the physiotherapy profession of the concept of role dilution where poorly managed areas could be taken up by other professions. The authors suggested that a

standardised amount of student exposure to patients at risk of deterioration from a cardiorespiratory cause could improve their willingness to take part in respiratory treatments.

Concerns within the physiotherapy profession about the provision, maintenance and lack of national guidelines for emergency on-call services have been raised by New Zealand physiotherapists (Reeve, 2003). A survey was undertaken of senior respiratory physiotherapists who were working in hospitals within New Zealand that provided on-call services (n=38). The aims of this survey were to describe on-call practice and provision, to identify trends and variations in on-call service provision, and to identify any concerns of physiotherapists. It was acknowledged that some students are able to qualify without any intensive care, high dependency unit, or acute cardiorespiratory patient experience. The survey found that 33 centres provided an on-call service. The response rate was high (97.4%; n = 37), implying a high level of importance of this matter to respiratory therapists.

The survey questionnaire was designed by Reeve (2003) using primarily closed questions. The tool was appropriately piloted and relevant changes made. This was a postal survey, confidentiality assured, and ethical considerations were met. Closed data were analysed using SPSS Version 10.0 for windows; content analysis and theme development were used for open data. The findings demonstrated great variation in on-call inclusion criteria, types of service available, grades of staff involved, availability of guidelines, training programmes utilised and competency maintenance.

Reeve notes that in New Zealand, formal competence assessment for the cardiorespiratory specialty is undertaken only at undergraduate level and acknowledges the association of on-call duties as key stress factors as described by Mottram and Flin (1988). The author suggests that any attempt to highlight problems and address strategies to rectify them would be appropriate considering the legislation requirements set out within the Health Practitioners Competency Assurance Bill, which was passed in 2003 (Physiotherapy Board of New Zealand, 2005).

In conclusion, Reeve called for improved guidelines and training for staff working on-call in New Zealand, suggesting that future research into the opinions and concerns of

on-call physiotherapists be done, and that differences between the experienced and novice practitioner in the emergency situation be investigated.

The concept of stress relating to on-call work, the general lack of interest and confidence in the respiratory on-call field and difficulties with recruitment and retention pose a difficult problem for managers of services who are responsible for a standard of service provision and the maintenance of a competent workforce. In the UK these concepts have been reviewed by the CSP who have published a guideline entitled *Emergency respiratory on call working: Guidance for managers* (CSP, 2004). The CSP recognised that a framework for managers was required to support respiratory on-call service provision in the UK and described the level of stress for staff already involved in these services as significant since they dealt with reduced staffing numbers to try and meet the demands for efficient and safe services to this acute patient group.

The guideline justifies its concerns by focussing on the causes of a dwindling willing and competent workforce, citing lack of exposure to acutely compromised respiratory patients at both undergraduate and postgraduate level, reduced placements in the acute respiratory field, and encouragement for new graduates to specialise early without having worked in a respiratory area, as key factors. Furthermore, the guideline outlines the impact on weekend staff resources of other areas which have started to demand a weekend service such as contracted orthopaedic initiatives and intermediate short-stay care facilities which take more staff from the weekend on-call pool. The purpose of the guideline was to provide a framework for UK service providers which was within national standards and enabled them to plan and deliver a local comprehensive respiratory service. No equivalent national framework exists in New Zealand and this may be a relevant area for future research.

2.08 *Emergency on-call service governance*

Setting the standards for emergency on-call work involves the creation of guidelines with a means to monitor and audit the service. It has been shown that prior to such guidelines existing in the UK management of this occurred at local level and standards varied. Dixon and Reeve (2003) performed an audit that investigated levels of support, education and training available to physiotherapists prior to their commencing on-call

duties in the Trent Regional Health Authority of the UK. Twenty large general hospitals were invited to take part in the survey. The authors sought to compare supports available with the standards of practice of the ACPRC who published a guideline entitled *Standards for Respiratory Care*. This document included specific on-call and emergency duty provision criteria upon which Dixon and Reeve were able to audit good practice. This audit sought to fulfil the recommendations from an earlier survey undertaken by the CSP. An audit tool was redesigned and a convenience sample of 18 senior respiratory physiotherapists responded. As with previous studies, the high response rate (90%) was suggested by the authors to reflect the importance of this issue amongst therapists.

As no nationally developed validated tool was available, the authors developed their own using an ACPRC criterion as a basis for question development. Closed questions predominated to enable direct measurement against the criteria. The authors piloted the tool on relevant representatives to identify problems and after minor alterations were made the tool was administered. There is clear description of methodology; questionnaire design; motivational factors used; adherence to ethical principles of confidentiality; and researcher identification. Coding strategies for late responders were stated. Nominal and ordinal level analysis was performed by hand; results are presented clearly in sections that relate directly to a subsection of the questionnaire.

The findings were that amongst the Trent Regional Health Authority, both senior and newly qualified staff members were expected to participate in on-call service provision and that the amount of training and audit of practice varied. By comparing findings with the ACPRC standards, the investigators determined that the level of training, service monitoring and auditing were the least adhered to criteria. Support levels varied, although all hospitals provided some form of senior support. The authors suggest that such variability within only one region indicated the necessity for specific guidelines to be produced, and on a national level. A potentially confounding factor is acknowledged in that the majority of the respondents were responsible for training programmes and support network systems, which may have influenced their ability to reflect actual rather than 'ideal world' responses.

A further survey auditing on-call service provision was performed by Harden et al. (2005). This was a postal survey (n=235) of respiratory on-call service delivery in the

UK aiming to generate a detailed national snapshot of service provision which could be audited and debated. A high response rate of 87%, (n = 204) was obtained, indicating the importance of this topic to a convenience sample of senior physiotherapists from different physiotherapy services who expressed an interest when attending an on-call competency launch conference in 2002. In their survey, Harden et al. utilised a mixture of closed and open questions to form a questionnaire tool which was appropriately piloted and modified prior to administration. Data was analysed using descriptive statistics and thematic analysis. The reliability improved by seeking agreement from an expert panel of respiratory physiotherapists. Non-responders were reported and rationales for non-response to certain questions are given.

The primary areas of concern were 'the management and support for on-call services'; 'matching supply and demand for on-call services' and the 'provision and uptake of appropriate training'. The level of respiratory experience of those working on-call was examined with 31%, (n=61) reporting that junior staff were required to complete a cardiorespiratory placement prior to commencing on-call duties and 69%, (n=135), relying on a combination of undergraduate and in-service training experience only. Formal pre-on-call working competency assessments were performed by 32%, (n=53), the remainder either undertaking informal bedside assessments or providing no assessment at all. The lack of domain specific experience mentioned in this paper was highlighted as a particular concern for ongoing training and support provision. For those returning to work a clinical ability assessment was available in 77% (n=177) of surveyed hospitals, but only 17% (n=27) were competency based. Concerns raised by respondents included the development of a confident, competent, valued staff base, which were well supported. This prompted further concerns surrounding the expectation that it is usually senior members of staff who were required to offer unpaid telephone support with increasing regularity; frustrations with increased demand for support and training for on-call staff becoming a major factor in recruitment and retention problems of senior cardiorespiratory clinicians.

An emergency duty guideline package was conceived in the UK by the ACPRC and CSP to support staff competence in emergency on-call working and launched in 2002. The emergency duty guidelines are reported to use self-reflection and guided action to identify needs and demonstrate evidence of competence; these are then linked with

performance reviews and outcomes. The effect on self-perceived competence of using a standardised guideline for on-call was examined by Broad (2005) who undertook a pilot study on two groups of on-call physiotherapists from two teaching hospitals in Wales which were matched for size and specialty. Broad noted that although previous models of competence and skill acquisition existed in the literature they were too context and task specific to sufficiently demonstrate a participant's knowledge integration, skills and attributes.

This pilot study by Broad (2005) had a clear aim with the intention for the results to provide data for a larger scale survey in the future. The prospective parallel design was appropriate given the aim and resource constraints described. Participants were purposively selected, inclusion and exclusion criteria were clarified and appropriate; one hospital had been using the emergency duty guidelines for three years and the other hospital had not used them at all. An extensive literature review identified relevant issues to the on-call workforce and informed the survey design; the ongoing problems of stress and poor confidence amongst on-call workers were discussed. Broad considered the pertinent issues of variable practical experience opportunities and levels of support available to on-call workers which may have affected confidence levels.

A questionnaire was used for this study which was initially designed by a panel of expert respiratory physiotherapists from the ACPRC. This had been nationally piloted on 60 physiotherapists of varying grades, refined and then utilised in this instance as part of the researcher's Master of Health Science degree. The questionnaire consisted of Likert-style scales to rate competence and confidence. Descriptive techniques were used to analyse open data. Although ethical permission was sought for this study, it was deemed unnecessary by the local ethics committee. Informed consent was implied by the return of completed questionnaires. Confidentiality was maintained throughout the process although the author noted the potential limitation of social response bias and recording 'should' behaviours rather than 'would' behaviours with Likert scales which may have been less likely if the questionnaire had been anonymous. Bias was reduced by the use of an independent researcher who reviewed steps for coding and analysis.

There was an excellent response rate (85.5%; n = 65) possibly improved by the various steps taken to achieve completed questionnaires. All responses were analysed; however, due to their small number, responses from two clinical specialists (one from each group) were removed in group analyses. No statistically significant differences were determined between groups although a trend was seen for the intervention group (i.e. those using the guidelines) to score more highly. Findings showed that scores for competence and confidence increased with seniority of physiotherapy grade across both groups. Of interest, junior staff from the control group were found to rate higher for confidence ($p = 0.04$). Senior staff from the intervention group had higher scores suggesting they would be more confident dealing with patients from a wide range of settings ($p = 0.03$) and Senior 1 staff from the intervention group had higher scores for feelings of confidence in their assessment abilities ($p = 0.02$). Thematic analysis of open comments demonstrated that junior staff had predominant concerns about training and practical experience whereas senior staff had particular concerns about working out of their specialty which demonstrated that emergency on-call stress was not limited to junior grade staff alone.

Gough and Doherty (2007) evaluated current emergency on-call service preparation and education for newly qualified physiotherapists in the UK using a postal survey. The authors describe a paucity of available literature in relation to on-call physiotherapy. This survey investigated adherence to ACPRC Standard 9 amongst a random selection of 75 hospital trusts, as performed in a single health region by Dixon and Reeve in 2003. The aim was to evaluate UK service provision and determine what training and monitoring approaches were being used.

Randomisation was appropriate, contact with chosen centres being made initially by telephone to identify service provision managers and to seek permission for the survey to take place. Thereafter all contact was by post and the survey was anonymous. Inclusion and exclusion criteria are stated. However, 'newly qualified physiotherapists' appear in both groups. A purposely designed pre-coded questionnaire tool was piloted to improve reliability and ensure content validity. The questionnaires were administered with accompanying consent letters assuring anonymity and confidentiality. Ethical approval is stated. Data were analysed using SPSS Version 12; descriptive statistics are used for nominal data analysis and

qualitative data are analysed in themes. Results are reported using tables and figures to demonstrate the findings more clearly.

A high response rate was recorded (88%; n = 72), all from different hospital trusts and overall a high level of adherence to ACPRC Standard 9 was demonstrated. There was some variation in on-call preparation and education. Wider variation was found in the educational content, delivery and duration of training and the authors note that these findings mirrored those of Dixon and Reeve (2003). Possible reasons given for this variation included variability in undergraduate experience; time required to become competent; local specialty requirements; and available resources. Limitations of the study are discussed and the potential for prestige bias is acknowledged.

All participants confirmed provision of an on-call induction programme in their hospitals although this varied in content and delivery. A shift in on-call education delivery styles has been recognised in this paper in that there is movement away from optional training towards more supervised methods which include compulsory updates. An educational tool is introduced in this paper, entitled “On Course for On-call”; this CD ROM was launched by the ACPRC in September 2005 in the interests of providing a standardised approach to on-call training. Further aims were to facilitate continued professional development by providing a structure through which ongoing learning and proven competency could be demonstrated and submitted as part of participants’ registration requirements. Whilst recognising the opportunity to improve national on-call educational standards, Gough and Doherty (2007) anticipate logistical resource issues once a minimum standard of on-call preparation and education is implemented. These include methods of implementation, financial constraints and training to ensure that there is national consistency. In conclusion, support is given for a consistent, standardised national on-call preparation and education programme facilitated by the CSP and ACPRC. Gough and Doherty call for further research into student perceptions of expectations prior to an on-call shift and measuring the affect of the ‘On Course for On-call’ CD ROM training programme.

In this section, concerns and perceptions of cardiorespiratory physiotherapy have been highlighted in an attempt to determine what key factors are associated with working in the on-call environment; these concerns appear to be shared across international and national workforces. In New Zealand, undergraduate student physiotherapists’ lack of

interest in the specialty is of great concern for the future of cardiorespiratory physiotherapy and on-call service provision. Problems have been discussed about the ability to provide a willing, available, competent and confident workforce and some strategies have been implemented to improve this. A new UK on-call training initiative is presented in answer to the challenge of providing a minimum national standard; although training options are available in New Zealand, to date no specific on-call national programme or minimum standard of on-call training exists. Cardiorespiratory skills are required in the on-call environment, if physiotherapists are unable or unwilling to maintain them the literature has shown that another professional group will. There is generally a high response rate to surveys administered to respiratory physiotherapists, which reflects the importance of this topic among those within the specialty.

2.09 *Novices and experts*

Advances in health and medical care roles and responsibilities have increased such that acute setting therapeutic input is almost impossible to standardise (Benner, 1984). Acuity levels of patients have increased and the diagnostic and treatment interventions available to them have increased also (Bott, 2000; Harden, 2004). Specialisation into areas which can be of most use to patients makes interchange between areas difficult, and quick replacement either impossible or very expensive (Benner). The demands of a holistic approach require professionals to be fully cognisant of disease processes, plus able to relate well to their patient to interpret, motivate and manipulate interactions to achieve the best outcomes. Shorter lengths of stay and high acuity levels place restrictions on treatment time (Gough & Doherty, 2007) which may impact on a therapist's ability to perform well (Benner). Guidelines and protocols are available to guide staff and standardise tasks; however, their response to these may differ depending on their level of experience (Benner, Higgs & Jones, 1995). In order to examine how responses may differ between staff who undertake these tasks a definition of novice and expert practitioner is required.

A model of skill acquisition was developed by Dreyfus and Dreyfus (1980) and described by Benner (1984) to study pilots' performances in emergency situations. The investigators felt that experience-based skill acquisition was safer and more efficient when based upon sound education. A five-stage model of the mental

activities involved in directed skill acquisition was developed. The five levels of proficiency described were novice, advanced beginner, competent, proficient, and expert. The Dreyfus five-stage model shows that during the acquisition and development of a particular skill, an individual passes through each layer of proficiency as they move from novice to expert level. Essentially, three general aspects of skilled performance are reflected and these are:

1. Moving from being heavily reliant on abstract principles to being able to use past concrete examples as a base;
2. Altering perceptions of an event; instead of recalling a set of equally relevant parts the observer sees the situation as a whole and places relevance on certain parts only;
3. Progression of involvement from being detached to integrated.

An example of such a progression is provided in a description of a blind individual who ambulates in a rigid and faltering way as a novice moving to the more fluid expert in the use of their cane. Benner notes, “The individual no longer feels pressure in the palm of the hand, but simply feels the curb. The cane has become an extension of the body” (p.33). The model progression is situation-specific in that an expert level of performance can be expected in a field where the individual is highly experienced and motivated to perform well given appropriate resources and under known or expected constraints. Altering any of those factors would be expected to alter the functioning level of the individual; as such the model does not support certification of individuals at any set level for all situations.

Benner (1984) applies the five-step model to nursing practice to determine how novices and experts manage particular situations. The model is used to demonstrate how an individual changes in their intellectual orientation, how they sort and integrate knowledge and are able to refocus their decision-making. Novices are described by Benner as having no experience of situations they are expected to work in, yet having the opportunity to do so becomes vital in being able to develop a skill base. Novices rely on, and are taught, measurable data and context-free rules which are designed to guide actions. There is a heavy reliance on protocols or procedures, tasks tend to be ordered and given equal priority. Working hard to recall rules and guidelines novices and advanced beginners can become overwhelmed in a new and critically demanding situation where filtering details and prioritising actions are paramount. The author

uses the term 'secondary ignorance' to describe the concept of an individual simply not knowing what they do not know, and having a limited understanding of how to change their situation or even why they might need to do so. The novice and advanced beginner levels are further identified by the author as having between nil and two years context-related experience.

Benner (1984) describes an expert as one who can quickly perceive a situation as a whole, utilising previous experiences as paradigms, moving to the crux of the problem efficiently. Experts will test and refine hypotheses, challenging current practice based upon a consistently updated knowledge base. Benner describes the process of challenge and refinement as experience via critical rationalism, noting that experience is a prerequisite for expertise. To become an expert the author suggests a required minimum of five years' context-related experience. Experts will describe a 'gut feel' or a 'sense that something is not quite right'. Through their experience they have learned not to ignore these hunches but to work proactively to investigate potential problems. Experts learn much information from maxims which may be seen as cryptic abstract information by novices. However, from these maxims an expert will gain sufficient knowledge and depth to have clear meaning. Experts tend not to rely on rules and guidelines in order to manage a situation; instead they have an intuitive grasp of events and are able to accurately prioritise and act appropriately.

Defining novices and experts by time spent gaining experience was also considered by Jensen, Shepard and Hack (1990) who performed an observational study of physical therapists' interactions with patients in an out patient setting in order to gain insight of the novice versus experienced clinician. A purposive sample of eight physical therapists with varying years of experience was obtained. The authors stated that amongst physical therapists and other professional groups an individual with more than 12 years experience was generally considered an expert. In their findings, the greatest difference between groups was determined between novices with less than two years' experience and experienced clinicians who had more than 12 years' experience.

Another model used to define novices and experts is presented by Thomas (1999) who discusses the issue of competence in respiratory care, examining several models used in physiotherapy in a review article which considered the models' ability to measure

competency against national standards held in the UK. Thomas suggests introducing a post-graduate qualification to assess competence if the profession is not able to confidently state that all new graduates are fit ‘for the purpose’ of working in a respiratory on-call situation. Support is given to a national initiative to ensure a recognisable standard of skill. Thomas discusses the ‘Dacum Model of Competence’ which has three stages of competence: the novice, competent practitioner, and expert. The novice and competent practitioner stages are further subdivided into three parts. The grades defining a novice and expert are presented below in Table 2.

Table 2.

Dacum Model of Competence Adapted and Presented in Thomas (1999).

Status	Level	Description
Novice	0	Cannot perform activity satisfactorily to participate clinically.
Novice	1	Can perform activity. Requires constant supervision, some assistance.
Novice	2	Can perform activity satisfactorily. Requires some supervision and assistance.
Expert	6	Can perform activity with more than acceptable speed and quality with initiative and adaptability. Can lead others to perform activity.

Various studies have been undertaken which involve novices and experts however no standardised definition is used. Case et al. (2000) performed a qualitative investigation that considered novice and expert responses to a respiratory case scenario. The process required a definition of expert practitioners. The authors cite the work of Jensen et al. (1990), who investigated expertise in physical therapy and concluded that despite extensive experience, not all physical therapists become ‘master practitioners’. Case et al. note the lack of an accepted definition of an expert and disagreement in the literature about how long it takes to become one. They conclude that it is the way in which the time gaining experience has been used that is of most importance in defining an expert. The authors go on to discuss novice and expert differences in knowledge storage and retrieval, and varying cognitive strategies used by either group. Case et al. sought to expose differences in novice and expert clinical reasoning processes within the cardiorespiratory area and acknowledge that by using senior and

junior physiotherapists for their study they were using experience alone as an indicator of expertise as there were no other criteria available.

In this study a random sampling method was used to select 30 hospitals within the UK from which 15 junior physiotherapists and 15 senior respiratory physiotherapists were selected. The methodology utilised was a vignette-based questionnaire presented in two sections. The investigators attempted to reduce bias by selecting one individual from each hospital involved, requesting that participants did not confer with others. Order effects were reduced by requesting that questions be answered in the order in which they appeared. The tool was piloted twice. It is unknown if the piloting group was generalisable to the intended sample. Questions following the two-part vignette were open, inviting participants to express opinions, speculate, describe feelings, indicate concerns and construct lists in order to determine thought processes used. Assurances were given that there were no right or wrong answers as this was an investigation into clinical reasoning processes. The tool was administered by post with additional information explaining the study. There was a 70% response rate, consisting of junior (n=12) staff with an average of 1.3 years' post-qualifying experience, and senior (n=9) physiotherapists with an average of 12.2 years'. The junior staff had less than one year of working experience in the respiratory field, while the senior staff had an average of seven years'.

Thematic analysis was used to categorise emerging patterns within the answers. Two research analysts worked independently and were blinded. A 'circular process' is described in the interpretation phase as researchers used available literature and re-applied information to the research analysis. Such consistency measures produced a high inter-rater agreement.

It is of interest to note that the authors realised that a potential disadvantage of expert thought processing can be their reliance on previously formed patterns whereby the clinician mistakenly determines a diagnosis prematurely, particularly if the knowledge base is less deep. This factor is suggested as a criterion that may help to differentiate experts from experienced practitioners. In this study the conciseness, vagueness, terminology use, general approach, tacit knowledge, intragroup consensus and the clinical reasoning process were themes identified that were able to determine a difference between novice and expert physiotherapists. The authors recognised links

between the earlier influential work of Benner (1984) and their findings which determined similarities within indicators defining the differences between novice and expert practitioners. Case et al. (2000) concurred with Benner, noting that expert level status based upon context-dependent knowledge is limited to that context. The authors suggested that understanding what factors create an expert has the potential to guide others toward achieving a similar position, possibly in a shorter time frame. The authors concluded the information has particular relevance to on-call services provision where the clinical reasoning process depends on knowledge and context-related experience of the on-call environment. It is suggested that undergraduates be given clinical reasoning experience of on-call scenarios, that newly qualified staff be afforded appropriate senior support, and further that they have the opportunity to be guided in their reflective thinking about their on-call experiences.

The ability to reflect under guidance is seen as a crucial step in the clinical reasoning process of novices in order to develop expertise. Clinical reasoning is described by Higgs and Jones (1995) as the thinking underlying clinical practice which relates to specific clinical contexts. Essential requirements for effective clinical reasoning include cognition or reflective enquiry, a strong foundation of context-related knowledge and metacognition which is the process by which cognition and knowledge are integrated. The development of an individual's ability to be effective in their clinical reasoning process requires the opportunity to reinterpret information and reform problems in order to achieve better understanding and this requires repeated encounters or experience. Research into the process of clinical reasoning has become more popular in the past decade as a changing health climate dictates accountability in decision making as an integral part of patient management; also it is regarded as a characteristic of an autonomous profession (Edwards, Jones, Carr, Braunack-Mayer & Jensen, 2004).

In physiotherapy, clinical reasoning is described as the thought processes associated with a clinician's examination and management of a patient, influenced by the individuals involved and their environment (Jones, Jensen & Rothstein, 1995). Clinical reasoning proficiency is vital to develop expertise in physiotherapy (Carr, Jones & Higgs, 1995). The wider interest in clinical reasoning of the physiotherapy profession is acknowledged as are the professions' efforts to determine the clinical reasoning process of experts for future novice training. Jones et al. state that it is not

how a problem is tackled but more the ability to activate pertinent knowledge as a consequence of a situation, which distinguishes experts from novices, as novices will engage in similar problem-solving processes as experts. May and Dennis (1995) note an expert with a greater amount of experience will alter direction in their management more easily than a novice as the problem evolves or changes before them. Jones et al. describe clinical reasoning in physiotherapy as being more than just a hypothetico-deductive process, citing Jensen et al. (1990), who determined it to be a combination of hypothetico-deductive and phenomenological processes involving the use of an individual's theory, knowledge and reflective experience whilst also considering the patient's experience (see Table 3).

