THE IMPACT OF PRESSURE ULCER RISK ASSESSMENT ON PATIENT OUTCOMES AMONG HOSPITALISED PATIENTS AT RIYADH MILITARY HOSPITAL – SAUDI ARABIA

A Thesis

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Dedication

This thesis is dedicated to the soul of my father and my mother who wished to see me complete my doctoral thesis

I also dedicate this work to my lively wife (EMAN), without her there is no meaning for my life. She was the one who encouraged me to continue with my higher studies.

I also dedicate this work to my children Bahaa and Tala for their patience through the years of my graduate studies.

Furthermore, I dedicate this work to all the patients who suffered pain of pressure ulcers and waiting to heal.

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Abstract

This study is designed to evaluate the effectiveness of using pressure ulcer (PU) risk assessment scales (RASs), namely the Braden scale, on patients' outcomes in terms of PU incidence. The study aimed to examine the effects of RASs (the Braden scale) compared to the effects of PU training and nurses' clinical judgement on patients' outcomes in terms of PU incidence.

A non-equivalent pre-test post-test controlled groups designs were used and the data were gathered using an observational checklist, the Braden scale for PU risk assessment, and nurses' clinical judgement rating scale. 719 hospitalised patients at Riyadh Military Hospital in Saudi Arabia were selected from 9 Medical-Surgical wards and were divided into 3 groups (A, B and C). In Group A, nurses received training on the Braden scale; in Group B, nurses received PU training, and Group C was control. The Braden score of ≤ 18 was used as a cut off score to determine at risk patients. The Agency for Health Care Policy and Research (AHCPR) (1992) classification system was used to consider PU incidence. Data were collected by one tissue viability specialist and two researchers.

The findings showed that 22.9% of the patients developed PU (stage one to stage four). The PU incidence was relatively similar between the study groups (24.4% in Group A, 23.4% in Group B, and 21.1% in Group C) which demonstrates no significant effect for using RASs (the Braden scale) compared to PU training and nurses' clinical judgment on PU incidence. The findings also pointed out a significant difference in PU incidence among pretest (31%) patients and posttest (19%) patients

which suggest the clinical benefit of the PU prevention programme implemented by the RMH. Logistic regression analysis revealed that age, clinical judgement scores, Braden scores, standard hospital-bed mattress, neuro-surgical diagnosis, and skin barrier creams have predictive function in relation to PU development. The ROC analysis showed a relatively similar performance for Braden scale and nurses' clinical judgement in relation to PU development.

The study concluded that there was no significant effect of using RASs (the Braden scale) on patients' outcomes in terms of PU incidence reduction. In respect of this, the study suggests that RASs (the Braden scale) and nurses' clinical judgement can be used together to improve patients' outcomes in terms of PU development.

Abbreviations

AHCPR..... Agency for Health Care Policy and Research

AUC ..... Area Under ROC Curve

α ..... Significance level in hypothesis testing.

BS ..... Braden scale

B .....Coefficient estimation associated with individual predictor in logistic model

CJ ..... Clinical Judgement

DF (*d.f.*) ..... Degrees of Freedom

EPUAP ..... European Pressure Ulcer advisory Panel

GA .....Group A wards, where the Braden scale was introduced

GB ..... Group B wards, PU training given and use of the Braden scale or any other RAS not enforced.

GC ..... Group C wards, where no specific PU training was given and the nurses used clinical judgement to identify patients at risk of PU development.

KW ..... Kruskal-Wallis H test

MW ..... Mann-Whitney *U* test

NCPU ..... Nosocomial Pressure Ulcer

NPUAP ..... National Pressure Ulcer Advisory Panel

NICE ..... National Institute of Clinical Excellence

n ..... Number of cases in a subgroup of the sample

N ..... Total number of cases or sample members.

OR ..... Odd Ratio

P ..... Probability value that observed data are consistent with null hypothesis

PU ..... Pressure Ulcer

RASs ..... Risk Assessment Scales

ROC ..... Receiver Operating characteristics Curve

RMH ..... Riyadh Military Hospital- Saudi Arabia

RMS ..... Risk Management Strategy

SPSS ..... Statistical Package for Social Science

SJT ..... Social Judgment Theory

TVNS ..... Tissue Viability Nurse Specialist

TVT ..... Tissue Viability Team

Wald x^2..... The significance of individual predictors in the logistic model.

χ^2 ..... Chi-Square test.

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Chapter One: Introduction

This chapter discusses pressure ulcers (PUs), introduces the concept of risk, defines PU and offers a brief historical perspective of their roots and development. It provides background to the PU problem specifically in relation to hospitalised patients at Riyadh Military Hospital (RMH) and explores the potential usefulness and significance of this study to the RMH as a health care provider. It also explores the aims of the study and presents the study's time scale.

Introduction

Risk is present in every aspect of human life in different levels (such as environmental pollution, global warming and car accidents) and emerged particularly in clinical practice as health care systems are becoming complex with changing and contemporary growing areas of practice. Health technology and complexity of health resources may entail additional risks to the patients, the health care team and the health care institution. Although risk assessment and risk management have taken a central position in numerous health care institutions, different risks are unavoidable (Crowe and Carlyle 2003) such as patients' falls, nosocomial infections and medical errors (Braine 2006). The development of pressure ulcers represents one area of these risks. Nurses are key instruments in health care services, and encounter conflicting and challenging forces that may affect their roles in health care context as a result of complex, multidisciplinary, multi-professional and changing situations. Clinical judgments are foundations of decision making in health care practices. Nurses have

demonstrated several clinical decisions central to patient care and health care environment and have had a key role in assessing and managing clinical risks through identifying these risks and implementing subsequent measures to reduce their adverse effects on patients and health care institution. There is a substantial body of published work on 'risk definition'. It reflects a range of distinct risk analysis perspectives and a high-level appreciation of risk knowledge creation. For instance, Thompson and Dowding (2002) define risk according to The Royal Society as 'the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge'. Macgill and Siu (2005) reviewed a substantial number of technical and social definitions of risk. For example, one technical definition of risk is 'the possibility of loss, injury, disadvantage or destruction; to expose to hazard or danger; to incur risk of danger' and one social definition of risk is 'uncertainty'. Although there is diversity in defining risk which may be related to complexity in nature and context of risk involving technical, economic, social, health, ecological and other dimensions; these definitions included probability and prediction.

Nurse practitioners deal with numerous clinical risks every day and they are not able to produce exact probabilities about the outcomes of health problems they deal with. Therefore, crucial clinical decisions take place based on prediction of probabilities of the event either happening or not happening. For instance, the nurse may consider a newly admitted patient who is seventy years old with a fractured neck of femur as high risk for developing pressure ulcers based on his/her previous knowledge and expertise, and the patient may be placed on support surfaces whether he/she developed pressure ulcer or not. On the other hand, the nurse may not intervene when patients are assessed as not being at risk, and subsequently developing pressure ulcers.

Risk is integral to nursing practice and nurses are instrumental in maintaining patients' safety and risk reduction through the risk management process, which includes risk assessment, risk analysis and developing strategies to manage risk (Thompson and Dowding 2002; Braine 2006). The process of risk management has become increasingly important in controlling the rising cost of health care (East 1995) and the priority in the evolution of health care risk management has changed to improve patient safety (Kuhn and Youngberg 2002).