The hypothetico-deductive reasoning model based upon the scientific paradigm is the most enduring clinical reasoning model in medicine and the physiotherapy profession, like other professions used this model. It is predominantly concerned with determining a diagnosis using objective and measurable means (Edwards et al. 2004). Since the mid-1990s, medical, nursing, occupational therapy and physiotherapy disciplines have considered the nature of patient experience and have moved to incorporate the phenomenological or 'lived in experience of humans' aspect. Some models from the cognitive science perspective are less focused on a process and describe knowledge organisation in the form of 'illness scripts' or 'pattern recognition' where the storage and use of such schemata improves with experience (Edwards et al.). The authors further suggest that the hypothetico-deductive model is used by novices and also by experts who are faced with unfamiliar problems, whilst experts generally operate using pattern recognition which is faster and more efficient.

Boshuizen and Schmidt (1995) suggest the components of expert clinical reasoning are possession of domain specific knowledge and the method of application of that knowledge. The authors investigated the role of biomedical knowledge in clinical reasoning by experts, intermediates and novices in medicine and found that experts possessed domain specific knowledge, gaining expertise by simultaneously acquiring further knowledge and undertaking clinical reasoning. Experts were found to have a greater amount of in-depth biomedical knowledge than the other two groups. For instance, experts would automatically recognise patterns which would lead them to a hypothesis which facilitated fluid problem management, in an efficient and timely manner. Novices focused more on collation of knowledge and validation of that

knowledge with clinical reasoning, taking the form of procedural steps based upon firm biomedical concepts, and this would take time. For novices, many hypotheses would be generated which would require investigation. May and Dennis (1995) note the generation of multiple hypotheses is not typical of experts but is of novices. Boshuizen and Schmidt state that novices who have repeated exposure to similar events are believed to achieve a knowledge base which would support future pattern recognition, speeding up problem management at each repeated opportunity.

Case et al. (2000) recognised that both novice and expert groups reached the same decision about a respiratory vignette but the way in which that decision was reached differed. The clinical implications of this are relevant to the on-call situation where staff involved have varying levels of context-related experience and knowledge. Ball (1999) reviewed the on-call service provision to surgical patients in a hospital in the UK. The on-call physiotherapy team demonstrated that they could provide an efficient respiratory service at weekends although not predominantly non-respiratory specialists. For this to occur, Ball advocated a standardised referral system and unit protocols that improved service quality and reduced costs. This again reinforces the work by Benner (1984) where providing sufficient support for novice growth and reflective learning for development produces a 'fit for purpose' staff base.

A number of studies investigating clinical reasoning of novice and experts are summarised and presented in Table 3 on the basis of their experimental designs, strengths, limitations and relevance to this study.

Table 3.

Studies Investigating Clinical Reasoning Differences in Novices and Experts.

Author (Year)	Purpose	Methodology and Participants	Relevant Results to this study	Strengths	Limitations
May & Dennis (1991)	To investigate clinical decision making in expert PT with varying direct access to patients (i.e. USA and Australia).	Postal questionnaire based survey; Participants: n = 638. Peer nominated expert PT from USA (n = 348) and Australia (n = 290).	In USA, C/P PTs responded more to perceptive style data gathering than orthopaedic and geriatric PT, THSD test (p = .05). Both USA and Australian PT in orthopaedics responding more to systematic style of information processing. Neurology PT identified more to intuitive style data processing THSD test (p = .05). Female PT from both countries identified more with perceptive style data gathering, males identified more with systematic style. Australian C/P therapists placed higher values on direct communication with patients in acute respiratory care areas; C/P PT from both countries placed high value on other sources of information (e.g. X-Rays) for treatment decisions than other area specialists. Hypothesis generated from study was that 'Cognitive style of PT is influenced by field of practice'.	Large sample; generalisable to target population Appropriate tool development and refinement with piloting; reliability improved All questionnaires included in analysis.	Purposive sample selection by peer nomination utilised national groups and defined criteria (difficult to control for confounding variables)
Jensen, Shepard & Hack (1990)	To develop a conceptual framework by which novice and experienced PT practices could be analysed.	Observational design; Participants: n = 8 PT, varying expertise observed in 4 different orthopaedic settings.	Five themes generated which distinguished novice and experienced PT: 1) PT allocation of treatment time; 2) Types and use of information gathered from patient; 3) Therapeutic environment impact on intervention; 4) Degree of PT to patient responsive therapeutic interaction 5) PT integration non-therapeutic interaction with therapeutic interaction. Differences determined mostly between novice (<2 years experience) and most experienced (>12 years experience) groups; the behaviours and interactions of experienced PT appeared distinctly different from rest of participants. Novices sought more information from patient overall whilst experienced PT consistently built questions based upon patient's responses and were able to clarify data more quickly.	Validity improved with controls for sample and setting. Researchers each underwent 2 pilot sessions for practice and generation preliminary coding categories; detailed description of coding revision process is supplied.	Small purposive sample. All of experienced PT group worked in same setting (private practice).

Author (Year)	Purpose	Methodology and Participants	Relevant Results to this study	Strengths	Limitations
Jensen, Shepard, Gwyer & Hack (1992)	To determine attributes which distinguish master and novice PT.	Observational design; Participants: n = 6 orthopaedic PT from different states of USA.	Original 5 themes (Jensen et al. 1990) revised to 5 attribute dimensions: 1) Ability to control the environment; 2) Confidence in outcome prediction and data interpretation; 3) Ability to maintain focused communication and rapport; 4) Evaluation and use of illness data; 5) Recognition of worth of teaching versus hands-on care. Master PT demonstrated more elaborate cognitive framework than novices based upon greater knowledge of pathology and clinical experience with patients. Master PT appeared comfortable in refining and revising hypotheses based upon selective data gathering and demonstrated more confidence in outcome prediction than novices. Master PT appeared to have well developed disease patterns or 'schemata' facilitating more efficient patient management. Novices appeared to be rule-governed, limited in ability to manage multiple tasks and more intent on structured data collation which was less selective to determine hypotheses than master PT.	Validity improved with controls for sample and setting; all researchers used same coding process for identification and interpretation of constructs. Reliability improved as all results reviewed by all four researchers; areas of conflict resolved to reach consensus	Small purposive sample increased likelihood of bias, 3 researchers each collecting data from 1 master and 1 novice PT potentially affects reliability of findings
Edwards, Jones, Carr, Braunack-Mayer & Jensen (2004)	To examine expert clinical reasoning in differing fields of physical therapy.	Observational design using interview; Coding strategy developed from attribute dimensions described by Jensen et al. (1992). Participants: n = 12 peer selected experts in orthopaedic, neurological and domiciliary fields	All participants used a range of clinical reasoning strategies which represented a diversity of thinking and actions in various tasks and related to many issues existing in clinical practice. Reasoning strategies used were governed by patients' needs and their contexts. A dialectical reasoning model is proposed as being relevant to clinical reasoning in physiotherapy which refers to the application of different paradigms of knowledge and their interplay within clinical reasoning.	Validity improved with controls for sample and setting; all researchers used same interview schedule. Reliability improved as all results reviewed by three coders; areas of conflict resolved to reach consensus. Methods described to improve rigor include negative case analysis, audit trail, thick description and triangulation	Small purposive sample increased likelihood of bias

Author (Year)	Purpose	Methodology and Participants	Relevant Results to this study	Strengths	Limitations
Chipchase & Prentice (2006)	To investigate decision making indicators in Australian acute care expert PT	Observational design using structured telephone and face to face interview Participants: n = 12 nominated acute care experts	Experts integrated reasoning strategies using an 'of risk or of benefit' analytical style and used a collaborative approach to care. Experts' assessments of acutely ill patients were found to be fluid and individualised. The context of the acute setting and environment underpinned clinical decision making	Credibility enhanced with measures taken to validate transcripts	Sampling technique used chain nomination (snowball strategy) may reduce validity. Participants observed differently, may confound results. Single researcher conducting interviews and analysing results can increase likelihood of bias. No software used for analysis.
Greenwood & King (1995)	To investigate clinical reasoning of Australian expert and novice orthopaedic nurses.	Observational design using concurrent and retrospective interview Participants: n = 18 sampled from two metropolitan hospitals.	Experts used more basic and subordinate concepts in clinical reasoning than novices and had a greater amount of knowledge which they were able to access more easily. Experts consistently used more strategies to manipulate and relate their information. Novices collected more information that was less selective than experts.	Validity improved with controls for sample. Reliability improved with all participants trained in 'think aloud' techniques prior to interviews to reduce bias	Discrepancy in novice versus expert ability to express self in think aloud sessions may have increased bias.

Note: PT = Physical therapist; C/P = Cardiopulmonary; THSD = Tukey's Honestly significant difference test; < = Less than; > = More than

In this section, various definitions of a novice or expert have been presented. The five-stage skill acquisition model described in Benner (1984) provides a detailed progression of the following skill levels: novice, advanced beginner, competent, proficient, and expert. There is no consensus in the literature about what defines novice and expert practitioners although there is agreement that the greatest differences can be seen between novice and expert groups (Benner, 1984; Case et al., 2000; Jensen et al., 1990). The level of skill acquisition has been presented above as a graded model of competence. Differences in the clinical reasoning processes of novices and experts in a variety of non-acute areas have been reported. No studies have been retrieved which specifically examine the differences in novice and expert attitudes, behaviours, beliefs and knowledge of the emergency on-call environment.

2.10 *Literature review summary*

From available literature the differences between quantitative and qualitative methodologies have been presented and their use in survey research has been discussed. The limitations and benefits of the survey approach have been debated and it has been shown that surveys, when conducted appropriately, provide valuable information. Vignettes in health research have been demonstrated to measure attitudes and beliefs well. However, standardising the context of the vignette is seen as an essential component to ensure that variability is minimised. Occupational stress in professions such as physiotherapy has been demonstrated in new graduate and junior staff only. The negative effects of stress and some situations in physiotherapy that lead to it have been presented.

The nature of on-call work and some physiotherapists' negative attitudes towards on-call experiences has been discussed. The debate about competency and being 'fit for the purpose' of on-call work within the UK has been reported, as have their current solutions. The lack of interest in cardiorespiratory physiotherapy among New Zealand students and qualified staff is of great concern to the profession, and particularly to those providing on-call services. As has been shown, emergency on-call work involves a large number of cardiorespiratory skills which, however basic, still require a standard level of competency. There is no national standard of measurement or audit available in NZ for emergency on-call skill maintenance. Surveys within the

cardiorespiratory and on-call field have tended to have a high response rate, reflecting the importance of the subject to those within the specialty.

There is no consensus about what defines a novice or expert practitioner. It would appear that length of experience alone does not necessarily create an expert. Suggested definitions are provided, the most detailed and structured being the five-stage model described by Benner (1984). The differences between novices and expert physiotherapists are studied in the context of measuring or maintaining competence and in their clinical reasoning process. To date, no study has examined the differences between staff working specifically in the emergency on-call environment.

Questionnaires are appropriate methods of obtaining objective information about beliefs, attitudes, knowledge and behaviour. A well-structured questionnaire and properly managed process which follows ethical considerations is expected to have a high response rate with meaningful results.

2.11 Purpose statement

Main Research questions

1. Do differences exist between emergency on-call physiotherapists in response to a clinical emergency on-call scenario?
2. If differences exist, are they affected by the amount of context-related experience?
3. Does the level of on-call experience affect self-perceived confidence and stress levels when working in the emergency on-call environment?

Survey Aims

This survey aims to explore the current reality of the emergency on-call environment as perceived by on-call physiotherapists and to determine if differences exist between physiotherapists with different levels of on-call experience. A further aim is to identify if and how the individuals' amount of emergency on-call experience has affected responses to the survey. Finally, it seeks a better understanding of the possible influence of emergency on-call experience on an individual's self-perceived confidence and stress levels.

3.0 Methodology

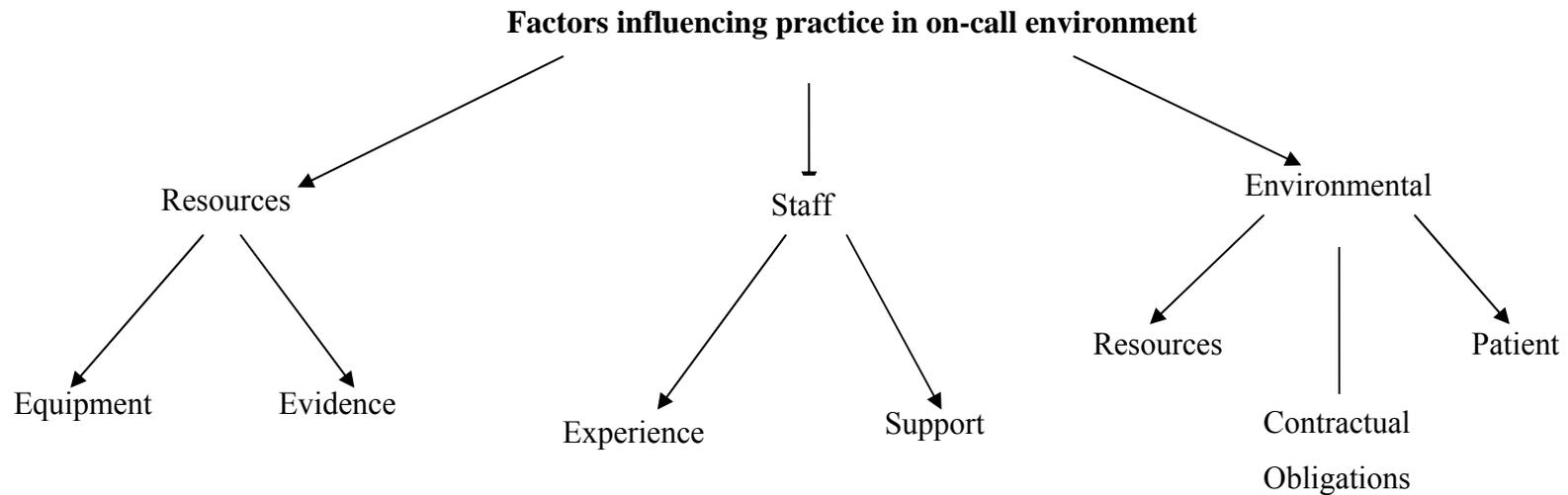
A postal survey was undertaken on a national sample of New Zealand physiotherapists who had different levels of experience (the independent variable) within the emergency on-call environment. The survey investigated whether different levels of on-call experience affected responses to a progressive vignette-based questionnaire (the dependent variable).

3.01 *Design*

This cross-sectional survey utilised a progressive vignette-based self-administered questionnaire which was administered by post. The model described by Wallace (1971) and discussed in de Vaus (1995) of theory construction and testing described in the previous chapter was chosen to organise and direct the research process. This facilitated the development of the questionnaire framework by pinpointing areas of interest which required exploration. From the literature it was seen that the main theories requiring investigation into the physiotherapeutic management of an emergency on-call cardiorespiratory patient were:

- a) That differences existed between staff with different levels of on-call experience
- b) That certain factors influenced physiotherapy practice in the emergency on-call environment
- c) That differences in (a) could potentially affect (b)

The two underpinning concepts in this study were the factors influencing physiotherapy in the on-call environment and the differences between physiotherapists working in the on-call environment. These concepts were subdivided into a number of dimensions to guide specific question selection for the questionnaire. It is acknowledged that not all of the dimensions could be tested by this questionnaire and may best be investigated by interview and observation in the future. The process of synthesising abstract concepts to develop questionnaire items to investigate those concepts is referred to as ‘descending the ladder of abstraction’ and it is the logical process driving improved sensitivity and specificity in the chosen selection of questions (de Vaus, 1995). Figures 1 and 2 represent the process of ‘descending the ladder of abstraction’ for this survey.



Relevant questions

- What equipment is available
- Who is aware of equipment available
- Who is aware of evidence
- Who is using the evidence

Relevant questions

- Who has context-related experience
- What support mechanisms are employed
- Self-rated confidence; support and stress levels
- Management large acute workloads

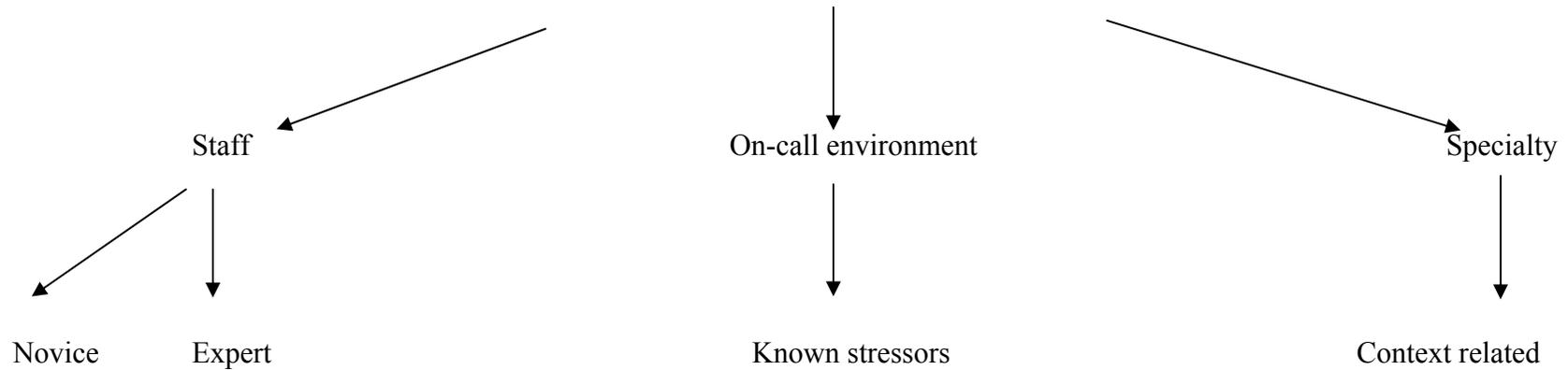
Relevant questions

- Available resources
- On-call policies; department protocol
- Level of service provision
- Familiarity with on-call environments
- Familiarity with acute deterioration
- Recognition of limitations in patient
- Contractual obligations
- Time constraints

Figure 1.

Factors influencing physiotherapy intervention in the on-call environment (Adapted from de Vaus, 1995)

Differences between physiotherapists working in the on-call environment



Relevant questions

Defining novice and expert in on-call
 Who analyses and prioritises well
 What are educational differences
 Who is protocol reliant
 Limitation recognition of self

Relevant questions

How do attitudes towards on-call duties vary
 How do behaviours towards on-call duties vary
 What factors affect or influence attitudes and
 behaviour

Relevant questions

Who has on-call experience
 Who has cardiorespiratory experience
 What are specific on-call training
 differences

Figure 2.

Differences between physiotherapists working in the on-call environment (Adapted from de Vaus, 1995)

3.02 *Participants*

This national survey required a sample which was representative of the total population of emergency on-call physiotherapists in New Zealand. This was determined by constructing a population sampling frame which gave a national snapshot of those who formed the emergency on-call service provider workforce. A purposive sample was taken from all emergency on-call providers (n=33) in New Zealand (Reeve 2003). A full population sampling frame was to be established with the aim that a minimum of 30% of staff in each provider would be sampled.

To improve generalisability the aim was to sample an equal number of staff per service area from the three types of on-call physiotherapists:

1. The current senior cardiorespiratory specialist/s
2. Senior staff from a different speciality
3. Junior staff with varied emergency on-call experience.

Some hospitals were able to provide more than one representative from each group whereas others were able to provide only one representative from one group. To ensure input from a national sample, a sampling frame was configured by the researcher detailing which types of physiotherapists from the three groups were available in each centre. These physiotherapists were approached for participation by the service coordinator who was established as such from the initial contact with each service. The administration and return rates from the three groups of physiotherapists is displayed in a tabular form within the results chapter (see page 62).

The Dreyfus five-stage model described by Benner (1984) was used to define novice and expert groups within the emergency on-call field by looking at length of emergency on-call experience, a method used in previous physiotherapy research (Chipchase & Prentice, 2006). Participants were placed into a novice or expert group based upon their years of emergency on-call experience. For the purposes of this study those physiotherapists with five years' or less emergency on-call experience were defined as novices. Those physiotherapists with more than five years' emergency on-call experience were defined as experts. It was expected that there would be equal representation in response rate from both novice and expert groups;

the responses used to place participants in novice and expert groups are displayed in a tabular form within the results chapter (see page 64).

From the literature, it was learned that high response rates to cardiorespiratory-themed postal questionnaires have been obtained from staff who appeared to have a high level of interest in the topic, e.g. senior clinicians within the speciality (Dixon & Reeve, 2003; Reeve, 2003). Achieving a high response rate from all staff sampled would have been advantageous as it would ensure that all possible permutations of emergency on-call were sampled. Postal surveys can have poor response rates when compared with interviewer-led surveys which are less easy to ignore (Burns & Grove, 2005). For this reason it was important to establish relevance with service providers who would be asked to sample a wide mix of their staff, not just those staff who shared an interest in the cardiorespiratory speciality. To do this, the researcher highlighted known problems with emergency on-call service provision noting anecdotal evidence which suggested that the work was highly stressful to staff who lacked confidence in the area, thereby becoming reluctant to take on such duties. The research aims were discussed with the expectation that the service provider would agree that such a study was in their interest.

The survey involved sending an introductory briefing letter (Appendix A) explaining the purpose of the survey to the managers of the on-call services of each hospital and seeking permission for their service to be included in the survey. The researcher also took the opportunity to introduce the topic to potential participants. Dillman (2000) suggests up to five contacts may be required with participants to secure a successful result. The researcher made contact two weeks later by telephone to determine what numbers of their staff were involved in the emergency on-call service provision and who on their on-call rosters met the inclusion criteria.

3.03 *Selection Criteria*

The inclusion criteria for this study were that participants were volunteers who had given their informed consent, implied by the returning of a postal questionnaire. All participants were qualified physiotherapists who were actively involved and participating in emergency on-call physiotherapy service provision. The physiotherapists had to be able and available to complete the questionnaire.

3.04 Procedure

The questionnaire was initially piloted. The reasons for undertaking a pilot in this instance were to examine the reliability and validity of the questionnaire in demonstrating a difference between physiotherapists who were working in the emergency on-call environment. This was done by using a small sample of the target population. This stage is discussed in more detail in section 3.05 (Research Tool). Burns and Grove (2005) state that a benefit of pilot surveys is the acknowledged experience gain to new researchers where interaction with target populations, methodology refining, and data management principles can be developed. In this instance, experiences gained during the pilot survey were invaluable whilst considering the feasibility of the future study. Following the pilot, further amendments to the questionnaires were completed prior to administration.

The questionnaires were presented in a standard booklet format so that all instructions and contents were met in the same order by all participants (Appendix B). The questionnaire was A4 size, printed on white paper with clear written instructions provided at the start. To ensure that conditions were controlled the instructions asked participants to complete the questionnaire in one sitting, in the order that questions appeared and to do so without any external assistance such as using texts or colleagues. The questionnaire was in two parts. Part one sought demographic data and investigated participant's attitudes towards emergency on-call service provision, using mainly closed questions. Part two included a vignette-based clinical scenario which asked questions throughout an evolving clinical case scenario using both open and closed questioning. The final part of the questionnaire required participants to record the time it took them to complete the questionnaire and to provide feedback about the process of completing the questionnaire.

Prior to commencing the survey, participants were instructed to read the introductory part of the booklet which stated that consent was implied by returning a completed questionnaire (Appendix B). A duplicate copy of the introductory letter was enclosed for participants to keep; this is advised as a means of reinforcing the value that they have to the study (de Vaus, 1995; Dillman 2000). This information also served as evidence of undertaking the vignette, which is listed as an appropriate work-based continuing professional development activity by the Physiotherapy Board of New

Zealand (Physiotherapy Board of New Zealand, 2005). Here links could be drawn with the social exchange theory of Dillman described earlier where points towards participants' annual recertification requirements may be gained. There were no personally identifying features on the questionnaires; this measure was particularly necessary to maintain anonymity as Dillman suggests that trust is an essential part of gaining meaningful responses. Each questionnaire was provided with a self-addressed, stamped A4-sized envelope. Upon completion of the questionnaire all participants were instructed to place their responses into the envelopes and post them. No names were attached to the response envelopes or responses themselves. The completed questionnaires were held in a locked cabinet at the researcher's residence in Taranaki until the research process was completed. All survey questionnaires were placed together for analysis and coding.

Coding is a structured process described by Pollard (1998) where data from questionnaires are reduced to a numerical or quantifiable value. Part one of the questionnaire consisted predominantly of closed questions where numerical symbols could be assigned to each of the answer categories and descriptive statistical processes were then used to provide meaning. Part two of the questionnaire used both open and closed question techniques. Open question coding, being more complex, involved the simplification of individual responses by placing them within similarly themed groups; a systematic analysis of both closed and open data was then possible. Whilst it is acknowledged that some data could be lost in this process the thematic analysis of open question data is based on a substantial sample's responses. Robson (2002) recommends a minimum of 50% of all cases be used to ensure that a defined representative set of standard responses is achieved and recoding avoided. Bowling (2002) suggests using a random sample of 30-50 questionnaires to form a coding frame, then testing that frame on further responses. In this survey thematic analysis was performed using all returned questionnaires. A coding frame was developed by the researcher utilising all of the responses and questionnaires were coded by the researcher who used an independent other to first determine appropriate theme selection and then appropriate categorising of responses into those themes. The primary supervisor reviewed the coding results of specific sections and mediated agreement in particular areas where agreement had not been determined. This process is recommended by Bowling (2002) to improve intra and inter-rater agreement.

3.05 Research Tool

As there was no valid appropriate tool available to use in this survey, a progressive vignette was used in keeping with Hughes (1998). Hughes utilised a progressive or serial vignette for their study which is described in the previous chapter. It consisted of a series of stages which were built on previous events to which participants were asked questions. The progressive style was chosen for this study for its ability to generate and maintain interest and increase credibility in the participant (Finch 1987). An extensive literature search was undertaken using national and international sources which identified a range of information around the subject of emergency on-call physiotherapy, vignette based survey research in health, and novice and expert practitioners. Available literature, conference papers and documentation of international debates on these subjects (1970-2007) were utilised to generate questions for this purpose. Generating a specific questionnaire tool using available literature, consultation and observation is a technique which has been used successfully within previous physiotherapy survey research (Roskell & Cross, 2003; Reeve, 2003; Gough & Dougherty, 2007).

The choice of a plausible condition which would stimulate interest yet remain realistic to the on-call situation was important. Guillain-Barré syndrome was chosen for its tendency to affect multiple systems and potentially cause rapid deterioration, particularly in the respiratory system, which would be sufficient to warrant on-call physiotherapy intervention. The progression or rather deterioration of the disease process in this case was designed to affect multiple systems which would challenge the participants to make choices in their management that required a considered response, weighing up the potential benefits and costs to the patient.

Once the tool was completed a pilot was undertaken to ensure that it had the correct attributes to be valid and reliable (de Vaus, 1995; Dillman, 2000; Rubenfield, 2004; Stone, 1993). The pilot was performed on selected senior and junior colleagues who were not involved with the survey to determine what adjustments were required, recommended by Robson, 2002, to be an appropriate technique.

Validity measures of a newly developed tool include content and construct validity testing (Bowling, 2005; de Vaus, 1995). This involved the components of scales being

checked for comprehensiveness, balance, clarity, and relevance to determine content validity. Where issues under investigation cannot be observed, such as beliefs and attitudes to on-call, Bowling (2005) suggests that testing for construct validity is particularly important. Construct validity is determined when the tool is demonstrated to measure what it intends to measure. A thorough literature review of theory relating to the research question was required which identified key theoretical criteria upon which this tool was measured. The test for construct validity was to determine if the answers reflected the relating theories underlying the question, a process recommended by Hicks (2004). In this case, the test for construct validity became a discussion with pilot participants about their responses with an underlying awareness by the researcher of relating theoretical foundations.

Other validity measures undertaken included face validity, where subjective questions were deemed reasonable by those undertaking the pilot to measure the variable they are designed for. Criterion validity refers to the ability of a tool to measure that which it was intended to measure and is determined by measuring the scale ideally against a 'gold standard' to determine a correlation (Bowling 2005; de Vaus, 1995). In the absence of such a standard (as in this case where no established tool was available), the results of the various groups within the study were compared with theoretical underpinnings to demonstrate predictive validity.

The consistency or reliability of the tool can also be questioned at the pilot stage which involves testing for internal consistency where homogeneity is tested for both between and within scale items. Test/retest reliability can be used, where the tool is re-administered after a set time period has elapsed (e.g. two weeks). However, as there was no guarantee that participant learning from the first test would not influence the second and the fact that the process would take an extended time period between tests (Bowling, 2005), a second test was not performed.

3.06 Data analysis

Analysis was performed using the computer software package for social sciences SPSS for Windows (Version 14). Results were analysed using descriptive statistics, including frequencies, measures of central tendency and dispersion. The three most commonly utilised forms of descriptive statistics include the use of graphs which visually display general trends and allow comparisons; measures of central tendency which present the most typical scores and results; and measures of dispersion which show variations in the scores.

Non-parametric methods of Mann-Whitney U, Chi-square and Spearman's rank order correlation were utilised to analyse data of the ordinal form. The Mann-Whitney U and Chi square tests were applied to responses where descriptive statistics showed apparent differences between novice and expert responses to establish if a difference was significant. The Z and p values are reported for the Mann-Whitney U test; the Chi square test is represented by the symbol χ^2 , and p values are also reported. Spearman's rank order correlation was used to assess the correlation of two relevant variables and determine the strength of relationship between them; the r and p values are reported. All study participants are accounted for; non-responders, missing data and 'other' categories are included within analyses.

As a new tool was developed for this survey, the researcher has described the data in terms of the presenting of key features such as average scores or ranges of scores. This technique is commonly used in survey research and is often used as the initial stage before formulating hypotheses (Hicks, 2004).

3.07 Ethics

To ensure informed consent Noble-Adams (1999b) recommends fully informing the prospective participant of the purpose of the research, why such research is being undertaken and what will be done with the information. This should be clearly written, leaving the participants in no doubt about what they are volunteering for. Measures taken to ensure a complete data analysis by including all responses in the coding stage and accounting for non-responses are important. Maintaining

confidentiality during any presentation of results is also vital to uphold ethical standards (Noble-Adams, 1999a).

Following the guiding principles of the Nuremburg Code and the Declaration of Helsinki, ethical approval was sought (Noble-Adams, 1999a). The Auckland University of Technology Ethics Committee (AUTEK) gave ethical approval for this research (Appendix E). The postal survey was performed irrespective of race; there were neither culturally-related questions nor potentially culturally-affected responses.

Confidentiality and anonymity were maintained as there were no personally identifiable details on the questionnaire; only the participants' level of emergency on-call experience differentiated the responses. Data was held securely in a locked filing cabinet at the personal residence of the researcher. Once results have been analysed, published data will be the responsibility of the researcher, as will ensuring appropriate professional data dissemination. All questionnaires will be archived at Auckland University of Technology and kept for five years.

4.0 Results

In order to aid the interpretation of these results it is recommended that the reader first becomes familiar with the questionnaire (see Appendix B) and then reads the case appraisal and synthesis of appropriate treatment strategies, which are substantiated by current available evidence (see Appendix C). In this section the results will be reported in terms of response rate and demographic information. Thereafter the analysis of questionnaire items will occur in the order that they appear in the questionnaire.

4.01 *Response Rate*

In total, 27 hospitals were identified as providing emergency on-call services, 26 of which agreed to take part, and 71 questionnaires were administered. A total of 56 questionnaires were returned; a response rate of 78.8% was achieved. Table 4 details the administration and return rates of questionnaires from the three groups of physiotherapists described in the methodology chapter.

Table 4.

Administration and Return Rates of Questionnaires from the Three Groups of Physiotherapists

Group	Administered n=71	Returned (%)
C/R Senior	20	13 (65.0%)
Non C/R Senior	26	23 (88.0%)
Junior	25	20 (80.0%)

Note. C/R = Cardiorespiratory

Questionnaire: Part One Results

4.02 Demographic data.

Demographic data and characteristics of participants are outlined in Table 5. The majority of participants had a bachelor's degree, were trained in New Zealand and undertook approximately one on-call shift per month.

Table 5.

Demographic Data of Participants

Participant qualifications	% (n)
Batchelor of Health Science	83.9% (47)
Graduate Diploma of Physiotherapy	14.3% (8)
Missing	0.8% (1)
Country gained qualification	% (n)
New Zealand	87.5% (49)
United Kingdom	8.9% (5)
Australia	1.8% (1)
Missing	1.8% (1)
Mean years qualified	n
Mean	8.5 years (SD 9.15; range 0.5-38)
Frequency of EOC duties performed by participants	% (n)
1 shift per week	16.1% (9)
>1 shift per month; < 1 shift per week	33.9% (19)
1 shift per month	21.4% (12)
<1 shift per month	21.4% (12)
< 3 shifts per year	7.1% (4)

Note. EOC = Emergency on-call

4.03 Defining novices and experts

Participants' years of emergency on-call experience defining novice and expert grouping are presented in Table 6. As can be seen, 60.7% (n = 34) were novices and 39.2% (n = 22) were experts.

Table 6.

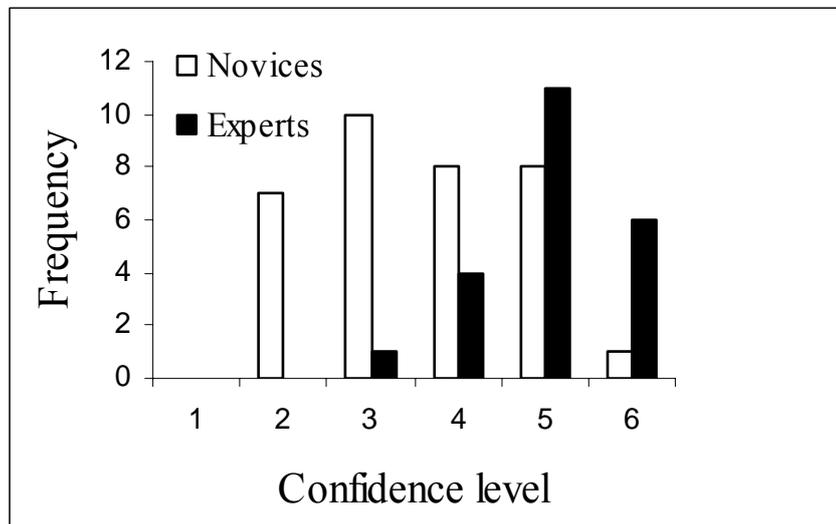
Years of Emergency On-call Experience Defining Novice and Expert Groups

Novices EOC experience in years	% (n)
Not >1 Year	19.6% (11)
> 1 year but not >2 years	14.3% (8)
> 2 years but not >5 years	26.8% (15)
Total novices	60.7% (34)
Experts EOC experience in years	% (n)
> 5 years but not >10 years	21.4% (12)
> 10 years but not >15 years	5.4% (3)
Over 15 Years	12.5% (7)
Total experts	39.2% (22)

Note. > = more than; EOC = emergency on-call

4.04 Levels of confidence in on-call novices and experts.

As can be seen in Figure 3, in comparison to the experts, the novices had lower scores for their confidence when working in the emergency on-call environment. This difference in confidence scores was significantly different, ($Z = -4.19, p = .0001$).



Note. Judgments were made on 6-point scales (1 = not confident at all, 6 = always confident).

Figure 3.

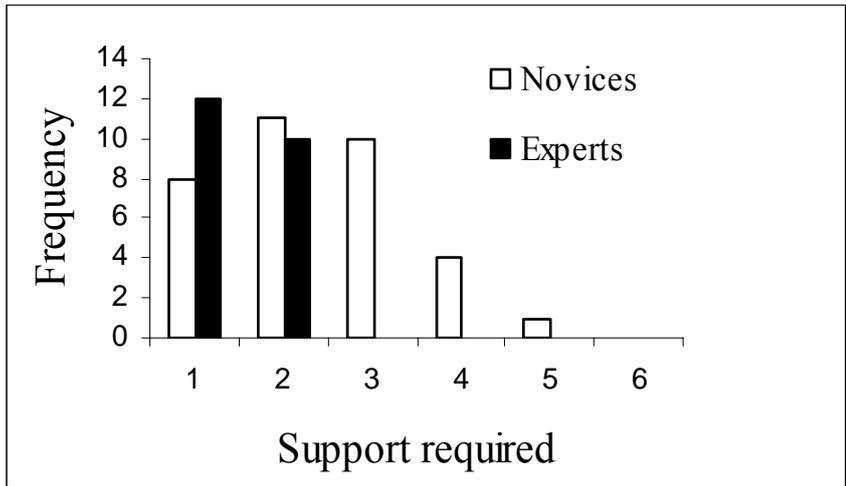
Novice and expert confidence levels when working in the emergency on-call environment

4.05 Levels of on-call support required in novices and experts

As can be seen in Figure 4 (page 67), in comparison to the experts, the novices had higher scores for the amount of support required when working in the emergency on-call environment. This difference in support scores was significantly different, ($Z = -3.38, p = .001$).

4.06 Levels of stress felt when performing on-call duties in novices and experts

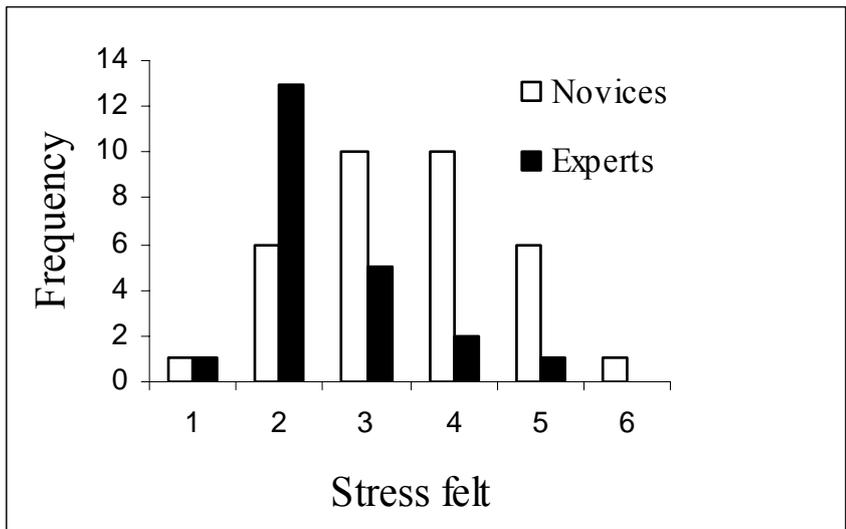
As can be seen in Figure 5 (page 67), in comparison to the experts, the novices had higher scores for stress when working in the emergency on-call environment. This difference in stress scores was significantly different, ($Z = -3.26, p = .001$).



Note. Judgments were made on 6-point scales (1 = no support required, 6 = maximal support required)

Figure 4.

Novice and expert support levels required when working in the emergency on-call environment



Note. Judgments were made on 6-point scales (1 = never stressful, 6 = stressful at all times)

Figure 5.

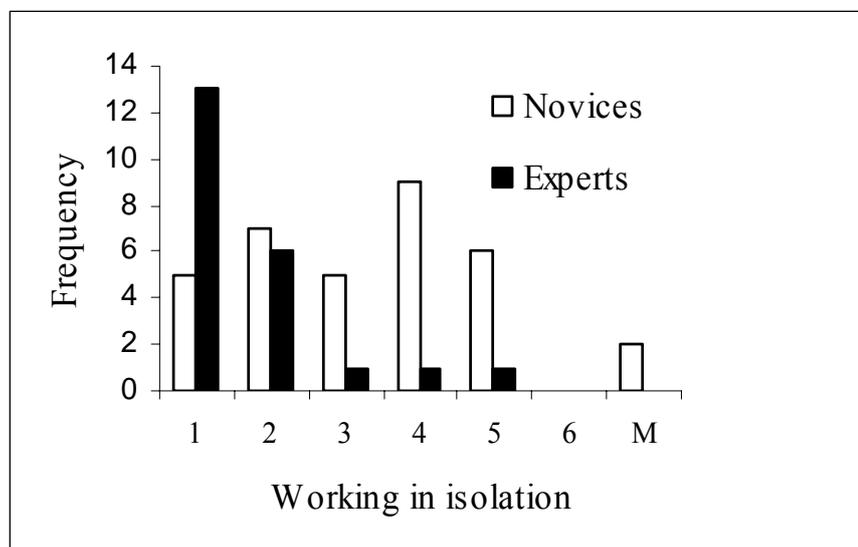
Novice and expert stress levels when working in the emergency on-call environment

4.07 Relationships between confidence, support and stress

Significant relationships were found between confidence, support and stress. There was a moderate negative correlation between confidence and stress scores ($r = -.58, p < .001$); a strong negative correlation between confidence and support scores, ($r = -.65, p < .001$); and a positive correlation between support required and on-call stress scores, ($r = .47, p < .001$).

4.08 Factors influencing stress levels in novices and experts

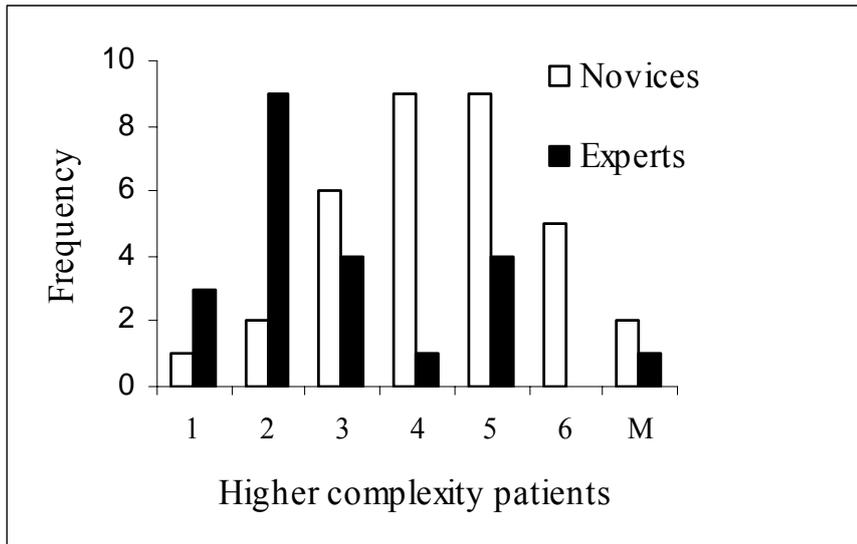
As can be seen in Figures 6 – 9 (pages 68 - 70), in comparison to the experts, the novices had increased scores of stress levels. These were significantly different when working in isolation ($Z = -3.70, p < .0001$), when working with a higher complexity of emergency on-call cases ($Z = -3.50, p < .0001$), when working outside of a familiar specialty ($Z = -2.55, p < .011$), when being called to work in a critical area such as the intensive care unit ($Z = -2.95, p < .003$).



Note. Judgments were made on 6-point scales (1 = no increase to my stress levels, 6 = increases my stress levels maximally); M = Missing

Figure 6.

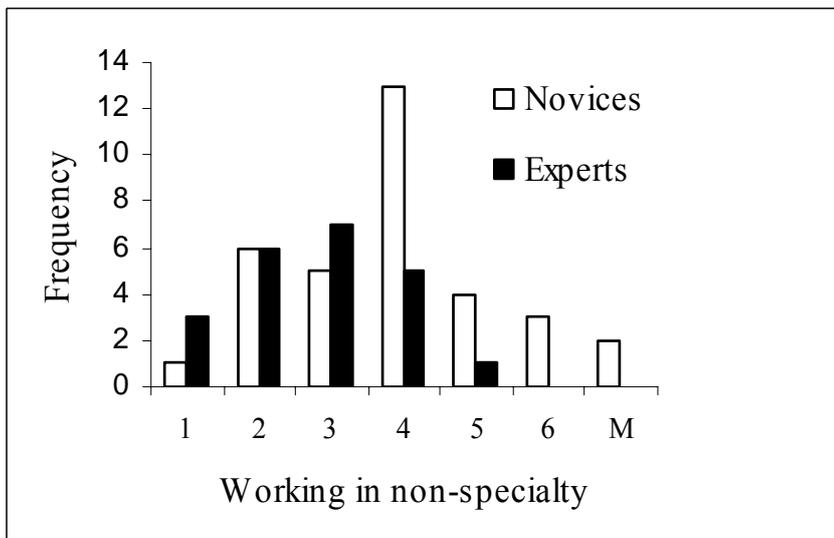
The influence of working in isolation on novice and expert stress levels



Note. Judgments were made on 6-point scales (1 = no increase to my stress levels, 6 = increases my stress levels maximally); M = Missing

Figure 7.

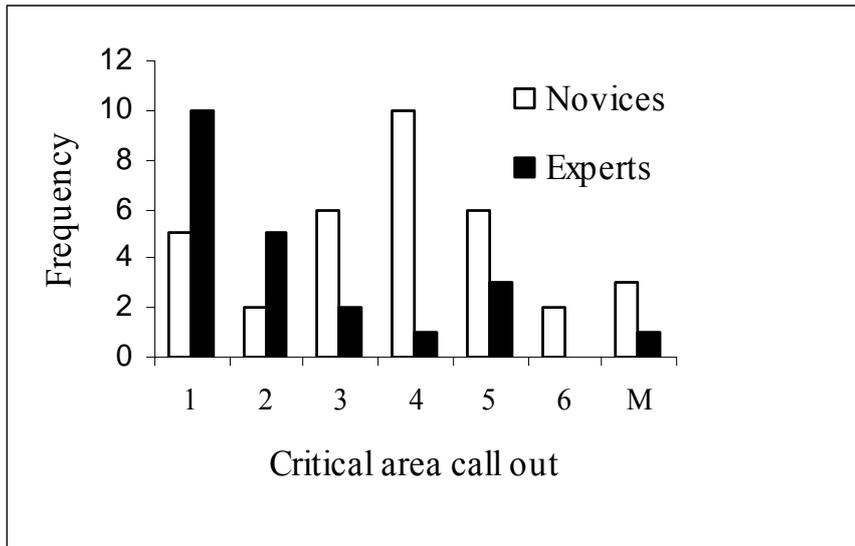
The influence of working with a higher complexity of patient on novice and expert stress levels



Note. Judgments were made on 6-point scales (1 = no increase to my stress levels, 6 = increases my stress levels maximally); M = Missing

Figure 8.

The influence of working in a non-specialty area on novice and expert stress levels



Note. Judgments were made on 6-point scales (1 = no increase to my stress levels, 6 = increases my stress levels maximally); M = Missing

Figure 9.

The influence of being called to work in a critical area on novice and expert stress levels

Questionnaire: Part Two Results.

As stated previously, a full copy of the questionnaire can be found in Appendix B and a detailed synopsis of the case is presented in Appendix C. It is recommended that the reader refer to both to aid interpretation of these results. Where appropriate normal values have been provided in the text to facilitate a better understanding of the results; detailed explanations and limitations are discussed in the following chapter.

4.09 *The vignette: Stage 1*

4.09.1 As the on-call physiotherapist, what is your primary concern about the patient?

As can be seen from Appendix B, participants were provided with a set of observations, in light of these, most participants were primarily concerned about a combination of disease progression and chest infection. The novices' responses were less focussed than the experts. Of note, 11.7% (n=4) of novices and 9.0% (n=2) of experts included secondary sequelae of immobility such as a deep vein thrombosis or backache as a primary on-call physiotherapeutic problem. Table 7 presents the primary concerns in themes.