RMH as a health care provider has been reactive to different clinical risks and the concepts of risk, risk assessment and risk management are not established. The complexity of clinical risks in RMH cannot be addressed through one discipline alone and requires the need for a culture of safety and risk reduction. The risk management process may present an avenue to evolve the concept of risk in the RMH as discussed further in Chapter Two.

1.1 Pressure ulcers: definition and brief historical perspective

Pressure ulcers (PUs) (also called bed sores, pressure sores or decubitus ulcers) remain a significant and complex health problem in hospital and community health care settings in terms of human suffering, pain, disfigurement, loss of productive time and financial burden.

A PU is defined as a localised lesion caused by unrelieved pressure, shear or friction that results in damage to underlying tissues due to a prolonged period of ischemia. It usually occurs over bony prominences such as the sacrum (Agency for Health Care Policy and Research (AHCPR 1992; Hitch 1995; Cullum et al. 1995; Ek 1987; Nyhlen 1979).

The presence of PU in Egyptian mummies as mentioned by Thompson (cited in Theaker 2004) suggests that this problem has a long history. It was described for the first time by Fabricius Hildanus, who is often called the "father of German surgery", in 1593 as being caused by external natural and internal supernatural factors, which are known today as external and internal risk factors, as mentioned by Defloor (1999). Pare (a French surgeon) in the sixteenth century recognised the importance of pressure relief and nutrition in curing this disease, which matches modern thought on the subject (Levine 1992).

Charcot (a French neurologist) in 1860 described PU as decubitus ulcers in patients suffering from acute or chronic brain and spinal cord diseases, noting that some patients developed PUs on their buttocks or sacrum before death (Levine 2005). It was associated with fatal septic infections and reported as a cause of thousands of deaths each year in the United States (Redelings et al. 2005). Higher mortality rates are expected findings for those patients who develop PUs, 65 per cent of whom developed them on the sacrum (Clough 1994).

In the twenty-first century, available scientific knowledge about PU is still developing. One example is Halfens' (2001) historical overview of PU literature of the past 35 years. The aim of this review was to examine the attention given to PUs in clinical reports and scientific literature and the specific topics targeted by those authors. A Medline search revealed a total of 6,056 articles regarding PUs. A further analysis showed that the focus on PUs has grown from 1965 to1999. Moreover, most studies were based on descriptive designs. The reviewer concluded that the number of studies on PUs as compared to general studies means that greater attention is being

paid by clinicians and scientists to the problem. However, it is still far from adequate compared to the cost of PU prevention and treatment in health care.

1.2 Background to the study

1.2.1 Introduction

The complexity of wound care management is continually evolving. Frequent changes can sometimes cause confusion, so the body of knowledge related to this specialty must be evidence-based, frequently updated and communicated. Much progress has been made in the last few years, but there is still more to discover. A wound care programme was developed at RMH in collaboration with the nursing administration, managers, educators, staff and other professionals. The goal of the programme was to provide a standardised level of care that meets the needs of patients and to educate nurses about standards, assessments and resources. The wound care programme began by researching the literature and using action research as a framework. Three aims were identified: to initiate a strategic change plan for wound management, to contribute to the development of the body of knowledge in wound management as an area of specialisation, and to promote the quality of nursing care provided on a daily basis.

1.2.2 Base line evidence

The first step in the nursing wound management action plan was to initiate a wound management database. An exploratory and descriptive methodology was utilised to build up an initial body of data. Ten wound care committee members were trained to collect data from a convenient sample of nine different medical-surgical wards. This

data was collected using observation and self-administered questionnaires with three sections (Appendix A). The first section consisted of observable patient data, the second of nurses' opinions of selected wound management practices, and the third measured nurses' knowledge of wound management. The results (Table 1.1) revealed that 36.4 per cent of patients developed PU following admission and 23.8 per cent were admitted with PUs. The results showed higher PU rates compared to other chronic wounds such as diabetic foot and venous leg ulcers. Among the nursing staff, 44 per cent of them demonstrated a lack of knowledge in wound management (the response rate was 96 per cent) and PU risk assessment (Norton risk assessment scale); brief and incomplete wound management documentation was also reported.

1.2.3 PU incidence and prevalence monitoring

PU incidence and prevalence surveys were performed annually and considered as part of the action change plan at the RMH. It showed higher rates of PU incidence and prevalence from 2003 to 2006 compared to developed countries such as the UK and other European countries. Despite the reported reduction in prevalence and incidence rates, the results at the RMH showed that prevalence ranged from 19.9 per cent (in 2006) to 23.8 per cent (in 2003) and the incidence ranged from 31.8 per cent (in 2006) to 36.4 per cent (in 2003) among hospitalised patients, as shown in Table 1.1. It revealed that the incidence rate was very high in some wards: nearly 50 per cent among Isolation ward patients and approximately 40 per cent among male medical ward patients from 2003 to 2006, indicating a problem that required urgent attention.

Table 1.1 PU incidence and prevalence rates from 2003 to 2006 among selected wards at the RMH.

Wards	No. of beds	No. of staff	PU incidence rate				PU prevalence rate			
			2003	2004	2005	2006	2003	2004	2005	2006
Female Medical	32	34	NA	NA	31.2%	37.5%	NA	12.5%	25%	20
Neuro-surgery	30	33	NA	NA	16.6%	9%	NA	6.6%	23.3%	10%
Isolation	14	17	48.8%	NA	62.5%	55.5%	58.7%	NA	36%	44.4%
Male Medical	30	30	46.1%	NA	38.8%	38.6%	64.3%	23.3%	31%	36%
Ortho-Spinal Surgery	32	28	16.6%	NA	NA	33.3%	21.6%	NA	8.7%	18%
Medical-Surgical VIP	23	24	NA	NA	NA	25%	NA	4.3%	27%	26.3%
Oncology	18	38	NA	NA	33.3%	25%	NA	22.2%	22.2%	12.5%
General Rehabilitation	26	30	NA	NA	33.3%	0%	NA	NA	20%	24%
Renal	32	30	NA	NA	25%	25%	NA	NA	9.7%	7%
TOTAL	**237**	**264**	**36.4%**	**NA**	**34%**	**31.8%**	**23.8%**	**13.5%**	**20.4%**	**19.9%**

Source: (RMH-nursing administration/nursing wound care management. pressure ulcers incidence and prevalence annual surveys 2003 to 2006).

1.2.4 The role of the multidisciplinary teams on PU management in the RMH

The nursing staff took the major role in caring for patients with PUs at the RMH, as opposed to the medical team's low level of participation in PU management. The RMH Operating Theatre's yearly report in 2006 revealed that only an average of six flapping or grafting operations per year were performed as surgical reconstructions by the plastic surgery team (Table 1.2).

Table 1.2 Total reconstructive surgeries of PUs from 2003 to 2006

Year	Total surgeries at the RMH	Total Plastic surgeries at the RMH	Total Reconstructive surgeries of PU(Grafts or Flaps)
2003	12667	428	**5**
2004	12808	446	**6**
2005	13173	423	**6**
2006	13708	432	**6**

Source: RMH-Operating Theatre Statistics 2003-2006.

1.2.5 Educational activities

The education policy at the RMH necessitates that the nursing staff must complete the mandatory wound care study yearly. According to RMH-Nursing Academic Affairs / Wound Care Study Day statistics (2004), 774 nurses had attended the wound care management study day. Wound care practice at the RMH was considered as an active,

challenging, conflicting and multidisciplinary area of practice which required nurses and other health care professionals to be knowledgeable about evidence-based wound care practice and updates.