Table 7.

Participants' Primary Concerns in Themes

Number	Themes	% of novice group (n)	% of expert group (n)
1	GBS progression causing RMW, raising WOB	23.5% (8)	22.7% (5)
2	Chest infection; reduced MCC	2.9% (1)	4.5% (1)
3	Secondary sequelae of immobility	11.7% (4)	9.0% (2)
4	General statement, for example 'respiratory complications'; 'cardiopulmonary status'; 'chest status'.	23.5% (8)	4.5% (1)
5	Combination 1 + 2	38.2% (13)	59.0% (13)

Note. GBS = Guillain-Barré Syndrome; RMW = Respiratory muscle weakness; WOB = Work of breathing; MCC = Mucociliary clearance.

4.09.2: Analyse these observations and indicate your concern about them.

There was generally a high level of agreement between novice and expert groups in their analysis of observations and expressions of levels of concern. Table 8 demonstrates the observation analysis of novices and experts.

Table 8.

Analysis of Observations by Novices and Experts

Observation	Raised		Lowered		Normal	
	Novice % (n)	Expert % (n)	Novice % (n)	Expert % (n)	Novice % (n)	Expert % (n)
Respiratory	54.5%	31.8%	0.0%	0.0%	64.7%	68.1%
Rate	(12)	(7)	(0)	(0)	(22)	(15)
Pulse Rate	100.0%	100.0%	0.0%	0.0%	0.0%	0.0%
	(34)	(22)	(0)	(0)	(0)	(0)
Blood	2.9%	0.0%	0.0%	0.0%	97.0%	100.0%
Pressure	(1)	(0)	(0)	(0)	(33)	(22)
Temperature	100.0%	95.4%	0.0%	0.0%	0.0%	0.0%
	(34)	(21)	(0)	(0)	(0)	(0)
SpO2	2.9%	4.5%	94.1%	95.0%	2.9%	0.0%
	(1)	(1)	(32)	(21)	(1)	(0)
Cough	Effective		Semi-effective		Poor	
	Novice % (n)	Expert % (n)	Novice % (n)	Expert % (n)	Novice % (n)	Expert % (n)
Cough	13.6%	4.5%	85.2%	61.7%	2.9%	0.0%
	(3)	(1)	(29)	(21)	(1)	(0)
Function	Independent		Semi-dependent		Dependent	
	Novice % (n)	Expert % (n)	Novice % (n)	Expert % (n)	Novice % (n)	Expert % (n)
Function	64.7%	47.0%	17.6%	22.7%	14.7%	4.5%
	(22)	(16)	(6)	(5)	(5)	(1)

Note. SpO2 = Oxygen saturation by pulse oximetry

The percentages of novices and experts who were concerned about the abnormal measures are presented in Figure 10. As can be seen, most participants, whether they were novices or experts, were most concerned about the cough, oxygen saturation and temperature. However, in contrast to the experts (72.7%, n = 16) the novices (41.0%, n = 14) were less concerned about a high pulse rate. There were missing data from the novice group in each of the observations listed in Figure 10, with these participants having analysed each of the measures but not indicating their concern about them.

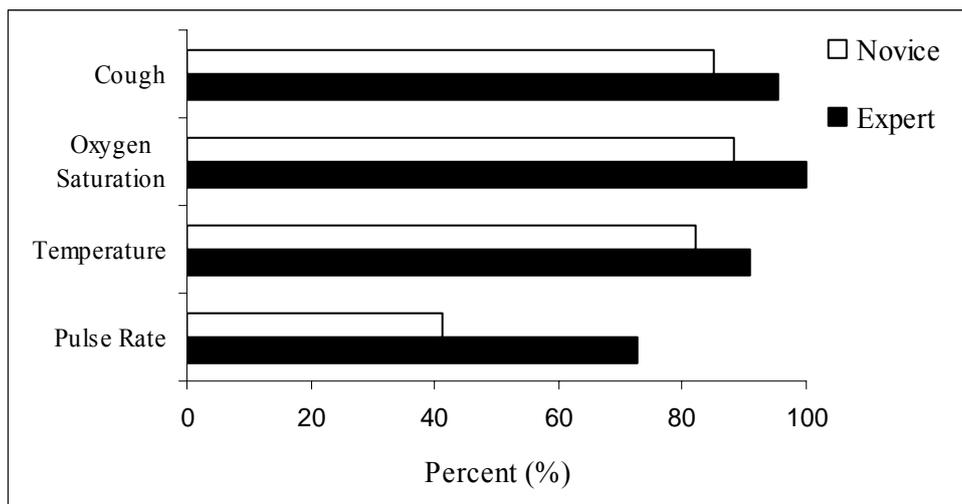


Figure 10.

Percentage of novices and experts who were concerned about abnormal observation results

4.09.3 What does the auscultation result tell you?

In order to facilitate ease of interpretation of responses throughout the vignette the researcher determined designated answers to be correct or incorrect and in some instances partially correct where choices were presented. These definitions were determined in concordance with best available evidence which is presented in Appendix C. The first auscultation result of bi-basal atelectasis was correctly interpreted by 61.7%, (n = 21) of novices and 72.7% (n = 16) of experts. Differences between novices and experts in their interpretation of the auscultation result were found to be not significant ($\chi^2 = .00$; $p = .99$).

4.09.4 How concerned are you about this Peak Flow Rate (PEFR) result?

Table 9 demonstrates novice and expert choices of a statement which best represented how concerned they were at that stage. The majority of both groups responded

similarly; however, novices were more widespread in their choices and more novices than experts chose the most extreme choice of ‘extremely concerned given the diagnosis’. Differences between novices and experts in their choice of statements were unable to be tested for significance as χ^2 test assumptions could not be met because there were less than five scores in four cells (50.0%).

Table 9.

Novice and Expert Concerns following Peak Flow Measurement

Peak Expiratory Flow - 3 attempts performed in A & E in sitting:

i. 340 L/min; ii. 370 L/min; iii. 360 L/min.

Sandra is 180cm in height and weighs 88kg

The predicted PEFR for these parameters is 480 L/min (SD 67L/min)

Statement	% of Novice group (n)	% of Expert group (n)
Concerned but I would expect this in GBS	55.8% (19)	68.1% (15)
Extremely concerned given the diagnosis	23.5% (8)	4.5% (1)
Mildly concerned, I would expect this in GBS	14.7% (5)	22.7% (5)
Not concerned, I would expect this in GBS	5.8% (2)	4.5% (1)

Note. GBS = Guillain-Barré Syndrome

4.09.5: Determine how the Arterial Blood Gas (ABG) results are altered from normal and interpret the blood gas result.

Table 10 indicates the analysis results of the first arterial blood gas by novices and experts. There was a high level of agreement between novice and expert groups in their analysis of the result. However, in the clinical interpretation of the result 2.9% (n = 1) of novices and 18.1% (n = 4) of experts were correct; 38.2% (n = 13) of novices and 45.4% (n = 10) of experts were partially correct and 47.0% (n = 16) of novices and 22.7% (n = 5) of experts were incorrect. Of interest are the 5.8% (n = 2) novices and 4.5% (n = 1) experts who ticked ‘unsure; don’t know’ as their answer and there were missing data from 5.8% (n = 2) novices and 9.0% (n = 2) of experts. Differences between novices and experts in their interpretation of the ABG results were unable to be tested for significance as χ^2 test assumptions could not be met because there were fewer than five scores in four cells (50.0%).

Table 10.

Novice and Expert ABG Analysis Results

ABG taken on 4L/min via a simple oxygen mask:-

PH 7.35; PaCO₂ 46mmHg/6 KPa; PaO₂ 65mmHg/8.7KPa; HCO₃ 26mmol/l

Parameter	Raised		Normal		Lowered		Unsure	
	Novice % (n)	Expert % (n)						
PH	0.0% (0)	0.0% (0)	94.1% (32)	90.9% (20)	5.8% (2)	0.0% (0)	0.0% (0)	4.5% (1)
PaCO ₂	38.2% (13)	45.4% (10)	55.8% (19)	50.0% (11)	0.0% (0)	0.0% (0)	2.9% (1)	4.5% (1)
PaO ₂	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	97.0% (33)	95.4% (21)	0.0% (0)	4.5% (1)
HCO ₃	11.7% (4)	22.7% (5)	79.4% (27)	68.7% (15)	0.0% (0)	0.0% (0)	5.8% (2)	4.5% (1)

Note. PH = Hydrogen ion concentration measure determining acidity or alkalinity; PaCO₂ = Partial pressure of carbon dioxide in arterial blood; PaO₂ = Partial pressure of oxygen in arterial blood; HCO₃ = Bicarbonate ion concentration.

4.09.6 State the pathological changes seen and clinically interpret the X-ray
Many participants had difficulties in determining specific pathological changes from a photocopied print; as a result this part of the question was frequently left blank. The clinical interpretation results demonstrated that 38.2% (n = 13) of novices and 40.9% (n = 9) of experts correctly identified right middle lobe pneumonia; 14.7% (n = 5) novices and 18.1% (n = 4) experts were partially correct and 47.0% (n = 16) novices and 40.9% (n = 9) experts were incorrect. Differences between novices and experts in their interpretation of the X-ray were found to be not significant ($\chi^2 = .24; p = .89$).

4.09.7 From the descriptions so far, list up to four physiotherapy problems in order of priority

Most participants, whether they were novices or experts, provided four physiotherapy problems and ranked them in priority order. Table 11 presents the top priority overall suggested by participants. Although novices chose more widely, the presence of hypoxia and poor gas exchange was determined as the main problem by both groups.

Of note, foot paraesthesia, increased respiratory rate and pain were suggested as priority on-call physiotherapeutic problems.

Table 11.

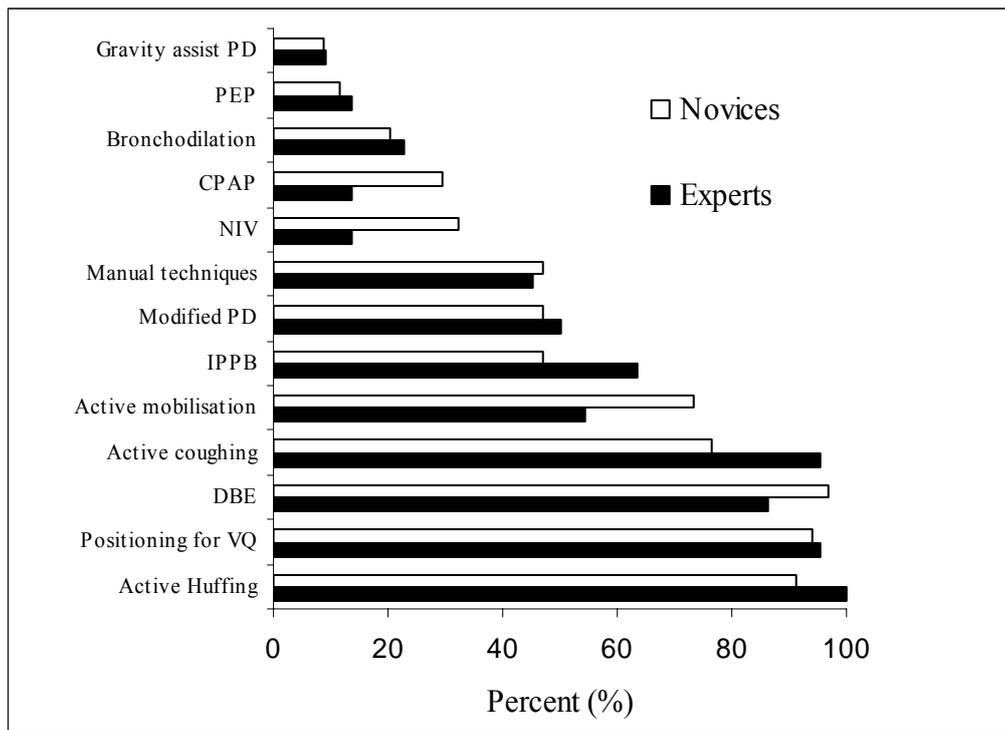
Novice and Expert Priority Problem Choices

First priority problem	% of novice group (n)	% of expert group (n)
Hypoxia; poor gas exchange	38.2% (13)	40.9% (9)
Poor cough; retained secretions	23.5% (8)	31.8% (7)
RM weakness; RM fatigue; potential RM failure	11.7% (4)	9.0% (2)
Reduced lung volumes; atelectasis	14.7% (5)	4.5% (1)
Right middle/lower lobe consolidation	8.8% (3)	0.0% (0)
Foot paraesthesia	2.9% (1)	0.0% (0)
Increased respiratory rate	0.0% (0)	4.5% (1)
Pain	0.0% (0)	9.0% (2)

Note. RM = Respiratory muscle; WOB = Work of breathing

4.09.8 Which treatment strategies would you choose at this time for the problems you have listed above?

The majority of both groups chose similarly with a high level of agreement between novice and expert groups for the four most common treatment options. At this stage few chose supportive ventilation methods with 73.5% (n = 25) of novices and 54.5% (n = 12) of experts choosing to actively mobilise the patient. Other treatment strategies suggested by both groups included humidification, analgesia and bed exercises. The treatments selected by novices and experts are shown in Figure 11.



Note. PD = Postural drainage; PEP = Positive expiratory pressure; CPAP = Continuous positive airway pressure; NIV = Non-invasive ventilation; IPPB = Intermittent positive pressure breathing; DBE = Deep breathing exercises; VQ = Ventilation.

Figure 11.

Treatment options chosen by novices and experts

There appeared to be a difference between the groups regarding the number of treatment options chosen; Figures 12, 13, 14 and 15 (pages 78-79) demonstrate the number of treatment options chosen by participants for each of the four physiotherapeutic problems they had identified in priority order. Figures 12 to 15 demonstrate a trend by the novice group to choose more treatment options for each of their problems than the experts but there was no statistically significant difference identified between the two groups (First priority problem: $Z = -.51$, $p = .61$; Second priority problem: $Z = -.64$, $p = .52$; Third priority problem: $Z = -.21$, $p = .83$; Fourth priority problem: $Z = -.74$, $p = .46$).

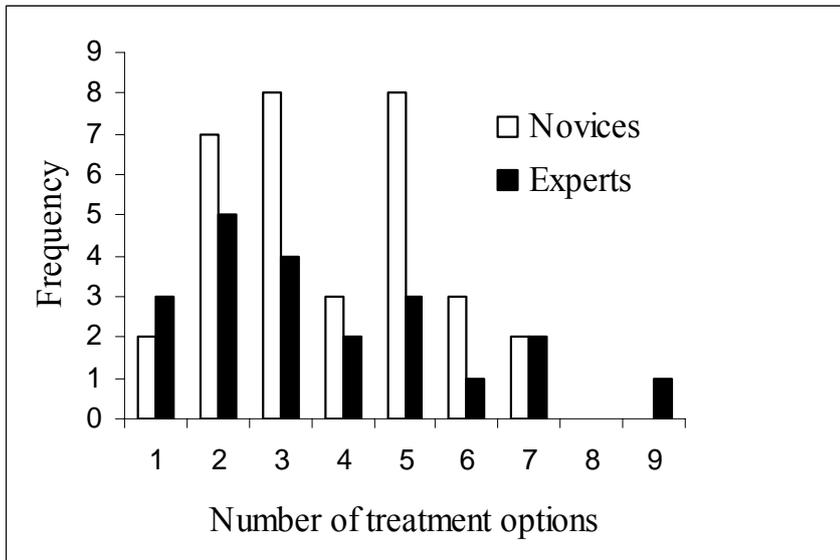


Figure 12.

Number of treatment options chosen by novices and experts for their first priority problem

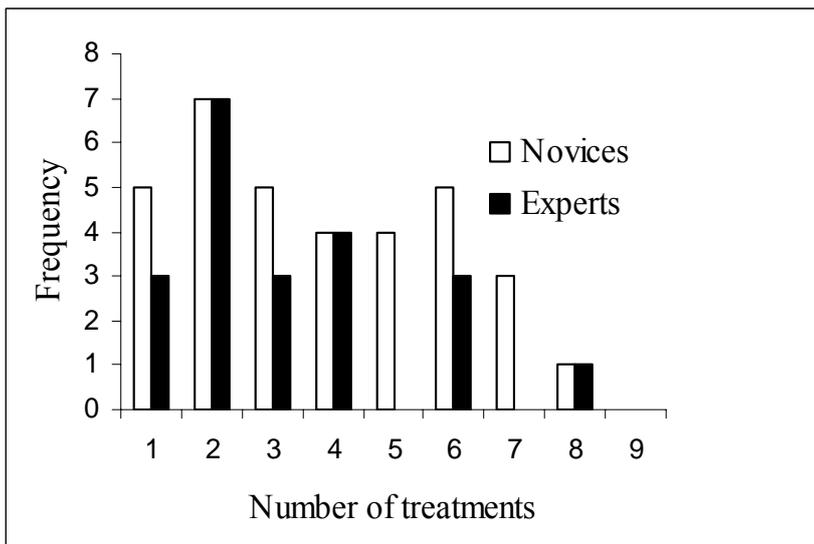


Figure 13.

Number of treatment options chosen by novices and experts for their second priority problem

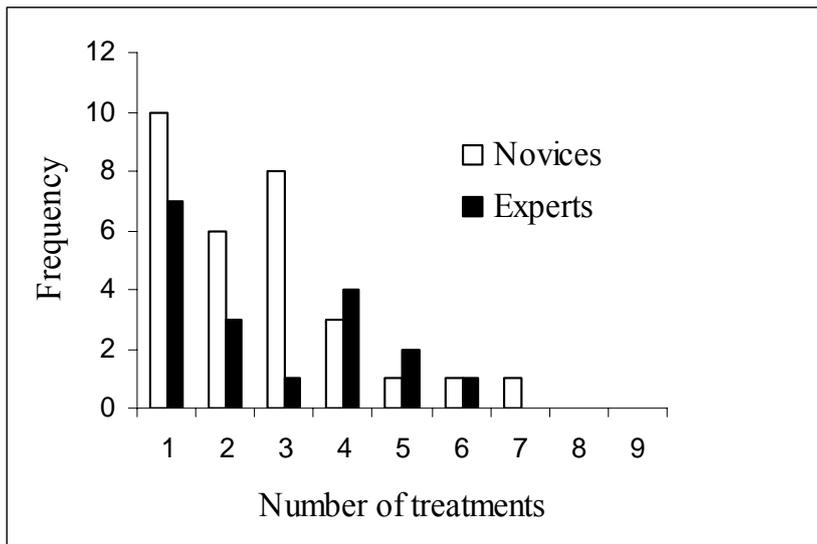


Figure 14.

Number of treatment options chosen by novices and experts for their third priority problem

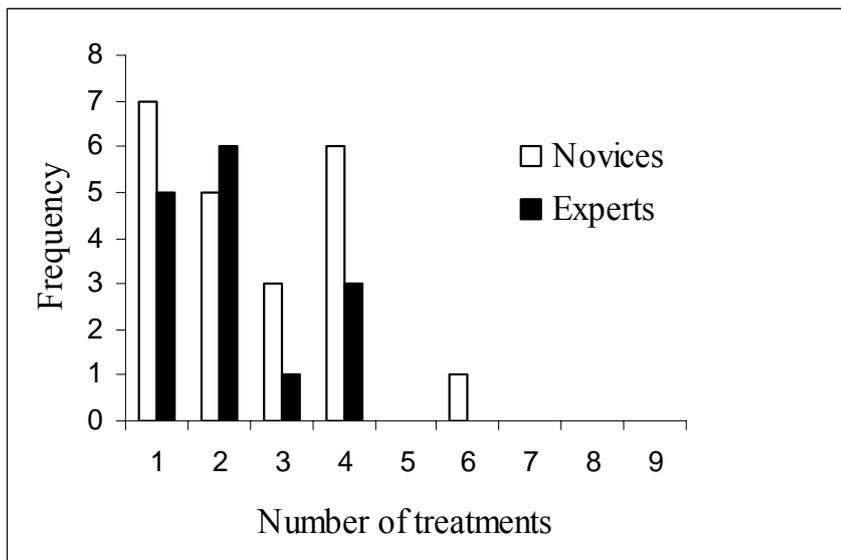


Figure 15.

Number of treatment options chosen by novices and experts for their fourth priority problem

4.09.9 What is the most important clinical indicator that you would use to evaluate change in Sandra's condition following your treatment?

The majority of novices (85.2%, n = 29) and experts (63.6%, n = 14) suggested that oxygen saturation would be the most important clinical indicator to use for evaluating change following treatment. Auscultation was suggested by 2.9% (n = 1) novices and 13.6% (n = 3) experts; work of breathing was suggested by 13.6% (n = 3) experts;

other clinical indicators included fatigue levels, respiratory rate, cleared secretions and lung function testing. Differences between novice and expert responses were unable to be tested for significance as χ^2 test assumptions could not be met because there were fewer than five scores in twelve cells (85.7%).

The vignette: Stage 2.

4.09.10 Determine how the Arterial Blood Gas (ABG) results are altered from normal and interpret the blood gas result.

Table 12 (page 81) shows the analysis of the second arterial blood gas result by novices and experts. There was a high level of agreement between the groups in their analysis of the result; however, in the clinical interpretation 38.2% (n = 13) of novices and 27.2% (n = 6) of experts were correct, 41.1% (n = 14) of novices and 63.6% (n = 14) of experts were partially correct and 17.6% (n = 6) of novices and 9.0% (n = 2) of experts were incorrect. Of note 2.9% (n = 1) novice ticked 'unsure; don't know' as their answer. Differences between novices and experts in their interpretation of the ABG results were unable to be tested for significance as χ^2 test assumptions could not be met because there were less than 5 scores in 4 cells (50.0%).

Table 12.

Novice and Expert ABG Analysis Results

ABG taken on 7L/min via a simple oxygen mask:-

PH 7.32; PaCO₂ 50mmHg/6.6 KPa; PaO₂ 59mmHg/7.9KPa; HCO₃ 28mmol/l

Parameter	Raised		Normal		Lowered		Unsure	
	Novice % (n)	Expert % (n)						
PH	0.0% (0)	0.0% (0)	8.8% (3)	9.0% (2)	91.1% (31)	81.8% (18)	0.0% (0)	4.5% (1)
PaCO ₂	97.0% (33)	100% (22)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	2.9% (1)	0.0% (0)
PaO ₂	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	97.0% (33)	100% (22)	2.9% (1)	0.0% (0)
HCO ₃	91.1% (31)	72.7% (16)	5.8% (2)	13.6% (3)	0.0% (0)	0.0% (0)	2.9% (1)	4.5% (1)

Note. PH = Hydrogen ion concentration measure determining acidity or alkalinity;

PaCO₂ = Partial pressure of carbon dioxide in arterial blood; PaO₂ = Partial pressure of oxygen in arterial blood; HCO₃ = Bicarbonate ion concentration.

Participants were asked to restate their level of concern after analysing the second blood gas result; the results are displayed in Table 13 where it can be seen that the majority of novices and experts were equally concerned as there were signs of respiratory failure. Of note: there were more novices who were extremely concerned about the result than experts; differences were unable to be tested for significance as χ^2 test assumptions could not be met because there were fewer than five scores in one cell (25.0%).

Table 13.

Novice and Expert Concerns Following Second Blood gas Analysis

Statement	% of Novice group (n)	% of Expert group (n)
Extremely concerned as signs of RF	76.4% (26)	81.8% (18)
Extremely concerned but expect this in GBS	23.5% (8)	13.6% (3)
Missing data		4.5% (1)

Note. RF = Respiratory failure; GBS = Guillain-Barré Syndrome

4.09.11 How appropriately is Sandra's oxygen therapy managed?

All participants who chose 'poorly managed, the device and flow rate require changing' were correct therefore 70.5% (n = 24) of novices and 77.2% (n = 17) of experts answered correctly. Differences between novice and expert responses were unable to be tested for significance as χ^2 test assumptions could not be met because there were fewer than five scores in two cells (33.3%).

4.09.12 What factor is affecting sputum clearance?

The majority of novices (35.2%, n = 12) and experts (36.3%, n = 8) chose pain as the most likely factor to affect sputum clearance. The other most common factors chosen by novices were fatigue (23.8%, n = 8) positioning (14.7%, n = 5) and respiratory muscle weakness (14.7%, n = 5). The other most common factors chosen by experts were reduced lung volumes (22.7%, n = 5) and fatigue (22.7%, n = 5). Differences between novice and expert responses were unable to be tested for significance as χ^2 test assumptions could not be met because there were fewer than five scores in nine cells (64.3%).

4.09.13 What do you believe to be the most likely cause of Sandra's pain?

The majority of novices (58.8%, n = 20) and experts (81.8%, n = 18) chose pleuritic pain as the most likely cause of the patient's pain. Of interest: 14.7% (n = 5) novices and 13.6% (n = 3) of experts chose neuropathic pain related to GBS as the primary cause; also 8.8% (n = 3) novices and 4.5% (n = 1) expert ranked musculoskeletal pain from excessive coughing as the primary cause of pain. Differences between novice

and expert responses were unable to be tested for significance as χ^2 test assumptions could not be met because there were fewer than five scores in ten cells (83.3%).

4.09.14 What does Sandra's SpO2 level indicate to you?

The results showed that 20.5% (n = 7) of novices and 18.1% (n = 4) of experts correctly chose 'her oxygen carrying capacity is reduced because her haemoglobin is poorly saturated' and 'she is hypoxic'. Differences between novice and expert responses were unable to be tested for significance as χ^2 test assumptions could not be met because there were fewer than five scores in one cell (25.0%).

4.09.15 What does Sandra's respiratory rate and pattern indicate?

The results showed that 50.0% (n = 17) of novices and 40.9% (n = 9) of experts correctly chose 'her work of breathing is increased due to sputum retention', 'her work of breathing is increased due to respiratory muscle weakness' and 'her work of breathing is becoming critical'. Differences between novices and experts in their interpretation of the respiratory rate and pattern were found to be not significant ($\chi^2 = .15; p = .69$).

4.09.16 What does this auscultation result tell you?

The majority of novices (58.8%, n = 20) and experts (54.5%, n = 12) correctly chose option 'a', 'consolidation is present on the right side'. Differences between novices and experts in their interpretation of the auscultation result were found to be not significant ($\chi^2 = .00; p = .97$).

4.09.17 State the pathological changes seen and clinically interpret the X-ray.

As previously, several participants had difficulties in determining pathological changes from a photocopied print and these difficulties are discussed in more detail in the limitations section. The clinical interpretation results of the second X-ray showed that 32.3% (n = 11) of novices and 45.4% (n = 10) of experts correctly identified worsening right middle and lower lobe consolidation. 52.9% (n = 18) novices and 40.9% (n = 9) experts were partially correct and 14.7% novices (n = 5) and 13.6% (n = 3) experts were incorrect. Differences between novice and expert responses were unable to be tested for significance as χ^2 test assumptions could not be met because there were fewer than five scores in two cells (33.3%).

4.09.18: What is your analysis of the lung function test results?

The results were widespread; difficulties with coding the results are discussed in the limitations section of the following chapter. The results did show that 82.3% novices (n = 28) and 81.8% experts (n = 18) correctly recognised the presence of respiratory muscle weakness which was affecting the lung function measurement.

4.09.19 What is the most important problem now?

In light of the participants' reevaluation of the primary problem at this critical stage it can be seen in Table 14 that most of the participants were concerned about respiratory muscle dysfunction, pending failure and retained secretions. Results showed that compared to the experts, novices' responses were less focused and tended to classify problems with a similar level of importance; also, (8.8%, n = 3) novices avoided this question altogether.

Table 14.

Novice and Expert Primary Problem Choice

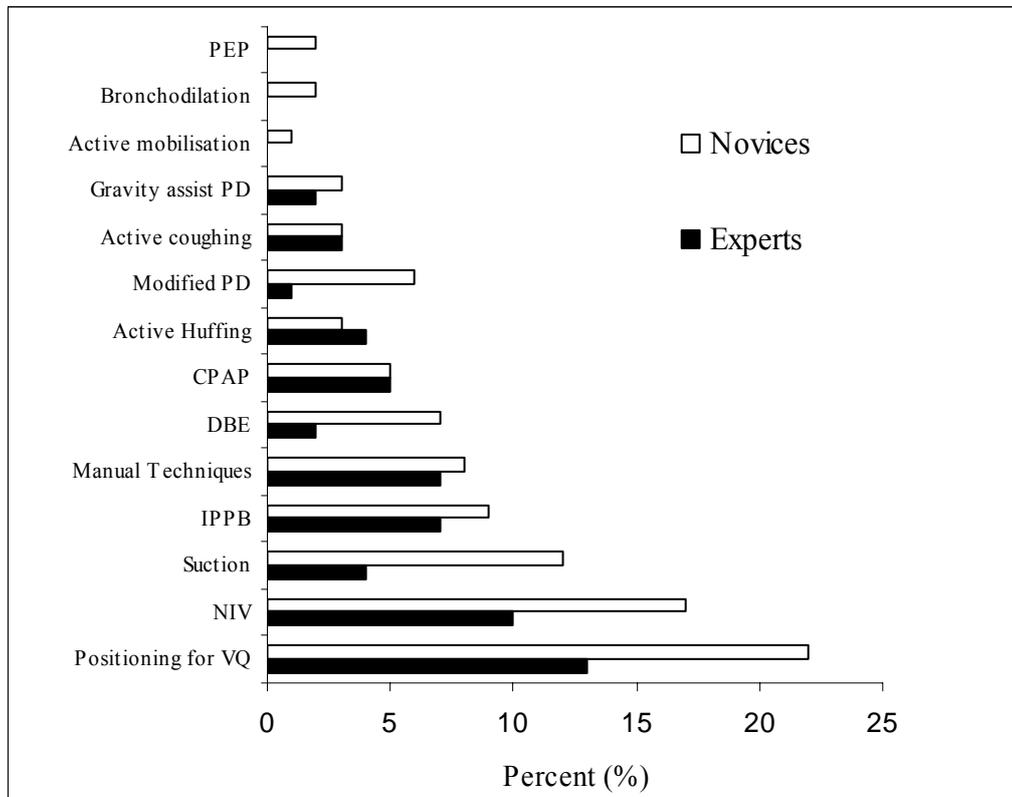
Number	Themes	% of Novice group (n)	% of Expert group (n)
1	RM weakness/ RM fatigue pending RF	26.4% (9)	31.8% (7)
2	Poor saturations / Poor VQ	5.8% (2)	0.0 % (0)
3	Retained secretions causing increased WOB	26.4% (9)	22.7% (5)
4	1+2	5.8% (2)	0.0 % (0)
5	2+3	5.8% (2)	0.0 % (0)
6	1+3	20.5% (7)	45% (10)
Missing		8.8% (3)	0.0 % (0)

Note. RM = Respiratory muscle; RF = Respiratory failure; VQ = ventilation / perfusion matching; WOB = Work of breathing

4.09.20: What specific physiotherapeutic treatment methods would you use to treat this problem?

A second list of treatment methods was provided and participants were asked to choose up to three treatment options which they would use to manage the primary problems they had previously identified. Figure 16 shows that the majority of both

groups chose similarly and that the experts focused on specific treatment options more than the novices. Of note, more novices than experts chose to suction the patient. Other treatment options suggested included assisted coughing and humidification.



Note. PEP = Positive expiratory pressure; PD = Postural drainage; CPAP = Continuous positive airway pressure; DBE = Deep breathing exercises; IPPB = Intermittent positive pressure breathing; NIV = Non-invasive ventilation; VQ = Ventilation.

Figure 16.

Treatment options chosen by novices and experts

Figure 17 demonstrates the number of treatment options chosen by participants for the physiotherapeutic problem they had identified. As previously noted, the novices had chosen more treatment options overall for their problem than the experts but there was no statistically significant difference identified between the two groups for number of treatment options chosen ($Z = .59, p = .55$).

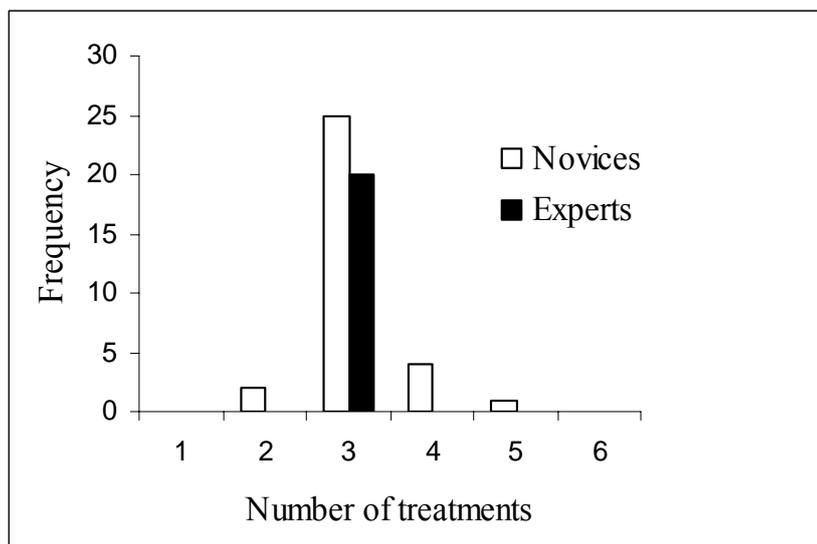


Figure 17.

Number of treatment options chosen by novices and experts for their priority problem

4.09.21 State any evidence within the literature that would support your treatment choices.

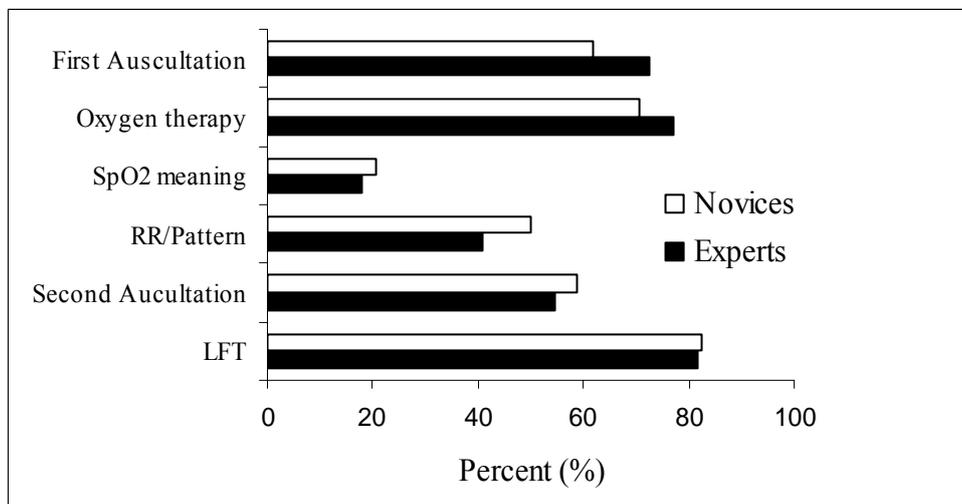
Most participants stated that they were aware of texts but could not name any specific references. In total, 17.6% ($n = 6$) novices and 27.2% ($n = 6$) experts cited references by authors' name only; these included Hough, Pryor, Paratz, Pryor & Webber, Dean, Stiller and Bott. Amongst the novice group, 8.8% ($n = 3$) supplied the following information: "K. Stiller - mobilising patients in an acute setting is more valid than specific deep breathing exercises"; "K. Stiller – safety aspects of mobilising acutely ill patients"; and "Dean backing up mobilisation, Pryor and Webber have done a lot of research backing up deep breathing exercises with and without huff and cough".

Amongst the expert group, 4.5% ($n = 1$) supplied authors' names and stated why the reference was relevant to their treatment choices: "British thoracic guidelines for NIV; E. Dean for body positioning; J. Pryor for manual techniques"; 4.5% ($n = 1$) gave three references which contained authors' names, dates of reference and relevance to their

treatment choice; these were “ACBT Cecins et al., 1999; Button, 1992 modified PD and IPPB Bott et al., 1992”.

4.09.22 Multiple choice questions.

There were six similarly styled multiple choice questions in the questionnaire which required baseline knowledge of the subject matter. It can be seen in Figure 18 that for questions on auscultation interpretation, determining appropriate oxygen therapy, understanding the significance of oxygen saturation (SpO₂) measures, determining the meaning of an altered respiratory rate and pattern and interpreting a lung function test, similar numbers of novices and experts were correct.



Note. SpO₂ = Saturation of oxygen; RR = Respiratory rate; LFT = Lung function test

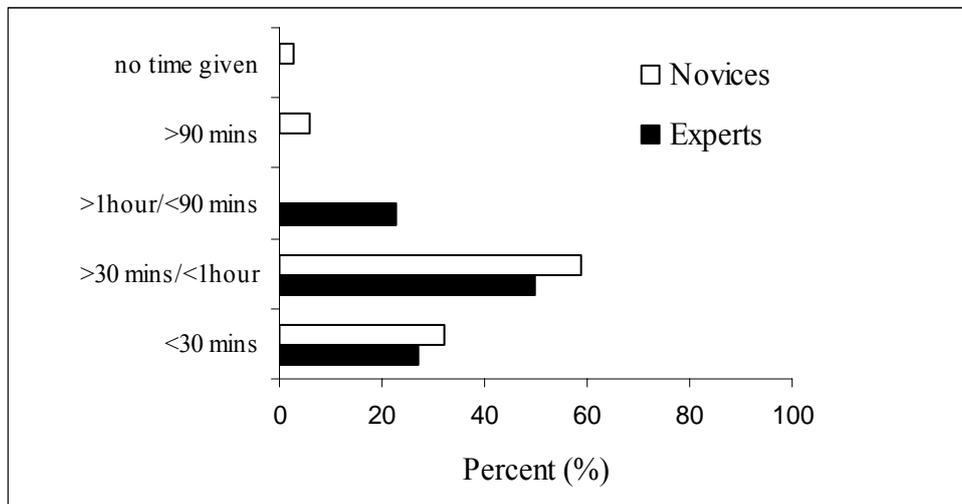
Figure 18.

Novice and expert correct responses to multiple choice questions

Questionnaire: Timing and Open comments.

4.10 Novice and expert times taken to complete questionnaire

Figure 19 demonstrates the times taken for novice and expert groups. In total, 12.5% ($n = 7$) of participants took over one hour; with 22.7% ($n = 5$) experts taking less than or equal to 90 minutes and 5.8% ($n = 2$) novices taking over 90 minutes; 2.9% ($n = 1$) participant from the novice group did not respond. There was no statistically significant difference between novices and experts in time taken to complete the questionnaire ($Z = .84, p = .40$).



Note. > = more than; < = less than; mins = minutes

Figure 19.

Novice and expert times taken to complete questionnaire

4.11 Participant comments

This new questionnaire showed improved face validity and received an overall positive critique from participants. A summary of their comments is presented in Table 15 where it can be seen that participants generally found the exercise to be a positive experience which helped to clarify their body of knowledge.

Table 15.

Summary of Participant's Positive Comments

Type of physiotherapist	Participant comments
(J,J,N)	A great exercise; see value in doing something like this routinely with active discussion, debrief and feedback
(N,N)	Now more aware of lack of knowledge; need to visit ICU and re-visit day to day presentations
(N,N,N)	Would be keen to see a 'gold standard answer'
(N)	I see the opportunity for clinical reasoning and discussion at many stages of the exercise
(N,C)	Realistic situation; good patient to get us thinking, look forward to results
(N)	You don't realise how much you rely on indicators and results until you do something like this

Note. C = Senior cardiorespiratory physiotherapist; N = Non cardiorespiratory senior physiotherapist; J = Junior physiotherapists.

Feedback from participants also included a number of competency concerns which are presented in Table 16 where it can be seen that a number of participants shared similar concerns about cardiorespiratory-based work in the emergency on-call environment.

For some participants, the reality of their workplace determined their interaction with acutely deteriorating cardiorespiratory conditions in that they either had very limited experience of these cases (as they were flown to larger centres) or they felt that the majority of decisions about treatment options discussed in the questionnaire were made by others, such as the intensivist.

The predominant concerns raised about the questionnaire focused on difficulties associated with reading a chest X-ray from a photocopied print, and timing of tests performed which were different from some participant's familiar routines. A small percentage (8.8%, n= 3) of participants felt that more information was required; a summary of remaining comments generated from thematic analysis is presented in Appendix D.

Table 16.

Summary of Participant's Competency Concerns

Type of physiotherapist	Participant comments
(N,N)	Although reasonably confident to deal with this type of patient they do tend to stress you out a bit more
(J,J)	Found this very difficult, never seen GBS before, don't feel equipped to deal with a similar situation
(N)	Acute respiratory patients put me out of my comfort zone - would call colleagues to advise
(N)	If I didn't have to do weekend work and on-calls I wouldn't have considered changing jobs to avoid it
(N,N)	Annual competency training sessions are held in department but it's difficult to retain details of acute respiratory patient assessments when they occur infrequently
(N,C,C)	Not had much experience with adults/neurology patients of this type - found this hard

Note. C = Senior cardiorespiratory physiotherapist; N = Non cardiorespiratory senior physiotherapist; J = Junior physiotherapists.

5 Discussion

This chapter discusses the results of the survey whilst relating findings to pertinent literature to determine meaning. Key concepts established from the findings are represented as subheadings in this section. The chapter concludes with a description of strengths and limitations of the research.

Dillman (2000) describes a social exchange theory of human behaviour asserting that action resulting in reward of some kind will motivate human participation. It was intended that this survey would highlight relevant issues within the on-call environment for physiotherapists, and participants may have felt a sense of involvement in a process that was of interest to all on-call physiotherapists and those responsible for on-call service provision. Many authors have supported on-call specific learning opportunities in order to better prepare staff for emergency on-call working (Carr et al. 1995; Case et al., 2000; CSP, 2004; Harden et al., 2005). In the UK, a process for standardising emergency on-call training exists; audits thus far have found the process to be successful (Broad, 2005; Byrne, 2002; Gough & Doherty, 2007). It is hoped that findings from this study will encourage better emergency on-call learning opportunities to become available in NZ. It is also hoped that findings of this study will encourage more acute cardiorespiratory and emergency on-call clinical learning opportunities to become available; seen by many as necessary before undertaking emergency on-call work (Bott, 2000; Reeve, 2003; Thomas, 1999; Thomson, 2000; Williams, 2002).

5.01 *Demonstrating a difference*

The models of novice to expert evolution (Benner, 1984; Thomas, 1999) and clinical reasoning strategies (Case et al., 2000; Chipchase & Prentice, 2006; Edwards et al., 2004; Greenwood & King, 1995; Jensen et al., 1992) were considered to predict that experts' responses to the questionnaire would be different from those of the novices. This prediction was based on the increased likelihood of experts having a greater amount of experience and knowledge of working with acutely deteriorating cases, having greater experience of patients suffering from Guillain Barré Syndrome (GBS) and having more experience of integrating both knowledge and experience in the emergency on-call environment. Case et al. found that novices and experts frequently

reached the same decisions but how those decisions were reached was different and therefore significant. Edwards et al. found that reasoning strategies were governed by the situation and context and acknowledged that although experience and expertise may not automatically be related, experience changed a clinician's thought process and subsequent practice. In this study the results showed a difference between novice and expert responses, primarily in their clinical reasoning processes and particularly in areas where participants relied upon previous clinical experience to respond to a question.

5.02 Response Rate and Demographics

Although of moderate sample size, findings were considered generalisable to the physiotherapy emergency on-call population as this was a national survey. There was a good response rate; other studies involved with this subject have primarily investigated people with cardiorespiratory interests (Broad, 2005; Dixon & Reeve, 2003; Harden et al., 2005; Reeve, 2003). This survey included non-cardiorespiratory seniors and junior physiotherapists who were the two larger responding groups. This is of interest as it suggests that the issues surrounding on-call work are important to all grades of staff involved in the process.

5.03 Novice and Expert Confidence, Stress and Support Levels

The frequency of emergency on-call duties varied widely which may have had an impact on the sample's levels of confidence, stress and support required. Links can be drawn with the novice traits of quantitative and qualitative overload which were described by Mottram and Flin (1988), (see page 23) and the effect on confidence levels of high stress, fear and anxiety (Thomson, 2000; Bennett & Hartberg, 2007). The novices in this sample reported being less confident, more stressed and requiring a greater level of support than the experts. Factors which could have influenced stress levels appeared to have had a greater effect on novice stress scores than experts.

Links can also be made with the model of novice to expert described by Benner (1984) where a rigid and faltering novice can become overwhelmed in new and critically demanding situations. Benner states that once the novice has undergone sufficient

experience of repeated situations they evolve by changing their intellectual orientation into the more fluid and refined expert. This evolutionary process relates to the findings of Broad (2005) who found that whilst emergency duty work was an area that all grades of staff found stressful, confidence and competence scores increased with seniority which suggested that experience could be required to be more confident. However, in this study competence and confidence scores were presented in a combined manner and therefore caution is advised in extrapolating confidence scores from these findings.

5.04 Differences Between Novices and Experts in Defining Problems Relevant to the On-call context

The ability of experts to perceive key problems that are most relevant to the context has been previously described (Benner, 1984; Chipchase & Prentice, 2006; Greenwood & King, 1995). Jensen et al., (1992), supported by Greenwood and King noted that generally there was a lack of focus in selectivity when novices were collecting and analysing data. When asked to establish primary concerns at different crucial stages throughout the vignette most participants from both groups chose similarly, the novices however, were less focused in their answers than the experts. More novices than experts gave a vague, general statement which might suggest a lack of certainty or reduced confidence in the answer, described by Benner (1984) and Jensen et al. (1992) as a novice trait. As expected, experts predicted complications more readily and focused on the most significant physiotherapeutic problems which were relevant for an on-call situation. Some participants from both groups chose less relevant problems for the emergency on-call context. It is likely that these responses were due to a lack of experience of such a case where those with experience would be more able to focus on pertinent issues within the context of on-call (Jensen et al., 1992).

5.05 Differences Between Novices and Experts in the Analysis and Interpretation of Observations

Participants were asked to consider their level of concern about a number of observations which they needed to analyse and interpret throughout the vignette.

Benner (1984) states that to perceive a situation, knowledge is required to formulate an understanding based on theory, principle and experience to date. Benner notes that a novice practitioner who has not seen a range of deviations would be expected to have difficulty in recognising them from normal and would be less able to develop an understanding of that situation. In this study, the interpretation and indication of a level of concern about a set of observations required the participant to recognise an abnormal result and then interpret it in relation to other clinical features. Although novices had the knowledge of an altered observation they may have lacked the context-related experience with which to interpret it and may have had reduced confidence in their own knowledge as a result (Chipchase & Prentice, 2006; Jensen et al., 1992). The theoretical aspects of these questions and a selection of theory-based multiple choice questions presented throughout the vignette were predicted to be equally achievable by both novices and experts (Benner) which was demonstrated in the results, yet more novices than experts failed to express their level of concern over deviated results.

Benner (1984) describes the greater potential for novice responses to be at the extremes of available choices. When asked to choose a 'best fit statement' from a list of statements, more novices than experts chose from the most extreme categories; this choice of extremes is likely to have been due to inexperience of GBS. As predicted, most of the experts responded similarly where they expressed concern but also indicated that they had expected such results given the condition.