1.2.6 Wound management documentation

The nursing documentation system at the RMH included various forms of PU assessment and management (Appendix B). The nurses have used the Nursing Data Base form since the 1980s, which included the Norton risk assessment scale (Appendix C). These returns revealed a lack of documentation. Where this was used, it was most frequently in the form of nurses' notes. In addition, no crucial decisions regarding the prevention and management of PUs were based on the application of the Norton scale, but rather on nurses' clinical judgement.

1.2.7 Wound care policy and procedures

The Nursing Practice Committee at the RMH is accountable for reviewing all nursing policies and procedures. The wound care policy was revised in 2004 as a result of the PU survey findings and a decision was made to introduce wound management guidelines, including the Braden scale for PU risk assessment, as part of the wound care policy, wound care referral and pressure ulcer management. The PU management policy included PU risk assessment, skin inspection, pressure redistribution devices, turning and seating of the patients, training and education.

1.2.8 Wound care committee

The Wound Care Committee was part of the RMH's Quality Assurance Committee. Its steering role was crucial in the development of the wound care management system through the implementation of a multi-professional, participatory and collaborative team approach. The Committee's mission and objectives and its members' functions were all established.

1.3 Significance of the study

The issue of PU prevention and management is of national and international concern. The true scale of the problem is unknown, but it is vastly underestimated. The literature suggests under-reporting of the problem, as many institutions believe that PU is a quality indicator of poor nursing standards, and lack awareness in relation to PU prevention and management, as mentioned by Day et al. (1997) and Anthony et al. (2006).

A review (Kaltenthaler et al. 2001) of the numerous estimates of the incidence and prevalence of PUs from different countries including the UK, the USA, Canada and Europe, revealed variations in the study population, different data collection methods, a lack of national and international consensus on PU grading systems and risk assessment scales, and an inadequate documentation of prevalence and incidence, which lack comparability between data sets collected.

The figures from the RMH showed that PU was one of the most significant problems among hospitalised patients compared to other chronic wounds investigated. PU prevalence and the incidence rates were high compared to developed countries. In addition, the figures showed inadequate PU documentation, risk assessment and training. The current methods for identifying patients at risk were inadequate and subjective, which required the need to investigate the effectiveness of PU prevention strategies.

The need to improve the figures of PU prevalence and incidence among hospitalised patients was well documented, with little evidence suggesting improvement, as mentioned by Pancorbo-Hidalgo et al. (2006), Flanagan (1995) and Panagiotopoulou et al. (2002). Theaker (2004) suggests that a problem of such magnitude and complexity cannot be effectively addressed by any one discipline alone.

Risk assessment scales (RASs) emerged as an initial step in PU prevention and management programmes. While RASs have been implemented to improve patient outcomes, research evidence to clarify this issue was scant. Additionally, RASs showed variable and inadequate reliability and validity in clinical application. It was not clear whether RAS was effective by itself in reducing PU incidence, or whether the effect of training and/or nurses' clinical judgment contributed to the reduction. The research evidence on the clinical effectiveness of RASs was weak. Exploring this area might therefore help in building a scientific knowledge base about such phenomena, which is important in order to support personal experience and eliminate other forms of bias from clinical decisions. In other words, after nearly fifty years of using RASs and the existence

of more than 46 different RASs in clinical use, this study investigates whether or not their use actually improves patient outcomes.

The implementation of the Braden scale in the RMH gave a unique opportunity to evaluate RASs and to explore the effects of using that scale, as well as training and clinical judgment regarding patient outcomes. This study introduces current evidence-based knowledge in PU prevention and management that enabled nurses to provide a better quality of nursing care. As a result, patient outcomes were improved, in terms of reducing PU incidence rates, through better identification of patients at risk and definition of those factors that contribute to PU development. As a result, patients' suffering was reduced along with pain, disfigurement and the time and cost of PU management. The reduction of the patients' length of stay and PU wound infection rates, as well as the improvement of PU wound healing times, may, however, be associated with PU incidence reduction. The findings of this study can also be implemented by nurses and health care teams to help provide optimum care and reduce suffering.

1.4 Aims of the study

This study aims to:

1. explore the effects of using risk assessment scales (The Braden Scale) on patient outcomes in terms of pressure ulcer incidence rates.

2. examine the effects of pressure ulcer prevention and treatment training on patient outcomes in terms of pressure ulcer incidence rates.
3. determine the effects of using clinical judgment as a way of deciding which patients are at risk of developing pressure ulcers on patient outcomes in terms of pressure ulcer incidence rates.

1.5 The study and research time scale

This study was conducted over five years and constituted two main stages:

1. MPhil, which involved proposal development, review of relevant literature, preparation and review of the research instrument, formulation of the conceptual framework and preparation and conduct of the pilot study.

2. PhD, which involved data collection, data analysis and writing up the thesis.

The proposed study time scale was:

1) Review of the literature, proposal development, preparation of the research instrument and conduct of the pilot study were developed over 36 months.

2) Data collection, data entry and data analysis were managed in 14 months.

3) Writing up the thesis over 10 months.

1.6 Summary

This chapter has described the background of the study. It has explored the effects of RASs (the Braden scale), PU training and nurses' clinical judgement on patients' outcomes in terms of PU incidence. Risk and risk management concepts PU definitions and a brief historical perspective were provided. The background of the study included baseline evidence, PU incidence and prevalence monitoring, all of which demonstrated the extreme impact on nurses and patients at the RMH. The background described the development and implementation of educational activities, the wound management documentation, the wound care policy and the wound care committee at the RMH. The significance of the study has been explored and includes its value to the RMH as a health care system in Saudi Arabia and to other health care professionals. The aims of the study were explored and the study's time scale plan was presented.

Chapter Two: Literature Review

Introduction

The term "literature review" refers to the activities involved in identifying and searching for information on a given topic and developing an understanding of the state of knowledge regarding it (Polit and Hungler 1999). The literature review aims to be a source of research ideas, familiarising the researcher with what was known about the subject and providing a conceptual context for information on the research approach.

Search strategy

Relevant literature was reviewed from different nursing databases, namely British Nursing Index (BNI), British Nursing Index Archive (BNIB), Cumulative Index of Nursing and Allied Health Literature (CINAHL) and International Bibliography of the Social Sciences (IBSS). Other multidisciplinary databases such as MEDLINE (Pubmed), European Pressure Ulcer Advisory Panel (EPUAP), and National Pressure Ulcer Advisory Panel (NPUAP) were used to retrieve relevant data related to different aspects of the pressure ulcer problem. Additional databases such as the Cochrane library were also used. Searches were performed on all abstracts, research reports, systematic reviews, texts, published and unpublished theses and dissertations for the keywords "pressure ulcers" and "risk assessment scales".

Searching was limited for works in English; full texts judged as relevant were obtained where possible.

The literature was searched for:

1) studies that used quantitative methods to evaluate risk assessment scales

2) studies conducted on hospitalised patients

3) all studies considered to be systematic reviews of risk assessment scales

4) studies considered to contain or constitute information about validity and reliability of risk assessment scale

5) studies describing the PU problem in terms of definitions, consequences, incidence, prevalence, conceptual frames, risk factors, and classification systems

6) studies including information about the role of nurses' clinical judgement in PU prevention, the effects of PU prevention programmes, and the effects of PU training programmes.

Exclusion criteria included:

1) studies reflecting personal experience or opinion

2) case studies

3) small sample sizes (less than 30 subjects in quantitative studies)

4) studies that used qualitative methods

5) studies that were medically oriented rather than nursing-focussed.

The data were accessed through the Internet, CDs, videotapes, proceedings of international conferences, wound care committee meetings, wound care study days and clinical experiences.

The results of the search of nursing databases (BNI, BNIB and CINAHL) showed that no national studies were undertaken on PU prevention, management and risk assessment. PU literature mostly concerned the following:

1) The epidemiologic aspect of PU in terms of incidence and prevalence

2) The main complications of the PU problem in terms of cost burden, delayed healing time, increased infection rate and prolongation of patients' stay

3) Various conceptual schemes and the process of PU development

4) PU classification system

5) PU prevention programmes

6) PU training and education programmes

The search showed a reasonable number (13 studies in 2003 to 33 studies in 2007) of publications about the PU risk assessment scales as shown in Table 2.1. The clinical effectiveness of using PU risk assessment scales on patient outcomes in terms of PU incidence or prevalence was shown in a limited number of studies (5 items up to 2007).

The following subsections present a critical review of the literature relevant to the study undertaken and introduce a conceptual framework that facilitates the understanding of the study variables.

Table 2.1 Publications on pressure ulcer using nursing databases (BRNI, BNIB and CINAHL) from 2003 to 2007

Year	*Number of items published on PU	*Number of items published on PU Risk Assessment Scales	*Number of items published on Risk Assessment Scales
2003	297	13	179
2004	355	17	259
2005	438	26	385
2006	491	31	513
2007	509	33	* NA

* Search limited to research, full texts, and studies in English language

* NA: Not Available.

2.1 Incidence and prevalence of PU

PU incidence was defined as new cases appearing during a specified period in a particular population, and PU prevalence as a cross-sectional count of the number of cases at a specified point in time (AHCPR 1992 and the European Pressure Ulcer Advisory Panel (EPUAP) in Defloor et al. 2005).

Several studies report PU incidence and prevalence among hospitalised patients. Kaltenthaler et al. (2001) report a PU incidence rate of between 2.2% to 29% per annum

over a maximum of six weeks in the UK and 8.5 to 13.4 per cent over a one- to four weeks period for a maximum of two weeks in the USA and Canada.

The prevalence reports from some European countries ranged from 7 per cent in 1995 to 28 per cent in 2004 in Germany and 15 per cent in 1995 to 33 per cent in 2004 in Netherlands (Tannen et al. 2004 and O'Dea 1995), while the equivalent UK scope was from 5.1 to 32.1 per cent, and the US and Canadian from 4.7 to 29.7 per cent (Kaltenthaler et al. 2001). In a recent study, Vanderwee et al. (2007) reported an 18.1 per cent PU (Stages One to Four) prevalence rate in 25 hospitals from five European countries.

The figures from the RMH (the setting of this study) showed that the prevalence ranged from 19.9 to 23.8 per cent and the incidence ranged from 31 to 36.4 per cent among hospitalised patients. Compared to developed countries, these findings demonstrated higher rates of PU incidence and prevalence, despite a reduction in prevalence and incidence rates being reported (Saleh et al. 2006).

PU prevalence and incidence were recommended by AHCPR (1992) and EPUAP (1998) as the main indicators for developing and evaluating PU programmes. Prevalence provides an insight into the magnitude of the PU problem at any given time, and aids in planning for health resources and facilities. PU incidence provides insight into the nature of patient groups who are at risk of PU development, and allows inferences to be made regarding the effectiveness of preventive measures, compliance with prevention and treatment protocols, and effectiveness of risk assessment tools (Defloor et. al. 2005 a and O'Dea 1995). The

introduction of a PU incidence monitoring survey is suggested as being helpful in highlighting the problem and in planning and implementing activities to improve PU management (Torrance and Maylor 1999, Halfens et al. 2001 and Klazinga 1994).

In this study, figures of PU incidence and prevalence are particularly useful in providing a broad view of the magnitude of the problem facing RMH and to help establish baseline data for future improvement in such situations in the absence of national studies and documentation of PU prevalence and incidence (Saleh et al. 2006).

Nevertheless, PU incidence and prevalence studies are methodologically limited as regards the interpretation of their outcomes, which makes it difficult to compare results between studies. There are four of these limitations, the first of which is a difficulty in comparing various populations in different health care settings (data collected from acute hospitals are not likely to reflect the community or home care population). Incidence and prevalence rates may be higher among several specific subpopulations such as orthopaedic and quadriplegic patients than in general hospital populations. The second limitation is that data collection methods range from direct observation of patients to retrieval of data from patient records. The third is the inclusion or exclusion of Stage One PUs from the study population, and the fourth is the under-reporting of PUs, different sample sizes, insufficient control of data acquisition, the use of different PU classification systems, the influence of discharge practices, and treatment and prevention protocols, all of which also make it difficult to compare (AHCPR 1992, Kaltenthaler et al. 2001, Bethell 2002, Bradley and Van der Wal 1995, Defloor et al. 2005, Klazinga 1994 and Whittington et al 2000).

2.2 PU Classification

Classification (or grading/staging) of PUs is a significant aspect in PU prevention and management. The classification systems allow objective assessment of the degree of tissue damage. There are numerous PU classification systems used in clinical areas, the best known of which are AHCPR (1992) and EPUAP (1998).

AHCPR (1992) classifies PUs in a way that is consistent with the recommendations of the NPUAP. Stage One PUs are characterised by the non-blanching erythema of intact skin; the heralding lesion of skin ulceration. Reactive Hyperemia should not be confused with Stage One PUs. The Reactive Hyperemia is normally expected to be present for one-half to three-quarters of the observed tissue as long as the pressure occludes blood flow to the area. Stage Two is marked by partial thickness skin loss involving the epidermis and/or dermis. The ulcer is superficial and presents clinically as an abrasion, blister or shallow crater. Stage Three involves full thickness skin loss involving damage to or necrosis of subcutaneous tissue that may extend down to, but not through, underlying facia. The ulcer presents as a deep crater with or without undermining of adjacent tissue. Stage Four involves full thickness skin loss with extensive destruction, tissue necrosis or damage to muscle, bone, or supporting structures such as tendons or joint capsules. Undermining and sinus tracts may also be associated with Stage Four PUs.

The EPUAP classification system agrees with AHCPR in classifying PUs into four stages and in specifying some signs of Stage One PUs in darker skin (e.g. discoloration of the skin, warmth, oedema and induration or hardness of the skin).

These classification systems have several limitations such as: uncertainty about how to define Stage One PUs, as opposed to any other stage (Bethell 2003) and a related difficulty in assessing Stage One PU patients with darkly pigmented skin (AHCPR 1992). Defloor et al. (2007) have suggested classifying Stage One PUs (non-blanchable erythema) not as PUs but as alarm signals. Another limitation is that when an eschar is present, accurate determination of the stage of the PU is not possible until the eschar has sloughed or the wound has been debrided, as necrotic tissues may mask the true extent of the wound (AHCPR 1992). Yet another limitation is low inter-rater reliability (Harker 2000 and Defloor et al. 2007).

In this study the AHCPR classification was adopted; there are currently no ideal classification systems, and none has been universally adopted (Reid and Morrison 1994 and Harker 2000). The AHCPR stages were present on patients from the RMH as shown in (Appendix L).