5.06 Differences Between Novice and Expert Problem Prioritisation

Benner (1984) describes experts as those who can quickly perceive a situation as a whole, using previous experience as paradigms, and prioritise more efficiently than novices; they are able to move to the accurate region of the problem without wasteful consideration of irrelevant options. Novices, however, can become overwhelmed amidst an array of symptoms and then struggle to filter details and prioritise quickly in an environment which demands autonomy. Benner notes that novices also have a reliance on protocols and procedures in the absence of experience or guidance which results in an inability to prioritise. An example of this in the vignette was seen in questions 26 and 27 where participants were asked to determine factors which would impact on sputum clearance and state a likely cause for the patient's pain. It was

predicted that most of the experts would choose pleuritic pain as the highest ranking factor affecting sputum clearance and that the cause of pain would be by infective processes based upon the interpretation of significant clinical features; also that novices would choose more widely. Findings demonstrated a similar response from the majority of both groups, some novices cited other causes such as neuropathic and musculoskeletal causes which indicate not only a reduced knowledge of the condition but also suggests an inability to recognise significant clinical features.

A further example of this was seen when participants were required to define a problem at the most critical stage (question 33). It was predicted that the experts would be focussed in their choice, using their superior clinical reasoning strategies to determine the most critical problem relevant to the on-call situation (Benner, 1984; Carr et al., 1995; Chipchase & Prentice, 2006) and indeed findings showed this to be the case. Equally predictably, novices were more widespread in their choices than experts. From this it could be determined that the experts were better able to recognise the situation as a whole and make appropriate choices relevant to the context.

5.07 Differences Between Novice and Expert Treatment Choices

Doody and McAteer (2002) found that experts were able to closely link treatment choices to their evaluated hypotheses and novices were not always able to make a hypothesis evaluation. The authors also found that novices were unable to evaluate cues and were therefore less able to tailor a treatment to a patient's specific problems; they were more likely to link treatment choices to an idea or a guess. Chipchase and Prentice (2006) found that expert acute care physiotherapists integrated reasoning strategies which they referred to as 'risk-benefit' analyses. They also found that expert treatment choices were made in a fluid and individualised way which the authors felt was representative of their superior clinical decision making processes.

In this study, participants were asked to choose from a list of treatment options the strategies they would use to treat their priority problems; it was predicted that experts would focus on a smaller number of treatment strategies overall for each of their identified problems than the novices (Benner, 1984; Chipchase & Prentice, 2006; Jensen et al., 1992). Experts were expected to use a holistic approach whilst remaining aware of the context; they were predicted to be more likely to choose techniques

which would not be detrimental to a progressively weakening patient, and the novices were predicted to choose more treatments overall and to be less selective in their choices. The majority of both groups chose similar treatment strategies for their problems. However, the active treatment options chosen and overall number of treatments per problem, particularly from the novice group, was different where six or more treatment strategies were frequently suggested by the novices for each of the listed problems. This was an emergency on-call setting; the patient had a condition for which fatigue was a real concern so this 'blunderbuss' technique exhibited by the novice group might have been detrimental.

A further example of this was seen in question 34 which required participants to choose up to three treatment options only for a single problem determined at a critical stage. Experts were expected to filter details more efficiently and prioritise to choose the most pertinent treatment options for their chosen clinical problem (Benner, 1984; Carr et al., 1995). The experts were predicted and subsequently found to choose a smaller number of treatment strategies for their identified problem and choose techniques which were appropriate for a critical patient with pending respiratory failure. The novices were predicted and subsequently found to be less capable of filtering details, choosing more treatments overall and were less selective in their choices as they may not have recognised the seriousness of the patient's ongoing deterioration (Benner, 1984; Carr et al.; Chipchase & Prentice, 2006). Although not statistically significant, a trend was demonstrated by the novice group to choose more than three treatment options for this problem despite a request to choose no more than three and overall chose more treatment strategies than the experts.

5.08 *Awareness of the Literature*

In emergency on-call situations, discussions with other professional groups are common, a task which novices find more daunting than experts (Mottram & Flin, 1988; Thomson, 2000). The ease with which evidence-based knowledge is integrated and used in these discussions develops with experience and assists in maintaining the profile of physiotherapy as an autonomous profession within the multidisciplinary team (Carr et al., 1995; Chipchase & Prentice, 2006; Edwards et al., 2004). It is the opinion of the researcher that being aware of available literature to support and defend a management decision about patient care is an integral part of clinical decision

making. Few participants were able to supply any supporting information without referring to departmental or home resources.

5.09 Limitations

5.09.1 The definition of novices and experts

There were no standardised definitions available for novice or expert on-call physiotherapists. Benner (1984) states that “experience is a requisite for expertise” and that clinical knowledge takes time to correlate (p.3). The definitions used in this research have been determined by combining appropriate models described in the literature review and have been based on time spent in a domain specific environment. It is to be acknowledged that had the definitions of novice and expert been different the results may also have been different (Case et al., 2000). As on-call service frequency, content and training strategies differ greatly within New Zealand it was felt that there were no other appropriate criteria with which to define novices and experts but a limitation is acknowledged here.

5.09.2 Sampling

This was a postal survey of a small, although national, sample; as such it is appropriate to acknowledge the potential threat to external validity which occurs when meaning is sought based upon results taken from a small purposive sample (Polit et al., 2001). Bias may also have been introduced when determining the purposive sample should the physiotherapy service provider not have been sufficiently aware of the sampling aims required and therefore be unable to provide accurate information (Bowling, 2002). A well constructed, explicit introductory letter and follow up phone calls with clear definitions of the target sample and survey aims was used with each service provider, which may have minimised this risk (de Vaus, 1995; Robson, 2002).

5.09.3 Data Analysis

The novice and expert group numbers differed so non-parametric statistical testing was required (Hicks, 2004). Due to the moderate sample size and the use of six-point scales the test statistic had borderline acceptability; therefore results included a graphical display of the spread of responses in conjunction with statistical measures. The complex nature of vignette responses and the small number of responses for some of the categories made it difficult to perform the Chi squared analysis as the conditions

for the test were often violated with fewer than five scores in each cell. Where the test was successfully applied, results were reported. Where tests for statistical significance were unable to be performed, descriptive analysis was provided.

5.09.4 The survey design and question structure

One of the criticisms of progressive vignettes is the potential to make the participant believe that they are incorrect by directing a course of action which would be different from that which they would choose in reality (Hughes, 1998). In this survey, statements within the vignette indicated an assumption of action, a technique which was intended to leave the participant free to answer without concern for hospital policy, procedure or bias. As the action may have been different from that which the participant may have undertaken, a limitation is acknowledged.

This survey utilised both open and closed question styles. The primary drawback of closed questions is that the researcher may overlook a potentially important response but they take less time to answer and are easier to code and analyse (Hicks, 2004; Polit et al., 2001; Robson, 2002). Some of the question responses were unexpectedly long or contained more than the requested number of answers. This may have been prevented if the question style had been more structured and instructions had indicated choosing only one response. In order to improve coding reliability the researcher utilised an independent person to code particular sections of the questionnaires and a further independent coder to recode areas of discrepancy to achieve consensus as recommended by Bowling (2002) and Hicks (2004).

Actual experience of a case would be likely to have had an influence on participant's responses and predictions (Benner, 1984; Bennett & Hartberg, 2007). A question to determine if the participants had seen such an acute respiratory patient previously or had experience of GBS was not included in this survey; had it been so, it may have provided valuable information and should be included if the study is repeated.

Participants were presented with two chest X-rays which had been professionally copied from a print source; all questionnaires had been printed professionally in an effort to minimise misinterpretation of the film. However several participants found the analysis and interpretation impossible citing difficulties with reading the X-ray due

to unclear printing. In hindsight this may have been prevented by providing a list of X-ray findings and having participants interpret the list rather than a printed copy.

In this questionnaire some responses were coded as correct, partially correct or incorrect using best available evidence. It is acknowledged that as is the nature of clinical practice there may be instances where a similar presentation may occur and the definitions used in this case may not apply.

5.09.5 Researcher bias

The potential for researcher bias is acknowledged as the researcher has worked in one centre and not the others (Bowling, 2002). This limitation is reduced by the fact that the researcher has not worked in that department for over two years, that all introductions and requests for volunteers were undertaken by post or telephone and all service providers were approached in the same way (Dillman, 2000).

5.10 *Strengths*

Benner (1984) recommends that strategies are needed to make clinical knowledge public so that it can be extended and refined, and notes that any event which changes previously held knowledge can be referred to as experience. The literature suggests that case studies are useful educational tools and are used in many professions requiring the integration of psychological, social, emotional, physical and affective aspects of patient care. Prior and Graby (1995) encourage the use of case studies as educational teaching methods as there is the ability for participants to make and correct errors, identify influences and integrate and apply knowledge in a safe, simulated reality. The opportunity is also presented for participants to witness the exemplary practice of experienced clinicians as they complete the case study whilst talking through their decision-making processes. Case studies can also be used for group discussion, debate and reflection in a safe and non-judgmental environment. Prior & Graby discuss the use of clinical case studies as appropriate tools to develop clinical reasoning in student nurses who learn to integrate psychological, social, emotional and physical aspects of patient care. The authors describe the most valuable tool for learning in the process being the reflective discussion involving deconstruction and reconstruction of expert answers. This opportunity to reflect is seen as a key factor for novice training (May & Dennis, 1995).

To the researcher's knowledge this is the first study of its kind in the field of on-call physiotherapy. The study received positive comments from participants who found completing the questionnaire to be a challenging and positive exercise.

5.11 *Recommendations for future practice*

Clinical placement experiences, and positive role models within the specialty, have been shown to have a direct effect on confidence and interest in the cardiorespiratory specialty, both as a place to work and as a possible career choice (Bennett & Hartberg, 2007). Acute-care cardiorespiratory student placements in New Zealand are in short supply (Kirk, Ferdinand & Conroy, 2007; Reeve, 2003) and cardiorespiratory placement supervision by suitably qualified staff has been identified as a problem area (Baxter, 2007). Many virginal on-call physiotherapists are facing their first on-call with minimal or no prior hands-on experience of working with acutely deteriorating patients, working with acute cardiorespiratory problems or working in a critical area such as intensive care. The profession is looked to for the provision of better ways to meet the needs of our future 'fit for purpose' emergency on-call workforce, without which other professional groups will be required to fill the gaps and cardiorespiratory physiotherapy utilisation will be reduced. It is appropriate to encourage all senior clinicians working within the cardiorespiratory specialty to offer clinical experiences for novice physiotherapists and to consider the most effective method of experience delivery. Case et al. (2000) and Jensen et al. (1990) counter the opinion of Benner (1984) stating that experience alone is not a prerequisite for expertise. The completion of a respiratory placement may not offer experiences of the type faced during emergency on-call working; opportunities need to be presented which can better prepare workers for the task.

Sufficient time spent gaining context-specific experience with the opportunity for reflective discussion in a supportive proactive environment; appear to be the most appropriate methods to facilitate a confident emergency on-call service worker (Thomson, 2000; Bennett & Hartberg, 2007). Novices may approach emergency on-call working with initial confidence but Benner describes the concept of 'secondary ignorance' in relation to novices, meaning an individual not knowing what they do not

know. The benefits of standardised guidelines have been discussed (CSP, 2002, 2004) and these ensure that all those involved have a set of core standards which guide learning. A standardised guideline specific to local emergency on-call need would seem appropriate to act as a benchmarking standard for staff entering the on-call system. Suggestions have been made in the literature that e-learning may be an appropriate forum for novice on-call worker training (Gough & Doherty, 2007) and it is recommended that this be considered for the New Zealand on-call workforce. Any national guideline would need to include strategies for self assessment and goal setting and would need to be freely available and user friendly; thus an on-line programme would appear the most appropriate method.

Higgs and Jones (1995) suggest that students should be taught to appreciate the value of higher cognitive skills such as metacognition and reflection in action, in domain specific areas. The authors recommend using simulated as well as real time methods rather than the trial and error option of experience alone, as learning requires processing with reflection and critical appraisal. Carr et al. (1995) recognise that physiotherapy students require opportunities to develop problem-solving approaches to clinical situations and that clinical reasoning proficiency is vital in order to develop expertise in physiotherapy. They acknowledge that novices will engage in similar problem solving approaches as experts but that ongoing experiential learning is essential in order to acquire the knowledge base typical of an expert, which is extensive, domain- and context-specific. There is an opportunity for the case study in this survey to be used in the future for educational purposes, or to serve as a guide for the development of other case studies. The researcher also recommends the use of simulated on-call scenarios using specifically designed teaching mannequins or role playing as part of novice on-call worker training.

Findings of this survey are to be displayed through publication and conference presentations which could stimulate further research into such an important area for on-call physiotherapists. National survey data could then be used in the power analysis calculation for future research, providing a sufficient sample size to support firm conclusions.

5.12 *Summary statement*

The key findings of this thesis were that problems exist with emergency on-call service provision within New Zealand which mirror those determined internationally. Differences exist between on-call physiotherapists and those differences are influenced by the amount of context-related experience. The type of experience as well as length of time spent gaining it are both important factors to consider when determining level of experience. No standard definition exists of novice and expert on-call practitioners. This study used definitions based upon time spent gaining context-related experience and demonstrated that raised stress levels, reduced confidence and an increased need for support were more common in novices, although present in experts. Certain factors such as working in isolation and working with a higher complexity of patients increased stress levels in both groups but more so in the novice group. Emergency on-call service provision requires a better framework for training and support which is easy to use and managed locally; currently no national standard of training exists in New Zealand. Issues involving emergency on-call physiotherapy services appear to be of interest to all those involved.

6 Conclusion

This thesis reports the results of a survey of novice and expert physiotherapists working in the emergency on-call environment. The purpose of the research was to determine if differences existed between emergency on-call physiotherapists with varying levels of on-call experience. To do so participants were divided into novices and experts using combined models presented in the literature review (Benner, 1984; Thomas, 1999). Differences in the results were further examined to determine what factors, if any had influence on them.

Literature has been reviewed which supports the use of questionnaire-based surveys to determine human attitudes and behaviours in social research. It has been determined that surveys provide valuable information when conducted appropriately and that standardised vignettes measure attitudes and beliefs well (Alexander & Becker, 1978; de Vaus, 1995; Helmes & Gee, 2003; Hughes, 1998; Polit et al., 2001). Studies (Bennett & Hartberg, 2005; CSP, 2004; Dixon & Reeve, 2003; Roskell & Cross, 2001; Thomson, 2003; Mottram & Flinn, 1988) have been presented which examine the pressures felt by physiotherapists associated with emergency on-call work and problems with service provision issues are discussed from a number of perspectives (Bott, 2000; CSP, 2004; Gough & Doherty, 2007; Harden et al., 2005; Reeve, 2003). The negative effects of fear and anxiety leading to occupational stress and burnout, particularly in novice physiotherapists, have been considered and reasons for recruitment and retention problems in the cardiorespiratory specialty have been discussed.

Cardiorespiratory-based skills have been demonstrated to be required in the holistic management of patients from numerous specialties and problems remain with maintaining competency within the specialty, particularly for acute on-call work. Studies have been presented which investigate novice and expert practices (Case et al., 2000; Jensen et al., 1990; Thomas, 1999) and links can be drawn with other professional groups noting the evolutionary process of development from novice to expert which appears to be a context-specific process and common to all occupations. Clinical reasoning proficiency has been described as a vital skill in the development of expertise in physiotherapy, and studies have been introduced which have examined different clinical reasoning processes (Carr et al., 1995; Jones et al., 1995).

International solutions to maintaining on-call competency for physiotherapists and reducing their fears and anxieties associated with on-call working are discussed; it is the opinion of the researcher that similar strategies are needed for the New Zealand workforce.

The findings of this study supported predictions made by applying the model of skill acquisition (Benner, 1984) and the Dacum Model of Competence (Thomas, 1999) which showed that within a sample of New Zealand on-call physiotherapists there was a statistically significant difference between novices and experts in their scores for confidence, stress and amount of support required in order to perform emergency on-call duties. A relationship was determined between confidence, stress and the amount of support required. Furthermore, factors were identified which had influence on the level of stress felt by on-call physiotherapists whilst performing emergency duties. As differences between novice and expert decision making through a case study were described, a trend emerged identifying what it was that novices lacked before they could perform as experts. It has been previously found that on-call services can be run without respiratory specialists as long as adequate support networks such as evidence-based guidelines and protocols are provided for novice growth (Ball, 1999). A need has been determined for novices to gain a type of experience which has the facility for independent problem solving and guided reflection; the use of vignette-based case studies may be one method which could be further exploited.

The questionnaire used in this survey is the first investigation to review differences in novice and expert physiotherapists working in the on-call environment and some important findings have been determined which will benefit the profession.

The expert and novice groups in this survey provided similar answers to most of the questions posed in the vignette. It is unknown if this finding is a result of the two groups being similar due to using a time-context definition alone. It may however be a representation of the fact that despite their anxieties to the contrary, novices are better prepared than was predicted.

Case studies have been demonstrated as useful learning tools (Carr et al., 1995; Jones et al., 1995). It is now recommended that this survey questionnaire be used as a learning tool or as a guide for the creation of other case studies pertinent to the

emergency on-call setting. It is of interest to those involved with emergency on-call service provision that some authors question the unrealistic expectation that undergraduate competency training is sufficient for the task (Reeve, 2003; Thomson, 2000), particularly when it is possible for some students to qualify with minimal or no acute respiratory experience (Bott, 2000; CSP, 2004; Roskell & Cross, 2001; Thomas, 1999).

The findings of this study suggest that better opportunities could and should be provided for New Zealand undergraduates to ensure exposure to acute cardiorespiratory scenario in preparation for undertaking on-call work and reducing anxieties associated with it. Opportunities also need to be considered for those returning to work and those who need to maintain a level of competency for on-call duties within a field which is not their specialty. It is proposed that a national standardised programme of emergency on-call training is formed and adopted by the whole on-call community with the ability for it to be managed and governed locally. Audits of staff using the programme would be recommended to determine its efficacy and measures of attitudes and beliefs towards on-call could be revisited and compared with findings from this research. The New Zealand Society of Physiotherapists (NZSP) and the Cardiothoracic Special Interest Group (CTSIG) are best placed to instigate this process. Rather than reinventing the wheel it might be prudent to purchase the programme recently developed in the UK by the ACPRC and CSP (Broad, 2005) and determine its potential use for the New Zealand market.

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Appendices

**Appendix A - Letters to Physiotherapy
Managers or Potential Participants**



Researcher: F Dunford
46 Dixon Street, Oakura 4314,
Taranaki

Julie Reeve
Auckland University of Technology
Private Bag 92006 Auckland 1020

28/08/06

Dear Physiotherapy Manager,

RE: On Call and Emergency duty physiotherapy

Physiotherapists working in the hospital environment are commonly required to undertake emergency on-call duties and are often dealing with complex problems both in isolation and in challenging circumstances where decision making needs to be rapid. The problem of undertaking on-call and emergency duties is becoming increasingly acknowledged by physiotherapy professional bodies and is amongst the most frequent requests for advice received by these bodies (<http://www.acprc.com>).

I am conducting a national postal survey whose aim is to investigate if different levels of experience affect physiotherapists' responses when working in the emergency on-call environment by examining their responses to a vignette-based case study/questionnaire. All units providing emergency on-call physiotherapy are being invited to participate and results from the survey are expected to highlight issues within emergency on-call service provision in an attempt to assist planning for future national research and training. The survey is part of a Master's research thesis, based at Auckland University of Technology, due for completion mid-2007.

The postal survey is expected to take up to one hour. I am seeking survey volunteers who have a mix of experience; both senior and junior staff who are

participating members of your emergency on-call service. It would be particularly valuable if the sample could include the following:

- 1) Senior cardiorespiratory specialist/s
- 2) Senior staff from a different speciality
- 3) Junior staff with varied emergency on-call experience

I would like to contact you by telephone within the next two weeks to determine if you are amenable to your staff being approached and involved in this survey. The information I will be seeking at this time will include how many staff are on your emergency on-call roster and if volunteers from the sample groups are available.

Participation in the survey is entirely voluntary; participants are free to withdraw at any time. I enclose a letter to administer to potential respondents which, with your permission will give notice of the pending research. If you identify staff who are willing to participate I would be grateful if you would supply them with a copy of this letter.

Ethical consent for this research has been gained from the Auckland University of Technology Ethical Committee (AUTEK). If you have any concerns about the conduct of this study please contact the AUTEK ethics coordinator; Madeleine Banda: Phone 09-921 9999 Email: ethics@aut.ac.nz.

Yours sincerely

Fy Dunford, MHSc candidate, AUT

Telephone: (06) 7527921. Email: fydunford@xtra.co.nz

Julie Reeve, MSc, Grad Dip Phys. Principal supervisor, AUT

Telephone: (09) 9219999 ext 7085. Email: julie.reeve@aut.ac.nz

Should you have any immediate concerns or comments about this study, my principal supervisor or I would be happy to talk with you.

Researcher: F Dunford
46 Dixon Street, Oakura 4314,
Taranaki

Julie Reeve
Auckland University of Technology
Private Bag 92006 Auckland 1020

Dear Physiotherapy Colleagues

**Re:Research seeking physiotherapists within the emergency
on-call workforce.**

This letter is to inform you of research into the above subject for which volunteers are required to participate. With your manager's permission I will be posting a vignette-based questionnaire to your department as part of a national survey of NZ physiotherapists undertaking on-call duties. It concerns the experiences of physiotherapists working in the emergency on-call environment, and seeks to determine if different levels of cardiorespiratory and on-call experience affect physiotherapist's attitudes to on-call work and clinical responses to a vignette-based questionnaire. The responses from this survey will be anonymous; information will be released only in summary with all other responses so that no individual is identifiable. I am writing in advance as I am aware that clinicians prefer to know ahead of time that they may be contacted, in order to plan their workload.

The survey is entirely voluntary; you can help the profession considerably by taking part in this research about the on-call environment. Depending on your speed of writing and potential interruptions, the survey is expected to take about an hour. We are seeking volunteers from the following groups:

- 1) Senior cardiorespiratory specialist/s
- 2) Senior staff from a different speciality
- 3) Junior staff with varied emergency on-call experience

If you would like to take part in this research, please tell your physiotherapy manager who will be passing out the questionnaires.

Please note that undertaking a survey may be recognised by the New Zealand Board of Physiotherapists as a work-related recertification activity. A copy of the survey information and consent letter will be made available for participant's portfolios. All data will be held securely; there will be no personally identifiable details on the questionnaires in order to maintain participant anonymity.

Thank you in advance for your time and consideration of taking part in this study. It is only with the help of people such as yourself that this research will be successful.

Yours sincerely

Fy Dunford, MHSc candidate, AUT

Telephone: (06) 7527921. Email: fydunford@xtra.co.nz

Julie Reeve, MSc, Grad Dip Phys. Principal supervisor, AUT

Telephone: (09) 9219999 ext 7085. Email: julie.reeve@aut.ac.nz

If you have any concerns or queries about the survey please contact either Fy or Julie at the above.

Determining differences in emergency on-call physiotherapists' responses in physiotherapists with differing levels of clinical experience.

Thank you for volunteering to be part of this research process. In doing so you are providing valuable information for physiotherapists, enabling us to determine if differences exist between responses of emergency on-call physiotherapists with differing levels of on-call and cardiorespiratory experience. The aim of the study is to determine what, if any differences exist in order to develop both national and international strategies to meet the needs of physiotherapists undertaking on-call and emergency work.

This questionnaire is anonymous. All data will be kept confidential. The research is in two parts:-

1. A short series of questions to ascertain your experience and thoughts about being on-call.
2. A vignette-based questionnaire which asks you to consider how you would respond to a particular on-call situation.