2.3 Consequences of PU

1) Costs of PU prevention and treatment

Several studies have estimated that the costs of PU prevention and treatment are very significant (Cullum et al. 1995, Richardson et al. 1998, Brooks and Semlyen 1997, Thomson and Brooks 1999, Day et al. 1997, Hermans and Bolton 1996, Clough 1994 and Bennett et al. 2004). Xakellis and Frantz (1996) noted that eighty per cent of the total costs of PU treatment were generated by the four per cent of patients who required hospitalisation for their PUs, and Bennett et al. (2004) concluded that PUs have a significant impact in the UK, equivalent to four per cent of the total health care expenditure. In a recent report, skin breakdown including PUs, venous leg ulcers and diabetic foot ulcers was estimated as costing the UK up to £3.1 billion annually (Smith and Nephew Foundation report 2007).

The majority of PU expenditure is on nursing time for dressing, positioning, and the provision of support surfaces (Clough 1994 and Bennett et al. 2004). Additionally, the treatment cost of PUs is significantly more expensive than their prevention (Clough 1994). The studies reporting PU cost estimates were limited to reports of over- or underestimation. There has been underestimation of resources needed in treatment and prevention, such as surgical reconstruction and nosocomial infections of PUs. Studies also varied widely, but with the overall trend indicating rising costs. Furthermore, human costs in terms of patients' quality of life were difficult to estimate.

2) Increased infection rates have been reported in many studies (Anthony 1996, Lindholm 2003 and Heym et al. 2004).

3) Increased length of stay. Ash (2002) notes that patients who develop PUs have longer stays than those patients who do not, and Anthony et al. (2004) report that nosocomial PU is a significant predictor of increased length of stay once the patient's general condition and age are taken into account.

4) Delayed wound healing as shown by Wallenstein and Brem (2004). Different rates of PU wound healing are reviewed by Bennett et al. (2004) who report that the mean time of healing was 28.4 days for Stage One, 93.8 days for Stage Two, 127.4 days for Stage Three, and 154.7 days for Stage Four. All of these stages had complications such as critical colonisation or infection, cellulitis and osteomyelitis.

2.4 Guidelines on Pressure Ulcer Prevention

PUs are accepted as a preventable but unavoidable disorder (Grewal et al. 1999, AHCPR 1992 and Day et al. 1997). Thus, numerous clinical guidelines have been developed and implemented in health care systems during the past twenty years to assist nurses to take appropriate decisions to improve PU prevention and management (Clark 1999).

The first guideline was developed in Netherlands in 1985. Four years later, the NPUAP in the USA developed new guidelines (Clark 1999), followed by the AHCPR guidelines (1992), EPUAP (1998) and NICE (2003). Most of these guidelines aim to identify patients who are at risk of developing pressure ulcers and the specific factors which place them at risk.

Do PU guidelines improve patient outcomes in terms of PU incidence or prevalence?

Several studies and systematic reviews have been conducted to find evidence for using PU prevention strategies on reducing PU prevalence and/or incidence. Many reviews have demonstrated a reduction in incidence, and for any prevention programme there may additionally be other positive outcomes such as reduced costs. The use of PU clinical guidelines leads to reduction of PU occurrence after implementation (Regan et al. 1995 and Xakellis et al. 1998) in Clark (1999).

PU prevention programmes consist of different components. Day et al. (1997) suggest that aggressive, ongoing PU prevention programmes, including thorough skin assessment and care, frequent repositioning, and careful selection of support surfaces (Cullum et al. 1995), have demonstrated significant reduction of PU incidence and time taken for treatment as well as dramatic cost savings; while Whitfield et al. (2000) conclude that an educational strategy has been seen as the most frequently employed intervention to reduce PU incidence or prevalence. The implementation of multidisciplinary working parties and multidimensional interventions including best practices and research-based protocols

(Hopkins et al. 2000), improved documentation (Gunningberg et al. 2001b) and systematic use of RASs are also suggested as effective strategies in improving PU prevention and reducing PU incidence and prevalence (Gould et al. 2000).

These variations in PU prevention programmes make it difficult to compare between studies, and although many activities in PU prevention programmes are associated with a reduction in PU occurrence, other components such as RASs remain unproven. It is not clear which components of prevention studies are most effective in reducing PU prevalence and/or incidence (Whitfield et al. 2000).

2.5 PU Risk Assessment Scales

Risk assessment scales (RASs, also called risk assessment tools, calculators or scores) are key components in any prevention guidelines and constitute an initial step in PU prevention models that aim to identify those patients at risk. RASs are structured models including categories of factors that are associated, to varying degrees of reliability, with PU development (Scott 2000; Day et al.1997).

RASs are a key tool in facilitating PU prevention and assisting practitioners in allocating appropriate pressure relief devices or deciding on preventive intervention for an individual patient. In addition, dividing patients into risk groups is important for a comparison of PU prevalence and the differences between two study populations (Tannen et al. 2004). Maylor (1999) believes that RASs could be useful as a communication tool between nurses for

assessment and could help to standardise nurses' documentation. Thus clinicians are encouraged to utilise a risk assessment scale that ensures systematic evaluation of individual risk factors (AHCPR 1992).

Pressure ulcer conceptual models and risk factors

Numerous conceptual models have been developed in order to explore PU development and to serve as basis for the development of RASs (Lowthian 1970; Braden and Bergstrom 1987; Defloor 1999). Defloor (1999) has introduced the most comprehensive conceptual scheme on PUs, based on a review of the literature related to the prediction and prevention of PUs. The author highlighted factors other than known risk factors (pressure and shear forces), which appear to contribute to the process of PU development. The scheme included four elements: pressure, shearing force, tissue tolerance for pressure and tissue tolerance for oxygen. This scheme may help in developing valid RASs and allow more adequate detection of those patients at risk of PU development (Oot Giromini 1995).

Several studies have been conducted using different methods and among different populations in order to identify risk factors associated with PU occurrence. These studies suggest that the understanding of risk factors and their interaction may help in refining RASs and improving their predictive performance. As a result, numerous risk factors have been found among different risk groups. For example, anaemia, faecal incontinence, length of stay, and noradrenalin infusion have been associated with PU occurrence among critically ill patients (Theaker 2004). Age (Anthony et al. 2003, Halfens et al. 2000,

Gunningberg et al. 2001b and Tannen et al. 2004), diagnosis, and support surfaces were significant in relation to PU development among surgical patients (Schultz et al. 1999). Additionally, length of surgery (Schoonhoven et al. 2002 a) and gender (Tannen et al. 2004) were also associated with PU development. The enormous number of risk factors associated with PU development makes it difficult to decide which risk factors should be included in a risk assessment scale.

Examples of RASs

There are numerous examples of RASs. Several new RASs have been developed and at least 40 such alternative scales have been described in literature, most of which exist in several variants (Defloor and Grypdonck 2004). Most of them are modifications of each other; the most commonly studied and reported scales in clinical use are the Norton, Waterlow and Braden scales.

The Norton scale (Appendix G) is the first recognised RAS. It is based on Lowthian's (1970) conceptual model, which includes pressure and shearing force as the main causes of PUs. It considers five risk factors (or risk indicators): general physical condition, mental status, activity, mobility and incontinence. Each factor is rated 1 to 4, with total scores ranging from a minimum of 5 to a maximum of 20. A score of ≤14 is considered as a cut off indicating risk status (Flanagan 1995).

The Waterlow scale (Appendix G) considers additional risk factors (or risk indicators) of build/weight, continence, skin type, mobility, gender, age, appetite, tissue malnutrition, neurological deficit, surgery/trauma and specific medications. Waterlow divides the degree of risk into three categories: scores of 10 to 14 are considered to be at risk, scores of 15 to 19 at high risk and scores of 20 and above at very high risk of developing PUs. The Waterlow scale includes guidelines of preventive measures and support systems needed according to each risk category (Waterlow, 2005).

In the present study the Braden scale (Appendix J) is used. It is based on Braden and Bergstrom's (1987) conceptual model, which included two main causes of PUs: pressure and tissue tolerance. The Braden scale considers six risk factors (or risk indicators): sensory perception, moisture, activity, mobility, nutritional status and shear/friction. Each category is rated 1 to 4 except shear/friction, which is rated 1 to 3. The minimum risk score is 6 and the maximum is 23. In this study, patients are deemed to be at risk when their cut off score is $\leq$18; there may be other Braden cut off scores for other research (Flanagan 1995 and Braden and Bergstrom 1987).

These scales have been evaluated and several suggestions have been made to improve the performance of current scales and refine their structure (Papanikolaou et al. 2003, 2007, Defloor and Grypdonck 2004).

Reviews of RASs

The literature critically reviews RASs and discusses different issues in relation to their evaluation and refinement, clinical effectiveness and reliability.

RASs evaluation

RASs have been evaluated using reliability and validity in terms of sensitivity (the percentage of patients who were predicted to develop ulcers and went on to do so), specificity, (the percentage of patients who were predicted not to develop ulcers and did not do so (Flanagan 1995), and predictive value. These measures have varied greatly among RASs (AHCPR 1992), but are the most commonly used and recommended tools for evaluating the predictive validity of PU RASs (Defloor and Grypdonck 2004). The inconclusiveness of studies examining the reliability and validity of various RASs makes the choice of a definitive RAS impossible (Flanagan 1995). For example, among hospitalised patients, the sensitivity of the Waterlow scale was 89.5 per cent while its specificity was 22.4 per cent (Schoonhoven et al. 2002b). Although Pancorbo-Hidalgo et al (2006) have reported accumulated analysis of indicators of validity for the Braden, Norton and Waterlow scales as sensitivities of 57.1, 46.8 and 82.4 per cent respectively and specificities of 67.5, 61.8 and 27.4 respectively. Reed et al. (2001) have suggested that the Braden scale is the most sensitive and specific RAS currently available. This variability probably reflects the differences in study setting, populations and outcome measures that have been implemented (AHCPR 1992), study methods (Flanagan 1995), lack of an operational definition within risk categories (Edwards 1995), PU definition, demographic

data of assessed patients, sample sizes (Lindgren et al. 2002, Mitchell 2004 and Brown 2004) and heterogeneity of length of observation (Defloor and Grypdonck 2004).

Effects of clinical use of RASs on validity measures

The validity measures of RASs' were highly variable in clinical practice. The main sources of such variability are:

1) **Different threshold scores (cut off points).** The cut off point indicates the number of patients scored at risk of PU development using an RAS; as the number of at risk patients increases, the incidence rate decreases (assuming that PU incidence is the number of patients, from a total scored at risk according to an RAS, who developed new PUs), which in turn reduces the sensitivity of the RAS used. Several studies have used different cut off points among different risk groups. For example, although Bergstrom et al (1987) have suggested that by using a Braden score cut off point of 16, sensitivity was 100 per cent and specificity ranged from 64 per cent to 90 per cent, Bergquist (2001) has evaluated the Braden scale scores in predicting Stage One to Four PUs and found that a Braden score of 19 was a better predictor in older people. Also, Brown (2004) has reported that a cut off of 18 or 19 were found to be the best predictors of risk of PU development using the Braden scale, while Defloor et al (2005) use a cut off score of less than 17 for the Braden scale to compare the predictive value

between the Braden and Norton scales. As a result, validity measures in terms of sensitivity and specificity were not relatively comparable, which make it difficult to conclude a pattern of using specific cut off points for particular RASs in settings and populations.

2) **The use of a wide range of preventive measures when evaluating RASs.** The use of effective prevention will alter sensitivity and specificity (Defloor and Grypdonck 2004, Defloor et al. 2005). The use of protective measures (support surfaces, turning and nutritional support) may be effective in reducing PU incidence if applied to those patients greatly at risk of PU development; however, this would reduce the sensitivity of the RAS used (Anthony et al. 2006). On the other hand, administering effective PU prevention relies on nurse competence to correlate the severity and degree of risk to the effective prevention required. For example, Gunningberg et al. (1999) say that risk identification using RASs does not necessarily mean that a patient will receive more preventative care. Additionally, Gunningberg (2005a) found that PU prevention was not optimal, as many patients with PUs or at high risk of PU development were not given prevention strategies.

3) **Users' perceptions of the purposes of RASs.** RASs were defined earlier (Scott 2000) as being devised to identify patients at risk of PU development. Edwards (1995) suggests that the Waterlow scale may be a predictor of PU development in elderly people, and Lindgren et al. (2002) also believe that

RASs predict PU development. Different perceptions of the purpose of using RASs may increase the outcome expectations in clinical use, and change their purpose to that of diagnostic screening. Defloor and Grypdonck (2004) have pointed out that RASs are not intended, unlike diagnostic tests, to identify the existence of a certain condition, but to ascertain the risk that a certain condition, such as PUs, may develop. RASs are also used to identify patients in need of preventive measures and are intended to contribute to the prevention of PU development. As a result, different perceptions of RAS may influence the reliability (Kelly 2005) and validity of RASs.

Reliability of RASs

RASs are shown in several studies to be reliable. Edwards (1995) reports that the Waterlow scale demonstrates 92.5 per cent reliability in terms of observer agreement, and it is possible that this scale is less reliable than Norton or Braden (Anthony et al. 2006 and Kelly 2005). Defloor et al. (2005) report the high reliability of both the Braden and the Norton scales, and Pancorbo-Hidalgo et al. (2006) have systematically reviewed the Waterlow, Norton, and Braden scales and found that the Braden scale is the most reliable in terms of inter-rater (inter-observer) compared to other risk assessment scales. The reliability of RASs might be influenced by the competence of individual nurses who assess risk in different ways (Gunningberg et al. 2001a and Reed et al. 2001). Additional factors such as training on the use of RASs (Defloor and Grypdonck 2005) and collecting accurate data will affect the reliability of RASs (Anthony et al. 2006).

Improving RASs validity and predictive performance

Different approaches have been suggested through which to validate RASs and strengthen their performance. Several reviews conclude that RASs are inadequately reliable and that their predictive performance is insufficient (Papanikolaou et al. 2007, Defloor and Grypdonck 2004, Flanagan 1995, Lindgren et al. 2002, Mitchell 2004 and Defloor et al. 2005). For example, Defloor and Grypdonck (2004) have suggested that utilising the outcomes of studies of different risk groups using two cut off points and combining two RASs will reveal significant data that may assist in the refinement of current RASs, while Papanikolaou et al. (2007 and 2003) have suggested the use of multivariate modelling of PU risk to determine and adequately weight the risk factors included in current RASs. For example, Anthony et al (2003) have used logistic regression and ROC analyses to consider significant predictive variables of PU development, and it was suggested that gender be removed from the Waterlow scoring system to simplify and improve its predictive performance. Vanderwee et al. (2007) have selected a new approach to examining whether the use of non-blanching erythema as indicator for the commencement of prevention care has better outcomes in terms of PU occurrence than conventional use of RASs. The findings were not significant enough to suggest refinements to RASs based on the characteristics of those patients with non-blanchable erythema who developed PUs despite the prevention care provided.