Your participation in this study is voluntary. You are free to refuse to answer any questions and you are free to withdraw at any time. Your response is entirely confidential (within the limits of the law) and there will be no attempt made, at any stage to identify you or your hospital, other than by your level of experience. The survey is part of a master's research thesis due for completion late 2007. Data collected will be securely stored at AUT for 6 years and accessible only to the researchers. Results from this survey will be available from Fy Dunford following data analysis and it is anticipated that these will be published in an appropriate journal.

Ethical consent for this research has been gained from the Auckland University of Technology Ethics Committee (AUTECH). AUTECH Reference Number: 06/165 Date: 11/08/06

If you have any concerns about the conduct of this study, you can contact the AUTECH ethics coordinator;

Madeleine Banda: Phone (09) 921 9999 ext: 8860 Email: ethics@aut.ac.nz

Consent is implied by the returning of a completed questionnaire in the stamped addressed envelope provided.

If you do not wish to participate in the research process please return your blank questionnaire.

All questionnaires need to be returned by:

A copy of this introduction statement is available for your professional portfolio. Please note that undertaking a survey may be recognised by the New Zealand Board of Physiotherapists as a work-related recertification activity.

We would be happy to answer any further questions you may have when all questionnaires have been returned.

This will assist in maintaining a standardised environment and avoid influencing the responses of others. We thank you in advance for your time and consideration.

Fy Dunford, PGDip HSc. (Cardiorespiratory). Grad Dip Phys. MSc. Research Candidate.

Julie Reeve, MSc., Grad Dip Phys. Senior Lecturer Auckland University of Technology. julie.reeve@aut.ac.nz

Survey Instructions.

- For the purpose of this survey the following definitions apply:

'Weekend on-call work' = being on-call during the weekend, following a pre-arranged rostered plan of service provision.

'Emergency on-call work' = being on-call and being called back in to a critically unwell patient.

- Dependent upon your preferred writing speed and potential interruptions this survey is anticipated to take up to an hour to complete; please aim to find sufficient time to complete it all *in one attempt* and answer the questions *in the order in which they appear.*
- Leave anything that you can't complete. We are interested in your opinions and choices; as such please do not use any other resources such as text books, internet, articles or discussions with colleagues.
- Please time how long it takes you to complete this survey and write your time in the space provided on the last page of the survey.

- **Write your start time here** _____

PART ONE

The following questions concern information about you to ascertain your level of experience and thoughts about undertaking on-call duties.

1. What *undergraduate* physiotherapy qualification do you hold and in which country was it gained? (i.e. Grad Dip Phys; BHSc)

_____ Qualification _____ Country

2. What year did you gain your undergraduate physiotherapy qualification?

_____ Year gained

3. Which of the following statements best describes your cardiorespiratory experience? (Tick only one)

	Options	Tick one
a	I work solely in the cardiorespiratory speciality at a senior level.	<input type="checkbox"/>
b	I have had two or more cardiorespiratory placements experience. I now work in a non-cardiorespiratory speciality at a senior level.	<input type="checkbox"/>
c	I have had one cardiorespiratory placement experience. I now work in a non-cardiorespiratory speciality at a senior level.	<input type="checkbox"/>
d	I have had no cardiorespiratory placement experience. I now work in a non-cardiorespiratory speciality at a senior level.	<input type="checkbox"/>
e	I have had two or more cardiorespiratory placements experience. I now work on rotation at a junior level.	<input type="checkbox"/>
f	I have had one cardiorespiratory placement experience. I now work on rotation at a junior level.	<input type="checkbox"/>
g	I have had no cardiorespiratory placement experience. I now work on rotation at a junior level.	<input type="checkbox"/>
h	Other, please state _____ _____	<input type="checkbox"/>

4. How many years have you undertaken *emergency* and weekend on-call duties? This includes all on-call years of your physiotherapy career. (Tick one)

- | | |
|--|---|
| <input type="checkbox"/> Not more than 1 year | <input type="checkbox"/> Not more than 10 years |
| <input type="checkbox"/> Not more than 2 years | <input type="checkbox"/> Not more than 15 years |
| <input type="checkbox"/> Not more than 5 years | <input type="checkbox"/> Over 15 years |

5. How often are you currently rostered to provide an *emergency* on-call service? (Tick one)

- | | |
|--|---|
| <input type="checkbox"/> 1 shift per week | <input type="checkbox"/> 1 shift per month |
| <input type="checkbox"/> Less than 1 shift per month | <input type="checkbox"/> More than 1 shift per month but less than 1 per week |
| <input type="checkbox"/> Other – please state _____ | |

6. What was the date of the last *emergency* on-call that you undertook? (i.e. when you were actually called in to perform physiotherapy) _____

7. In which of the following areas are you expected to provide an *emergency* on-call service? (*Tick all that apply*)

- | | | |
|---------------------------------------|---|--------------------------------------|
| <input type="checkbox"/> ICU/HDU | <input type="checkbox"/> Medical | <input type="checkbox"/> Surgical |
| <input type="checkbox"/> Orthopaedics | <input type="checkbox"/> Neurology | <input type="checkbox"/> Paediatrics |
| <input type="checkbox"/> Elderly care | <input type="checkbox"/> Other – please state _____ | |

8. Confidence in the *emergency* on-call environment can be described as having a feeling of certainty about your own assessment, treatment and analysis abilities.

How confident are you in performing *emergency* on-call duties? (*Please tick one*)

- | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Not confident at all | | | | | Always confident |
| 1 | 2 | 3 | 4 | 5 | 6 |
| <input type="checkbox"/> |

9. Support in the *emergency* on-call environment can be described as requiring peer or senior assistance to analyse a presenting problem; to receive guidance in deciding on treatment options and determining outcomes.

How much support do you need to provide *emergency* on-call duties? (*Please tick one*)

- | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| No support required | | | | | Maximal support required |
| 1 | 2 | 3 | 4 | 5 | 6 |
| <input type="checkbox"/> |

10. Feeling stressed in the *emergency* on-call environment could be described as having raised anxiety levels, feeling in difficulty, feeling taxed and tense, finding the situation tiring, traumatic or worrying.

Do you find *emergency* on-call work stressful? (*Please tick one*)

- | | | | | | |
|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Never stressful | | | | | Stressful at all times |
| 1 | 2 | 3 | 4 | 5 | 6 |
| <input type="checkbox"/> |

11. How do the following situations influence your stress levels when performing *emergency* on-call duties?

<u>Situation</u>	No change to my stress levels					Increases my stress levels maximally
	1	2	3	4	5	
a Working in isolation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Higher complexity of <i>emergency</i> on-call cases	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Working outside of familiar speciality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Being called out to Intensive Care or other critical areas	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Other-please state _____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. Have you attended a cardiorespiratory – related course within the last 2 years, (other than during undergraduate training)?

YES/NO (circle one)

If Yes, please state the course name and who delivered this course below.

PART TWO

Reminder – your responses are entirely anonymous; there are NO personally identifying features contained in these forms.

In order to simulate a ‘real case scenario’ please remember to:-

- 1) Answer the questions in the order that they appear
- 2) Use no other resources to help you fill this in
- 3) Answer this in one sitting
- 4) Continue to time how long it takes you and document this on the last page
- 5) Use additional pages if necessary to complete your answers

Sandra, a 38 year old postal worker presented to her GP this morning, complaining of a persistent cough, general fatigue and backache. She was immediately referred to the Accident and Emergency department (A&E) with suspected Guillain-Barre Syndrome (GBS) and was admitted to the high dependency unit (HDU). In addition Sandra has had a lower respiratory tract infection for the past two weeks, which developed after having had her usual ‘flu’ vaccination. Sandra has never smoked and is usually in good health. She is married and has two pre-school age children. Sandra’s past medical history is minimal; she has only a history of a DVT in 2003 following the birth of her second child. She is not on any regular medication.

As a consequence of Sandra’s admission to the HDU with suspected GBS, she is referred to you. It is 6pm and the staff nurse has contacted you following the medical registrars’ rounds – they have asked for your input.

Upon your arrival, Sandra is sitting up in bed and holding a conversation with her husband. Sandra tells you that her main concerns are her tiredness and backache; she is finding that her feet are feeling a little numb from being in bed all day.

13. As the on-call physiotherapist, what is your primary concern about Sandra at this time? (*State briefly here*)

Sandra’s observations are:-

Respiratory Rate (RR) 16

Pulse Rate (PR) 112

Blood Pressure (BP) 123/80

Temperature 38.3° C oral

SpO₂ 94% on 4litres/min via a simple oxygen mask

A **cough** is present; Sandra can clear small amounts of creamy secretions with effort, finding that her persistent cough irritates her sore back.

Function – Sandra is able to transfer herself to a chair independently.

14. Analyse these observations which are listed below and indicate your concern about them. (Please circle the most appropriate description for each specific observation in brackets and then circle either yes or no in the box provided to indicate your concern).

Circle the most appropriate description for each observation listed below					Are you concerned about this result? Please circle		
a	RR	(Raised)	(Lowered)	(Normal)	(Unsure)	Yes	No
b	PR	(Raised)	(Lowered)	(Normal)	(Unsure)	Yes	No
c	BP	(Raised)	(Lowered)	(Normal)	(Unsure)	Yes	No
d	Temp	(Raised)	(Lowered)	(Normal)	(Unsure)	Yes	No
e	SpO₂	(Raised)	(Lowered)	(Normal)	(Unsure)	Yes	No
f	Cough	(Effective)	(Semi- effective)	(Poor)	(Unsure)	Yes	No
g	Function	(Independent)	(Semi-dependent)	(Dependent)	(Unsure)	Yes	No

Auscultation: Reduced breath sounds with fine crackles are audible on end inspiration bibasally; right more than left lower lobe.

15. What does this auscultation result tell you? (Tick all that apply)

Options	Tick
a Atelectasis is present bi-basally	<input type="checkbox"/>
b There is a pneumothorax	<input type="checkbox"/>
c Pleural effusions are present	<input type="checkbox"/>
d Consolidation is present bibasally	<input type="checkbox"/>

Peak Expiratory Flow Rate (PEFR), 3 attempts performed in A&E, in sitting:-

i. 340 L/min

ii. 370 L/min

iii. 360 L/min.

Sandra is 180cm in height and weighs 88kg; the predicted PEFR for these parameters is 480L/min (SD 67L/min).

16. How concerned are you about this PEFR result? (Tick one only).

Options	Tick one
a Extremely concerned given the diagnosis	<input type="checkbox"/>
b Concerned but I would expect this in GBS	<input type="checkbox"/>
c Mildly concerned, I would expect this in GBS	<input type="checkbox"/>
d Not at all concerned, I would expect this in GBS	<input type="checkbox"/>

Arterial Blood Gases (ABGs) taken on 4litres/min via a simple oxygen mask:-

PH 7.35

PaCO₂ 46mmHg/6 KPa

PaO₂ 65mmHg/8.7KPa

HCO₃ 26 mmol/l

17.

a) How are the above ABG factors altered from normal values? (Circle the most appropriate description contained in brackets)

PH	(Raised)	(Normal)	(Lowered)	(Unsure)
PaCO ₂	(Raised)	(Normal)	(Lowered)	(Unsure)
PaO ₂	(Raised)	(Normal)	(Lowered)	(Unsure)
HCO ₃	(Raised)	(Normal)	(Lowered)	(Unsure)

b) What is your clinical interpretation of this result? (State briefly here)

18.

a) Examine this chest X-Ray and name any pathological changes that you believe are relevant.



b) What is your clinical interpretation of this X-Ray? (State briefly here)

A Spinal tap has confirmed GBS; Intragram therapy has been started.

19. From the descriptions so far, list up to 4 physiotherapy problems here in order of priority with 1 being the most important, 2 being the second most important and so on.

20. From the list below, which treatment strategies would you choose to use **at this time** for the problems you have listed above in question 19? (Tick all that apply for each problem)

Treatment Method		1	2	3	4
a Active mobilisation/walking	a	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Deep breathing exercises	b	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Active huffing	c	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Active coughing	d	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Manual techniques (percussions and vibrations)	e	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f Intermittent positive pressure breathing (IPPB) e.g. Bird	f	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g Non-invasive positive pressure ventilation (NIV)	g	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h Continuous positive airway pressure (CPAP)	h	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i Positioning to assist ventilation	i	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j Gravity assisted drainage (head down tilt)	j	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k Modified gravity assisted drainage (excludes head down tilt)	k	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
l Bronchodilation therapy	l	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
m PEP therapy (includes oscillating PEP devices)	m	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
n Other-please state _____	n	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
o Other-please state _____	o	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

21. Are you aware of any evidence within the literature that would support your treatment choices? (Please include names of authors; titles of works and dates of publication if able to)

22. What is the most important clinical indicator that you would use to evaluate change in Sandra's condition following your treatment? (State one indicator only)

It is now 2am; the medical registrar is calling you again.

Over the phone the registrar tells you that after your last treatment session Sandra's S_pO_2 remained stable at 93-94% with a **RR** of 12-16. However in the last hour her breathing has appeared more laboured and her S_pO_2 is now 89% with a **RR** of 25.

Sandra's cough sounds moist to the registrar and he notes that small amounts of light green sputum have been expectorated over the course of the evening. He has increased her oxygen to 7L via the simple oxygen mask and requested a portable X-ray.

Sandra's **ABGs** on 7 litres/min of O₂ via a simple oxygen mask are:-
PH 7.32
PaCO₂ 50mmHg/6.6KPa
PaO₂ 59mmHg/7.9KPa
HCO₃ 28mmol/l

23.

a) How are the above ABG factors altered? (Circle the most appropriate description contained in brackets)

PH	(Raised)	(Normal)	(Lowered)	(Unsure)
PaCO2	(Raised)	(Normal)	(Lowered)	(Unsure)
PaO2	(Raised)	(Normal)	(Lowered)	(Unsure)
HCO3	(Raised)	(Normal)	(Lowered)	(Unsure)

b) What is your clinical interpretation of this result? (State briefly here)

24. How concerned are you about this result? (Tick one only).

Options	Tick one
a Extremely concerned but I would expect this in GBS	<input type="checkbox"/>
b Extremely concerned as there are signs of respiratory failure	<input type="checkbox"/>
c Mildly concerned, I would expect this in GBS	<input type="checkbox"/>
d Not at all concerned, I would expect this in GBS	<input type="checkbox"/>

25. How appropriately is Sandra's oxygen therapy managed? (Tick one only)

Options	Tick one
a Well managed, there is an appropriate device and flow rate	<input type="checkbox"/>
b Adequately managed, there is an appropriate device but it requires a greater flow rate	<input type="checkbox"/>
c Adequately managed, there is an appropriate flow rate but the device should be changed	<input type="checkbox"/>
d Poorly managed, the device and flow rate require changing	<input type="checkbox"/>
e Poorly managed, there is an appropriate device but the flow rate requires changing	<input type="checkbox"/>

Assuming you have made the decision to return

Sandra has complained of feeling 'chesty' and is having difficulty expectorating.

You find that Sandra is awake, responsive but tired, warm, moist to touch and looks flushed. Sandra says she has had a few hours sleep but kept waking due to a combination of noise and her irritating cough. Sandra is complaining of a sore (R) side and back, which is worse when she coughs, she is talking quietly and her cough is ineffective.

She is in bed, semi-recumbent at 30° propped up by pillows. With the help of the nurse, you assist Sandra to sit forward to auscultate and find that her pillows and sheets are damp. Sandra complains of dyspnoea with the forward movement and is uncomfortable.

26. From the above comments name **up to 4 factors** which are impacting on Sandra's ability to clear sputum where **1** is the most important and **4** is the least important.

27. What do you believe to be the most likely cause of Sandra's pain? *(Please rank the causes if you consider there to be more than one cause with 1 being the most likely cause)*

Her observations on 7L of oxygen via a simple face mask are:

S_pO₂ 90% **RR** 26 **BP** 130/95 **PR** 132 **Temperature** 38.8°C via oral thermometer

As you auscultate you notice a further increase in her breathing rate to 35. There is a noticeable increase in muscular activity of the sternomastoids and scalenes; Sandra wriggles to brace herself against the mattress. There are palpable upper respiratory crackles when Sandra coughs.

28. What does Sandra's S_pO₂ level indicate to you? *(Tick all that apply)*

Options		Tick	
a	Her haemoglobin levels are reduced	a	<input type="checkbox"/>
b	Her oxygen carrying capacity is reduced because she is low in haemoglobin	b	<input type="checkbox"/>
c	Her oxygen carrying capacity is reduced because her haemoglobin is poorly saturated	c	<input type="checkbox"/>
d	She is hypoxaemic	d	<input type="checkbox"/>
e	She is hypoxic	e	<input type="checkbox"/>
f	Her oxygen extraction is poor at tissue level	f	<input type="checkbox"/>
g	She is poorly peripherally perfused	g	<input type="checkbox"/>

29. What does Sandra's respiratory rate and pattern indicate to you? *(Tick all that apply)*

Options		Tick	
a	Despite an increased RR her work of breathing is unaltered she is just anxious	a	<input type="checkbox"/>
b	Despite an increased RR her work of breathing is unaltered she is just tired	b	<input type="checkbox"/>
c	Her work of breathing is increased due to sputum retention	c	<input type="checkbox"/>
d	Her work of breathing is increased due to respiratory muscle weakness	d	<input type="checkbox"/>
e	Her work of breathing is increased due to metabolic changes	e	<input type="checkbox"/>
f	Her work of breathing is increased but it is not critical	f	<input type="checkbox"/>
g	Her work of breathing is becoming critical	g	<input type="checkbox"/>

O/A Bronchial breath sounds right mid and basal zones. Coarse crackles are audible on deeper breaths and with coughing.

30. What does this auscultation result tell you? (*Tick only 1 response*)

Options	Tick one
a Consolidation is present on the right side	a <input type="checkbox"/>
b There is pulmonary oedema	b <input type="checkbox"/>
c The upper airways are constricted	c <input type="checkbox"/>
d There is airway obstruction caused by secretions	d <input type="checkbox"/>
e There is fibrous scarring on the right side	e <input type="checkbox"/>
f There is a pleural effusion on the right side	f <input type="checkbox"/>

31.

a) Examine this portable chest X-Ray and name any pathological changes that you believe are relevant.



b) What is your clinical interpretation of this X-Ray? (*State briefly here*)

Pulmonary Function Tests have been performed at 8pm at the bedside, propped up in sitting. The expiratory flow result shows a smooth curve and the results were:

- Vital Capacity (VC)** 1.7L (**predicted normal (P/N)** = 3.73L)
- Forced Expiratory Volume in 1 Second (FEV1)** 1.80L (**P/N** = 3.15L)
- Forced Vital Capacity (FVC)** 2.15L (**P/N** = 3.65L)
- PEFR** 230ml (**P/N** = 480ml)

Sandra was able to fully complete the test without distress but found it a challenge, the notation by the result states that she tolerated the nose peg but struggled with forming a good seal on the mouthpiece.

32. What is your analysis of the lung function test results? (*Tick all that apply*)

a Obstructive pattern	<input type="checkbox"/>	e Poor technique	<input type="checkbox"/>
b Restrictive pattern	<input type="checkbox"/>	f Copious secretions present	<input type="checkbox"/>
c Combined a + b pattern	<input type="checkbox"/>	g Respiratory muscle weakness	<input type="checkbox"/>
d Poor effort	<input type="checkbox"/>	h No change from admission	<input type="checkbox"/>

33. What is the most important physiotherapy problem now? (*State problem here*)

34. What specific physiotherapeutic treatment methods would you use for this problem with Sandra tonight? (Tick no more than 3 options)

Treatment Method		Tick	
a	Active mobilisation/walking	a	<input type="checkbox"/>
b	Deep breathing exercises	b	<input type="checkbox"/>
c	Active huffing	c	<input type="checkbox"/>
d	Active coughing	d	<input type="checkbox"/>
e	Manual techniques (percussions and vibrations)	e	<input type="checkbox"/>
f	Intermittent positive pressure breathing (IPPB) e.g. Bird	f	<input type="checkbox"/>
g	Non-invasive positive pressure ventilation (NIV)	g	<input type="checkbox"/>
h	Continuous positive airway pressure (CPAP)	h	<input type="checkbox"/>
i	Positioning to assist ventilation	i	<input type="checkbox"/>
j	Gravity assisted drainage (head down tilt)	j	<input type="checkbox"/>
k	Modified gravity assisted drainage (excludes head down tilt)	k	<input type="checkbox"/>
l	Bronchodilation therapy	l	<input type="checkbox"/>
m	PEP therapy (includes oscillating PEP devices)	m	<input type="checkbox"/>
n	Suction	n	<input type="checkbox"/>
o	Other-please state _____	o	<input type="checkbox"/>

35. Do you know of any evidence in the literature which supports your treatment choice? (Include names of authors, titles of work and dates of publication if able)

- **This concludes Part Two; please write the time here** _____

- How long has it taken you to complete this questionnaire? _____

- Please check you have answered all the questions.

- There is a comments box below- feel free to make comments before you return this questionnaire.

- **Place your questionnaire into the self-addressed envelope supplied, seal it and post today.**

Thank you

Appendix C - The Case

Patients with respiratory muscle weakness present with a variety of symptoms which require early acknowledgement, careful monitoring and swift and appropriate management to avoid further deterioration (Hough, 2001; Pryor & Prasad, 2002). Guillain-Barré Syndrome (GBS) is the most common cause of acute paralysis of the respiratory muscles; the presentation is often preceded by a bacterial infection in 66% of cases or a viral infection in 22% of cases (Laghi & Tobin, 2003) and affects 2:100,000 people per year worldwide (Foster & Mulroy, 2004). Meythaler (1997) notes flu-like upper respiratory tract infections are the most common preceding illnesses occurring two to four weeks prior to presentation of GBS symptoms. GBS is one of a group of neurological diseases which includes fatigue as an essential symptom; fatigue of the respiratory muscles, if ignored, can have devastating consequences (Féasson, Camdessanché, Mhandi, Calmels & Millet, 2006).

Laghi and Tobin (2003) note that GBS accounts for more than half of the patients with a primary neuromuscular disease who are admitted to an intensive care unit and can take just a few hours to deteriorate and progress to respiratory failure. Meythaler (1997) reports that a classically acute onset of GBS can deteriorate from normal to ventilated within two or three days; respiratory failure being the most serious short-term complication which requires invasive mechanical ventilation in 20-30% of patients (Durand et al., 2006). As the course of GBS is variable, most patients are admitted to a high dependency area and monitored closely for signs of deterioration. Laghi and Tobin state approximately 33% of cases of GBS are ventilated secondary to ventilatory failure or loss of bulbar function. Durand et al. (2006) suggest early predictors for mechanical ventilation are a time between onset and hospital admission of less than seven days; inefficient cough; inability to clear bronchial secretions despite vigorous chest physiotherapy; severe bulbar dysfunction; and the presence of atelectasis.

A case was presented of a patient with suspected GBS (see page 6, Appendix B) who progressively deteriorates from admission to a critical state and participants were asked a series of questions relating to various stages. Initial primary concerns for this case were the need to monitor for respiratory muscle weakness which could impact upon respiratory functions, and to manage the reduced mucociliary clearance

occurring from an unresolved chest infection and developing respiratory muscle weakness. A series of observations were provided (see page 6, Appendix B) and participants were required to analyse them and indicate if they would be concerned about them.

A normal pulse rate is considered to be 60-100 bpm (beats per minute) and a rate beyond 100bpm is referred to as tachycardia (Pryor & Prasad, 2002). In this case the pulse rate of 112 bpm reflected the patient's response to fever, lowered oxygen levels, infection, pain and anxiety and was sufficiently high to be of concern. A fever is considered the main harbinger of infection; a normal temperature range is 36.5–37.5°C and a fever is considered above 37.5°C. Fever may be accompanied by an increased respiratory rate and pulse rate as excess heat raises metabolic rate and oxygen consumption so that for every 1°C rise in temperature there is a 10% elevation in metabolism and oxygen consumption (Hough, 2001). The temperature reading in this case was 38.3°C which was sufficiently high to indicate a fever and therefore to be of concern.