Clinical effectiveness of RASs

A limited number of studies have reviewed the clinical effectiveness of using RASs. Few reviews have discussed the effects of using RASs on patients' outcomes in terms of PU prevalence and/or incidence. A critical review of these studies demonstrates a significant reduction in PU incidence (Bale et al. 1995 and Hodge et al. 1990) while Gunningberg (1999) finds no significant difference in the reported PU prevalence between an experimental group, on which risk assessment and PU classification were performed on a daily basis, and a control group, where intervention was not applied. The results of these studies were not conclusive enough to demonstrate robust evidence for the clinical effectiveness of using RASs on patients' outcomes, as many flaws were reported. These included:

1) Specific patient groups at risk such as hospice patients (Bale et al. 1995) and patients with hip fractures (Gunningberg 1999) were studied.
2) Outcome measures where PU incidence was used in Bale et al. (1995) and Hodge et al. (1990) and PU prevalence was used in Gunningberg (1999).
3) Different interventions such as sophisticated prevention measures (Bale et al. 1995) and greater awareness level of the nurses who applied PU prevention (Hodge et al. 1990).
4) The effect of contributing factors (age, gender, and diagnosis) may be associated with PU development (Bale et al. 1995).

5) Although the Braden scale was the extensively studied RAS (Pancorbo-Hidalgo et al. 2006), the Norton (Hodge et al. 1990) and modified Norton (Gunningberg 1999) scales were used in evaluating the clinical effectiveness of RASs on patient outcomes.

However, the conclusions of these studies and systematic reviews by Cullum et al. (1995) and Pancorbo-Hidalgo et al. (2006) were that there is no evidence that RASs are effective tools for reducing PU occurrence. This does not mean that RASs are useless in practice; they may be effective within a formal risk-based programme (Halfens et al. 2000).

Summary of reviews of RASs

From 1990 on, a steadily increasing number of research projects on risk assessment tools were initiated (see Table 2.1). Most topics have been studied using a descriptive design (Halfens 2001). The literature reviewed indicates ambiguity in the way that certain risk factors have been chosen when devising RASs. Also, it was not clear how the risk factors were weighted to produce a total score and the role of the other factors in contributing to PU development. Numerous studies have evaluated RASs in the last 15 years; a limited number of them empirically investigated the risk factors that predict PU development (Pedley 2000, Anthony et al. 2006, Waterlow 1996, Lyne et al. 2000 and Scott 2000).

A crucial problem affecting proper utilisation of RASs is related to the scale's reliability and validity in terms of sensitivity, specificity and predictive value, which vary according

to changes in patients' conditions and the nursing care they receive. The AHCPR (1992) stated that the reported specificity and sensitivity of RASs have varied greatly. This variability probably reflects differences in study settings, populations, outcome measures (such as inconsistent definition of Stage One PUs) and the degree to which preventive measures have been implemented. Furthermore, many RASs lack operational definitions of risk factors, leading to their poor predictive performance. However, RASs rely on the competence of individual nurses who all assess risk in different ways (Edwards 1995, Flanagan 1995, Reed et al. 2001 and Gunningberg et al. 2001a).

The literature review showed that there are currently no RASs that are completely sensitive or specific. It is also not clear which one is the best, as there are no standards by which to compare RASs with each other. Furthermore, no RAS is perfect (Anthony et al. 2004). Defloor and Grypdonck (2004) suggest that making comparisons between the scales based on specificity and sensitivity is meaningless, and furthermore that the significance of differences is doubtful, as they do not usually take into account the prevention strategies that affect the outcomes, thereby their value is limited (Anthony et al. 2004 and Scott 2000). This raises the question whether sensitivity, specificity and predictive values are indeed valid measures for the performance of RASs (Edwards 1995 and Defloor and Grypdonck 2005). However, such measures should continue to be used to test RASs until valid and refined ones have been created.

Most RAS evaluation studies considered one scale and used different methods and different patient groups (Flanagan 1995, Pedley 2000 and Lindgren et al. 2004). For example, of the

many extant risk assessment scales, only the Norton and Braden scales have been tested extensively (Reed et al. 2001 and Pancorbo-Hidalgo et al. 2006). The Braden scale has been widely used as a risk assessment tool, evaluated in diverse sites that included medical-surgical units, intensive care units, paediatric wards and nursing homes. The Norton Scale has been tested with elderly patients in hospital settings (AHCPR, 1992).

Arguably an ideal research environment in which to evaluate RASs in clinical practice is to administer a RAS for the patients, and then to offer no preventative intervention but for them to be closely monitored to identify those who develop PUs and those who do not. However, such research would not be ethically advisable (Defloor et al 2004). The issue of threshold scores is another important one affecting the choice and the performance of a scale (Clark and Farrar 1991, Edwards 1995, Scott 2000 and Brown 2004).

To sum up, the literature suggests that several studies evaluate and examine RASs in terms of predictive performance without producing any clear and consistent evidence that RASs are effective tools in improving patients' outcomes, and that a more valid way of evaluating the clinical effects of using RASs would be to measure these effects on patient outcomes in terms of PU incidence reduction.

2.6 Nurses' clinical judgment

Clinical judgment (CJ) and clinical decision making have been used to describe the same entity (Kozier et al. 2004 and Atherton 2004). Additional terms are used to describe CJ in literature; these include clinical reasoning, clinical inference and diagnostic reasoning (Thompson and Dowding 2002). These terms are interlinked and it is difficult to make clear distinctions between them. In a nursing context, CJ is the most commonly used term to describe the way by which the nurses develop and select a set of alternative courses of action to decide patients at risk of PU development and the related prevention strategies. CJ becomes a complex process because of the distribution of resources, undetermined roles of health care members, the conflicting forces that may affect the decisions to be made, and the challenging and rapidly changing situation in which nurses are required to make many decisions every day. The prevention of pressure ulcers represents one area of decision making (Gunningberg et al. 2001a).

Theoretical background of CJ and decision making

Thompson and Dowding (2002) and Shaban (2005) suggest that judgment and decision making theories can be divided into three categories: normative, descriptive and prescriptive. Normative theories assume that an individual is rational and logical. It concentrates on how decisions should be made in an ideal situation. Furthermore, normative theories are concerned with a decision's outcome and not with how decisions or

judgments are made. Descriptive theories describe how individuals reach judgments and decisions. Prescriptive theories try to improve these individual judgments and decisions by examining how individuals actually make them, and by trying to help them.

Thompson and Dowding (2002) explain CJ as an information processing theory, which suggests that individuals go through a number of phases in their reasoning process. The common features of this process include the gathering of preliminary clinical information about the patient, the generation of initial tentative hypotheses to explain the data collected, the interpretation of information and its classification as confirming or refuting the initial hypotheses, and the subsequent evaluation and choice of a possible explanation based on the balance of the evidence.