The oxygen saturation measure records the extent to which haemoglobin in arterial blood is saturated with oxygen and normal levels are 95-98% on air (Hough, 2001). In this patient the measure of 94% on supplemental oxygen (4 litres oxygen per minute via a simple oxygen mask) would be considered low and of concern.

Coughing is a strong physiological reflex which serves to clear secretions and is less efficient when lung volumes are compromised (Hough, 2001). This patient had a semi-effective cough which in the presence of a recent chest infection and fatigue was of concern.

Auscultation findings were presented (see page 7, Appendix B) which indicated that atelectasis or microscopic lung collapse was present bi-basally, commonly reported in neuromuscular disease (85%) and a clear indication for physiotherapeutic intervention Hough, (2001).

A peak flow measurement (PEFR) was provided (see question 16, Appendix B); this measure provides a quick and simple indication of airway obstruction. The technique requires full patient cooperation, with a handheld device utilised to record the best of

three forceful exhalations, ideally performed in standing. The limitations of the device include being effort-dependent, being sensitive to resistance primarily in the larger airways, and the device having varying reliability at middle to high flows (Hough, 2001). PEFr measures are often performed as part of an early assessment and can be used for the ongoing monitoring of suspected airway obstruction such as that involved with a chest infection. The test was performed in the A&E area which could have been distracting and testing was performed in sitting, a position which could have affected the result.

The use of PEFr for assessment of respiratory muscle weakness is questionable. McGillicuddy, Walker, Shapiro, and Edlow (2006) recommend comparing maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) measures. MIP, MEP and 'sniff test' measures are recommended by Clanton and Diaz (1995) as being more relevant measures of respiratory muscle weakness. While there does not appear to be a standardised test, many authors recommend vital capacity be measured using a vitalograph (Durand et al., 2006; Hough, 2001; Pryor & Prasad, 2002).

Arterial blood gas (ABG) measurements indicate a patient's ventilatory, gas exchange and acid-base status. ABG interpretation should be related to the clinical state of the patient and the level of inspired oxygen (Pryor & Prasad, 2002). Relevant factors in this case which caused a mismatch in ventilation and perfusion (V/Q) were retained secretions, atelectasis, poor positioning and inadequate oxygen delivery. Participants were presented with a blood gas result (see question 17, Appendix B) which indicated hypoxaemia or a low partial pressure of oxygen (P_aO_2), a PH at the lower end of normal with a borderline high partial pressure of carbon dioxide (P_aCO_2). Responses were coded as correct if 'low P_aO_2 with a borderline high P_aCO_2 level' and 'pending respiratory acidosis and /or type I respiratory failure' was stated; partially correct if one or the other were present or incorrect if none were present.

Participants were provided with an X-ray which demonstrated patchy infiltrations at the right middle lobe, an unclear right heart border and loss of right costophrenic angle with no volume loss (see question 18, Appendix B). This X-ray was to be interpreted as a right middle lobe consolidation (Harden, 2004; Hough, 2001; Pryor & Prasad, 2002). Responses were coded as correct if 'right middle lobe consolidation' was stated; partially correct if 'right middle lobe consolidation' was stated alongside other

pathologies which were not present in the X-ray and incorrect if ‘right middle lobe consolidation’ was not stated at all.

The case was formerly diagnosed as GBS (see page 8, Appendix B). Early clinical features in this case of paraesthesia, fatigue and backache had been described and major clinical manifestations of limb weakness and changes to respiratory function had been presented. Having established the primary problems of ‘hypoxia; poor gas exchange’ and ‘poor cough with retained secretions’, participants were required to select what treatment options they would utilise to treat the problems (see question 20, Appendix B).

A huff is a forced expiratory manoeuvre of mid to low lung volumes performed with an open glottis. Whilst less strong than coughing, a huff has the advantage of increased patient control to balance dynamic airway collapse against expiratory force (Lapin, 2002). Holland and Button (2005) suggest vigilance to avoid dynamic airway collapse with forced expiratory techniques indicated by non-productive huffing and the presence of an expiratory wheeze. Huffing would be an appropriate treatment for this case in the initial stages as an inability to alter the expiratory force such as that found in respiratory muscle weakness with reduced lung volumes and altered mucus rheology will affect mucociliary clearance and secretions will become retained (van der Schans, 1997).

Active coughing promotes mucociliary transport and clearance (Dean & Frownfelter, 1996; Hough, 2001; Pryor & Prasad, 2002); Dean and Frownfelter also advise that care is required to avoid arterial desaturation, dynamic airway compression, atelectasis, and further fatigue from persistent vigorous coughing. High expiratory airflows and therefore large lung volumes and forceful expirations are required to produce forces sufficient to cause mucus shearing (Rubin, 2002). Initially, the patient had sufficient lung volumes for an effective cough but careful instruction and monitoring would be required to prevent the deleterious effects of forced expiratory techniques.

Deep breathing exercises augment alveolar ventilation and minimise alveolar collapse and atelectasis. Techniques can be taught which optimise accessory muscle use, stabilise the chest wall and reduce abdominal visceral encroachment on the diaphragm

which reduce the work of breathing (Dean & Frownfelter, 1996; Hough, 2001; Pryor & Prasad, 2002). Deep breathing exercises would be appropriate for a compliant and capable patient.

Optimal positioning increases the distribution of ventilation and perfusion in the lung which maximises gaseous exchange; positioning can diminish the work of breathing, thus reducing oxygen demand (Hough, 2001; Pryor & Prasad, 2002). Positioning to promote gas exchange would also be appropriate in this case.

The treatment of manual techniques includes percussion and vibrations which deliver an oscillatory force to the airways in an attempt to shear secretions from the chest wall, techniques recommended by Hough (2001) in patients who are exhausted or weakened by their condition. There is a dearth of high level evidence to support any particular secretion clearance method; manual techniques have not shown significant improvement in mucociliary clearance when performed independent of gravity assisted drainage (Fink, 2002; Pryor, 2006; Rubin, 2002).

Traditional postural drainage has been shown to improve secretion mobilisation in high mucus-producing conditions such as cystic fibrosis, particularly when combined with percussion, vibration and breathing techniques (Fink, 2002; Pryor, 2006). For these conditions, when mucociliary clearance is impaired, gravitational effects are more important (Fink, 2002; Houtmeyers, Gosselink, Gayen-Ramirez, and Decramer, 1999). Traditional postural drainage involving head down tilting impacts haemodynamically and should be avoided in patients with unstable blood pressure. The shifting of abdominal and thoracic viscera may also have deleterious effects and if an airway is not protected can cause aspiration (Fink, 2002; Rubin, 2002). Holland and Button (2005) determined that the head down tilting position has been associated with a 30% reduction in functional reserve capacity (FRC) and has been shown to cause gastroesophageal reflux (GOR) in subjects with normal lungs. They also found that in patients with obstructive disorders head down tilting has increased the work of breathing and worsened dyspnoea, but side lying without head down tilting has reduced dyspnoea in patients with large volumes of secretions (Holland & Button, 2005).

Gastroesophageal reflux can lead to respiratory dysfunction where microaspiration of highly acidic gastric contents causes bronchoconstriction from an inflammatory mediator response (Rubin, 2002; Hough, 2001). Traditional postural drainage positions have also been shown to cause desaturation of oxygen levels, headaches and sinus pain and have a history of poor adherence (Holland & Button, 2005). For the reasons discussed the head down tilt postural drainage position would not be appropriate for this patient who had low lung volumes and a potential for autonomic disturbances and bulbar instability.

Intermittent positive pressure breathing (IPPB) has been used acutely to augment tidal volumes and improve cough effectiveness and therefore sputum clearance for patients with low lung volumes from many conditions including neuromuscular diseases (Denehy & Berney, 2001). The use has declined over the past 20 years, studies involving IPPB have been inconclusive and there has been an increase in available positive pressure options. IPPB has limitations: spontaneously breathing patients need to be cognisant of the treatment and able to fully cooperate by triggering the unit on inspiration by creating sufficient inspiratory pressure which becomes less likely as respiratory muscle weakness progresses. Improved tidal volumes, effective cough, improved arterial blood gases and reduced work of breathing have been demonstrated but no significant difference has been shown between IPPB and other active chest techniques. Denehy and Berney suggest that for breathless patients with excess secretions, IPPB could reduce the work of breathing sufficiently to provide respiratory muscle rest and support a stronger cough. In patients with respiratory failure, however, IPPB will not ventilate effectively and non-invasive ventilation (NIV) is more appropriate.

Continuous positive airway pressure (CPAP) has been used to supplement low lung volumes, the effects including a pneumatic splinting of alveoli and airways which increase the functional reserve capacity (FRC) and reduce work of breathing. The increased collateral ventilation caused by the splinting process assists sputum clearance. The use of CPAP in the presence of hypercapnia and hypoventilation is inappropriate as CPAP will not augment tidal volumes and is contraindicated in patients with haemodynamic instability as it causes increased mean intrathoracic pressures which can reduce venous return and cardiac output (Denehy & Berney, 2001).

NIV combines the beneficial effects of IPPB and CPAP; there is evidence to support its use in neuromuscular disease. Often used to avert intubation, it will correct hypoxaemia without worsening hypercapnia in acute respiratory failure. NIV is indicated for patients with GBS who are hypoxic and hypercapnic at night (Meythaler, 1997). NIV provides both an inspiratory and expiratory pressure which increases tidal volume and FRC; it will improve gaseous exchange, maximise respiratory muscle rest and reduce work of breathing. Although studies have shown a clear positive effect of NIV in respiratory failure, Denehy & Berney (2001) suggest its use is a matter of clinical judgment made with a sound physiological knowledge base and an awareness of the latest research.

Active mobilisation elicits an exercise stimulus which improves alveolar ventilation and mucociliary clearance, enhances oxygen transport, and counters the effects of immobility (Dean & Frownfelter, 1996). Factors to consider are autonomic disturbances which in more severe cases of GBS are indicated by orthostatic hypotension, fluctuations in pulse rate or blood pressure and a loss of bladder and bowel function; Meythaler (1997) notes that autonomic dysfunction is related to the need for mechanical ventilation. In the early stages of GBS, for patients where skeletal muscle weakness is evident, or the disease nadir (peak) has yet to be reached, avoidance of fatigue is essential to prevent respiratory failure (Foster & Mulroy, 2004; Meythaler, 1997). Once weakened, a muscle requires rest to reverse the fatigue but since respiratory muscles are unable to rest, any activity should be brief to reduce fatigue. Movements should be precise, supported and preceded with medication if painful (Hough, 2001). GBS has been associated with respiratory muscle injury where weakness and fatigue perpetuate which contribute to respiratory muscle dysfunction and injury (Reid, Clarke & Wallace, 2001). In the early stages of GBS once respiratory muscle weakness signs are evident but the disease nadir and rate of decline are unknown, it would be appropriate to consider active mobilisation with extreme caution, where the physiological costs of activity are weighed against the potential benefits.

Bronchodilation therapy is used to decrease bronchospasm in patients with airflow limitation which is demonstrated by a reduction in lung volumes such as the forced expiratory volume in one second (FEV_1), FEV_1 /forced vital capacity (FVC ratio), PEF and forced expiratory flow over the middle half of the FVC, (FEF_{25-75}) (Hough,

2001; Pryor & Prasad, 2002). This patient had an ineffective cough and decreased mucociliary clearance secondary to poor lung volumes but at this stage no bronchospasm was evident.

Positive expiratory pressure (PEP) therapy involves using a hand-held device creating a 10-20cm H₂O resistance force on exhalation which promotes lung volumes and facilitates secretion removal; lung volumes of slightly more than tidal volume are required. Forced expiratory techniques (huffing and coughing) are encouraged to clear secretions between periods of PEP use. Available literature suggests that PEP adjuncts are as effective as other sputum clearance techniques and their use is largely determined by patient preference (Elkins, Jones & van der Schans, 2006; Holland & Button, 2005; Patterson, Bradley, Hewitt, Bradbury & Elborn, 2005; Pryor, 2006). Oscillating PEP transfers a vibratory pressure to the airway wall causing a shear force on mucus collections altering the cohesive and viscoelastic properties. Devices are tuned to resonate with ciliary beat frequencies (15Hz) using a tilting procedure which enhances sputum clearance. Devices such as the Acapella[®] are available for debilitated patients with reduced airflows (<15L/min) and there is evidence (Patterson et al.) to support Acapella[®] use over techniques such as percussion and vibration for patients who find oscillation forces helpful in clearing secretions yet prefer to be independent in doing so. PEP therapy for this patient may have been effective if the patient was able to hold (and form a good lip seal around) the device or to supply enough force to hold a mask tightly to the face. This patient would require optimal positioning to reduce work of breathing by supporting accessory muscles and to avoid further back pain whilst using the equipment if PEP therapy were to be utilised.

Humidification is an essential part of supplemental oxygen therapy in order to maintain normal ciliary activity and efficient mucociliary transport. In the presence of infection and dehydration the viscosity of mucus increases and normal mucociliary clearance is disrupted; mucus stagnation will cause further infection and reduce gaseous exchange (Hough, 2001; Pryor & Prasad, 2002). This patient was hypoxaemic and required supplemental oxygen which should have been delivered by an appropriate system incorporating humidification: the delivery of humidified, supplemental oxygen would be considered a priority.

Pain compromises function and functional work capacity and is often a prominent feature of GBS often presenting as bilateral sciatica or aching felt in the thigh and back (Meythaler, 1997). Foster and Mulroy (2004) suggest avoiding exercising painful, weak and denervated muscles in GBS as this will further damage the motor unit and delay recovery. At this stage the patient had complained of worsening backache since admission which was associated with the early clinical features of GBS (Meythaler, 1997). Medication would have been appropriate and this would normally have been managed by the medical team.

Bed exercises serve to minimise the effects of immobility. Deep vein thromboses, joint contractures and stiff, sore muscle bellies are common clinical features in GBS (Foster & Mulroy, 2004; Hough, 2001; Meythaler, 1997). A programme of bed exercises to reduce pain, including spinal rotations, would be appropriate in an on-call situation if the patient was less mobile and in pain from immobility than the case presented. Up to 72% of GBS patients have muscle pain which is exacerbated with the first active or passive range of motion but reduced with subsequent repetitions (Hough, 2001). A bed exercise programme for this patient would appropriately be constructed within normal working hours.

Participants are asked to state what they would use to monitor the patient's status (see question 22, Appendix B). Monitoring before, during and after a physiotherapeutic intervention is considered normal practice as part of a physiotherapist's assessment process to evaluate change in a patient's status (Hough, 2001; Pryor & Prasad, 2002). Oxygen saturation monitoring demonstrates the extent to which haemoglobin in arterial blood is saturated with oxygen and a normal range is considered to be 95-98%. Oxygen saturation monitoring would be the most appropriate measure to be used in this case as it would provide continuous non-invasive monitoring, results would be obtained immediately, and trends of improvement or decline would be rapidly detected.

The case progressed to a second stage where participants were recalled to see the patient and provided with objective signs of further deterioration (see page 9, Appendix B).

Participants were presented with a second blood gas result to analyse which indicated critical hypoxaemia (low P_aO_2), a low PH and a high P_aCO_2 (see question 23, Appendix B). Responses were coded as correct if ‘low or critical P_aO_2 with a high P_aCO_2 level indicating respiratory acidosis; some metabolic compensation present’ and ‘in type 1 respiratory failure, pending type 2 respiratory failure’ was stated; partially correct if one or the other were present or incorrect if none were present. Hypercapnia (raised P_aCO_2) in the absence of coexisting lung disease occurs if the VC is <50% of normal (Pryor & Prasad, 2002). Pryor and Prasad also note that in a patient with severe respiratory muscle weakness, nocturnal hypercapnia can insidiously develop due primarily to hypoventilation and progressive hypoventilation can lead to type II respiratory failure (RF), i.e. hypoxaemia in the presence of hypercapnia. Type II RF is also known as ventilatory failure and is a clinical manifestation of respiratory muscle weakness or fatigue when respiratory muscle strength is 30% of normal (Hough, 2001). This patient was heading into type II respiratory failure and with critically low oxygen levels required accurate recognition and swift, appropriate management.

A series of theoretical multiple choice questions were posed at different stages of the case which would provide participants with the opportunity to demonstrate knowledge without the need for experience. The question of oxygen therapy management required knowledge of available oxygen therapy equipment and a good understanding of theory relating to practice (see question 25, Appendix B). It could be seen that the oxygen delivery was poorly managed and the device and flow rate required changing (Pryor & Prasad, 2002). The question about oxygen saturation required knowledge of the mechanism of oxygen absorption, transport, extraction and measurement (see question 28, Appendix B). In this case the oxygen carrying capacity was reduced because the haemoglobin was poorly saturated and the patient was hypoxic (Hough, 2001). The question about respiratory rate and pattern required knowledge of the mechanism of the control of respiration, and changes which occur during pathology (see question 29, Appendix B). The patient’s work of breathing was increased due to sputum retention, respiratory muscle weakness and was becoming critical. The questions about auscultation required knowledge of auscultation findings in the presence of pathology (see questions 15 and 30, Appendix B). These observations collectively demonstrated that the initial atelectasis present in both bases had progressed to consolidation on the right side.

Since lung parenchyma contains no pain fibres, Hough (2001) suggests physiotherapists need to be aware of relevant chest pains in order to distinguish those likely to affect physiotherapy treatment. Pleuritic pain is often described as sharp and worse with deep breathing; to avoid the stabbing pain patients will often not take deeper breaths and can usually indicate an area within the chest where the pain is strongest. Coughing and talking are also affected and there is a reluctance to be handled or to move (Hough; Pryor & Prasad, 2002). This patient had signs of an altered respiratory rate and depth; they had adopted a slumped position, and was uncomfortable with a movement which required a deeper breath (see page 10, Appendix B). Costovertebral tenderness from hyperinflation or abdominal muscle strain from chronic coughing was reported (Hough, 2001). Musculoskeletal pain from excessive vigorous coughing could be the result of direct muscle injury where fatigued muscles are traumatised from lack of respite from excessive loading (Reid, Clarke & Wallace, 2001). There were many factors which could have impacted on sputum clearance. In this case, the most significant factor affecting sputum clearance at that stage was pain. The pattern and course of pain associated with GBS has been discussed earlier in this section. The cause of pain was pleuritic inflammation associated with a worsening chest infection and the patient had adopted an altered breathing pattern and position to avoid discomfort.

Participants were provided with a second X-ray which demonstrated patchy infiltrations at the right middle and lower lobes, an unclear right heart border and loss of right costophrenic angle with an upward shift of the right hemidiaphragm (see question 31, Appendix B). This X-ray was to be interpreted as worsening right middle and lower lobe consolidation (Harden, 2004; Hough, 2001; Pryor & Prasad, 2002). Responses were coded as correct if 'right middle and lower lobe consolidation' was stated; partially correct if 'right middle and lower lobe consolidation' was stated alongside other pathologies which were not present in the X-ray and incorrect if 'right middle and lower lobe consolidation' was not stated at all.

Participants were asked to interpret a lung function test result and eight response options were provided (see question 32, Appendix B). Responses were coded as correct if respiratory muscle weakness was included in the answer. This theoretical question required a basic knowledge of lung volume measurement and changes in

specific pathologies. The test result was accompanied by supporting text which indicated that the patient was in a compromised position and had struggled to form a seal on the device which would have resulted in a poor technique due to progressive muscular weakness of the facial and skeletal muscles.

Patients with neuromuscular diseases show reduced chest wall compliance due to respiratory muscle weakness and changes in lung and chest wall mechanics. Although changes are specific to each disease physiology, the usual order of decline is a reduced total lung capacity, reduced tidal volume, and reduced functional reserve volume (Laghi & Tobin, 2003; Reid et al., 2001). GBS can cause respiratory muscle weakness and progress to ventilatory failure in up to 20% of patients, and this decline can be rapid (Hough, 2001). Monitoring lung function in patients with suspected GBS is common and usually entails spirometry testing which provides more information about specific lung volumes and includes a PEFr measure. There is insufficient evidence to recommend a specific monitoring method for respiratory function in GBS patients but vital capacity is the most commonly used (Durand et al., 2006). The characteristic abnormalities of inspiratory muscle weakness include a reduced vital capacity (VC) and reduced total lung capacity. It is usual to regularly monitor a patient's VC and consider intubation if the VC decreases to between 18 and 20 millilitres per kilogram (mL/kg), (Hough, 2001; Durand et al., 2006).

The patient had retained secretions that were causing an increased work of breathing which, due to progressive respiratory muscle weakness, was deteriorating to respiratory failure. Participants were required to select what treatment options they would utilise to treat the problem (see question 34, Appendix B). At this stage the condition was continuing to progress and the disease nadir was not yet reached. The potential for loss of airway protection if bulbar function was lost and the potential for haemodynamic instability had to be considered when determining treatment choices as some are contraindicated in such circumstances.

Suction in adults is indicated if secretions are in the upper airways and therefore accessible to the catheter. If the secretions are detrimental and if the patient is unable to clear secretions by themselves, however, it is a highly invasive procedure and therefore carries significant risk (Hough, 2001; Pryor & Prasad 2002). The technique provides an effective immediate answer to retained secretions and ineffective

coughing. The process involves the insertion of an appropriately sized catheter through a nostril into the trachea where a cough is triggered and secretions removed by applying a suction pressure whilst withdrawing the catheter. The process can be uncomfortable as it is invasive, and various measures are required to ensure the technique is safe and effective (Hough, 2001; Joanna Briggs Institute, 2000; Pryor & Prasad 2002). Relevant complications include the potential for further atelectasis caused by suction pressure, worsening hypoxia caused by the technique and cardiovascular anomalies which can occur from vagal nerve stimulation. The Joanna Briggs Institute suggests that these complications can be reduced or avoided by taking appropriate precautions.

In the absence of haemodynamic instability, and with careful monitoring, suctioning may have been an appropriate choice for this patient in order to quickly reduce the work of breathing and improve gas exchange. However, the presence of respiratory muscle fatigue and failure requiring rest meant NIV and appropriate positioning could be utilised to support and rest the respiratory muscles and improve oxygenation. NIV is contraindicated in patients with reduced bulbar function due to the risk of aspiration and also contraindicated if a patient is unable to clear their secretions or is haemodynamically unstable (Denehy & Berney, 2001).

As the case was continuing to deteriorate the physiotherapist would be liaising with members of the medical team and it would be likely that the patient would have been mechanically ventilated in order to rest the fatigued respiratory muscles and facilitate secretion clearance.

Appendix D - Open comment summary of remaining themes

Theme	Comment Summaries
Critique	<p>Chest X-rays difficult to read pathology versus printing issues (N,C,N,C,C)</p> <p>Booklet layout difficult to maintain focus when turning back pages (N)</p> <p>Lung function testing difficult to interpret also timing unrealistic (C,J)</p> <p>Didn't like wording of questions asking 'how concerned' - was concerned about most results but not on a call out for a respiratory problem (C)</p> <p>More information re muscle strength would have been useful (J)</p> <p>Not enough info given for all questions (J,J)</p> <p>GBS is not a commonly seen condition - possibly not a good choice for such a study (C)</p> <p>Scenario after 2am unrealistic for us as patient would be ventilated (N)</p>
Reality of workplace	<p>Smaller hospital; cases such as this are flown out (N,N,N,N,N)</p> <p>In reality this patient would be managed by a team so liaison with medical staff / intensivist occurs - they would be making a lot of these decisions (N,N,N,N,N,N)</p>

Note. N = Non cardiorespiratory senior physiotherapist; C = Cardiorespiratory senior physiotherapist; J = Junior physiotherapist.