Another approach is suggested by Kozier et al. (2004) and Atherton (2004). CJ is proposed as a critical thinking process for choosing the best actions to meet desired goals. At the same time critical thinking is the process that includes creativity, problem solving and decision making. The critical thinking process, as related to the clinical setting, implicitly includes theoretical and applied knowledge. Theoretically, CJ includes an identification of purpose, a setting of criteria regarding desired outcomes, a weighing of the criteria and a seeking of alternatives, an examination of those alternatives by the application of creative thinking and scepticism, implementation of the decision into action and finally an evaluation of the outcomes.

Nurses seem to use past experiences when making clinical decisions regarding PU management. Thompson and Dowding (2002) have discussed how past experience may influence clinical judgment. Nurses may use similar patients with similar condition dialogue, past experience of a probable outcome of the patient's present state and a knowledge of the patient (Defloor and Grypdonck 2005) in order to form a judgment.

CJs would be effectively enhanced through self-assessment (Kozier et al. 2004), seeking situations where good thinking is practiced and creating environments that support critical thinking (Atherton 2004), peer evaluation and reliance on memory (Thompson and Dowding 2002).

Are RASs doing better than nurses' CJ?

The literature suggests contradictory views about the role of CJ in clinical performance in relation to PU risk assessment and prevention. For example, Defloor et al. (2004) have argued the role of nurses CJ in PU prevention. The researchers point out that in most studies nurses decide autonomously whether or not a patient receives preventive care, and which preventive measures to use depending on experience, knowledge, beliefs, type of staff, workload, and equipment, thereby different patients will be identified as at risk and will receive preventive measures. Whilst Defloor et al. (2004) cast doubt on the generalisation of the results of these studies, Emparanza et al. (2000) develop a reliable PU severity scoring system based on assessments by experienced clinicians, which verifies the important role of CJ in clinical practice.

A limited number of studies have compared the PU RASs with nurses' CJ in terms of validity measures. Gould et al (2002) and Gould et al. (2004) have examined and compared the validity of RASs and nurses' CJ using patient simulation. Nurses were requested to rate the patients' risk using an RAS and visual analogue scale as a measure of their own clinical judgment, and these assessments were then compared with assessments of expert panel used as a gold standard. The results of Gould's studies have shown that nurses' clinical judgment agreed more closely with expert opinion than any of the RASs used, which would imply that using nurses' CJ is superior to the RASs in identifying risk of PU development (Anthony et al 2006). However, Pancorbo-Hidalgo et al's (2006) systematic review of RASs and nurses' CJs finds that although the Braden scale achieves the best predictive value of any RAS, and the Norton and the Waterlow scales do not perform better than nurses' CJ, RASs were better PU risk prediction tools than nurses' CJ. Additionally, Defloor and Grypdonck (2005) suggested that although the predictive value of the Braden and Norton scales was poor, their use is better than relying on nurses' CJ.

The poor PU risk prediction performance of RASs (Flanagan 1995) and of RASs compared with CJ (Brown 2004, Defloor and Grypdonck 2005, Gould et al 2002 and Gould et al. 2004) suggests that there is insufficient evidence on the relative accuracy of RASs and nurses' CJ, which makes it difficult to confirm whether RASs are better tools than nurses' CJ in identifying patients at risk of PU development; it also casts doubt on the evidence of their use in improving patients' outcomes (McGough 2000, Brown 2004 and Cullum et al. 1995). It also suggests that the employment of validity measures such as sensitivity and

specificity are not appropriate methods by which to evaluate the predictive value of RASs compared to CJ (Defloor and Grypdonck 2005), and a check needs to be made against patients' outcomes (Anthony et al. 2006).

As a result of these findings and the poor predictive value of RASs and CJ, it has been suggested that RASs aid and facilitate CJ (Scott 2000, Brown 2004 and Mitchell 2004) and encourage systematic evaluation of patients' risk of PU development (Flanagan 1995), as there is no robust research evidence to support the use of RASs as superior to nurses' CJ in identifying patients at risk of PU development.

A key finding of these critical reviews is that there is a need to compare the effects of using RASs and nurses' CJ on patients' outcomes in terms of PU incidence - for instance, to provide clearer evidence about their role in improving patients' outcomes.

2.7 PU education and training

PU training and education is well documented in the literature, which suggests that it is fundamental in promoting awareness of PU prevention and best practice management (Butler 2004, Hopkins 1998, Banks 1998, Panagiotopoulou et al. 2002, Day et al. 1997, Scott 2000, Bostrom and Kenneth 1992, Pieper and Mott 1995 and King 2000).

PU prevention programmes including continuing education programmes have demonstrated significant reductions of PU incidence and time taken for treatment (Buss et al. 1999,

Suntken et al. 1996 and Day et al. 1997). AHCPR (1992) has suggested that PU educational programmes should be structured, organised and comprehensive in order to reduce the incidence of PUs. PU training programmes should include information on aetiology, risk factors, risk assessment tools and their application, skin assessment, selection and/or use of support surfaces, development and implementation of individualised programmes of skin care, demonstration of positioning and instruction on accurate documentation of pertinent data. Several studies reviewed the effectiveness of education in improving PU risk assessment skills. For example, Gunningberg et al. (2001a) use a PU prevention educational programme including documentation of risk of PU development and they conclude that, even with limited utilisation of available knowledge and research findings in clinical practice, nursing staff knowledge and documentation of risk, prevention and treatment of pressure ulcers could be improved.

Clarke et al. (2005) evaluated the implementation of PU programmes based on AHCPR (1992) guidelines in clinical practice and found that nurses' knowledge increased in relation to PU prevention and treatment. Increased nurses' knowledge about PU risk assessment and producing higher risk scores might not lead to better PU prevention (Anthony et al. 2006). Although nurses have a good knowledge of PU risk factors to identify those patients at risk of pressure development, they are not able to interpret such knowledge into practice in order to offer related PU prevention care (Panagiotopoulou and Kerr 2002). Therefore, in any PU prevention programme implementing RASs, training has been suggested as an essential component for the appropriate application of RASs (Defloor and Grypdonck 2005) and to link the higher scores of a particular RAS to prevention intervention that

reduces the risk of PU development (Anthony et al. 2006). The literature reviews have shown the effects of PU prevention programmes, which consist of several components including the RASs and training on them. The training in this case may conceal the clinical effects of applying an RAS in terms of patient outcomes. Therefore, no clear research evidence will apply to an RAS itself in improving these outcomes.

2.8 Theoretical background of risk and judgment

As highlighted in Chapter One, risk is defined as the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge (Thompson and Dowding 2002). Risk assessment is one of the most common judgments nurses make in clinical practice which can have a significant effect on the care that patients receive (Thompson and Dowding 2002). In health care, PU is considered a clinical risk: thus risk assessment becomes an essential component in any PU prevention and management programme. It provides a probabilistic function to identify those patients at risk of PU development. Though PU risk assessment is fundamental, inaccurate judgments of patients at risk of PU development may mislead therapeutic decisions such as providing inappropriate support surfaces. Therefore, it is imperative to explore and understand the foundations of risk which is central to risk assessment and risk management processes, with regard to judgments nurses make.

The literature on risk and risk management suggests that the nature of risk issues and contribution to effective risk management cannot be drawn from a single disciplinary perspective because the nature of risk issues is multi-dimensional and the qualities of complexity, conflict and uncertainty are taken to be fundamental in characterising the contemporary environmental risk issues (Macgill and Siu 2005).

The literature review describes several theories which can useful in understanding risks and risk perceptions, which are central to risk assessment, risk management and decision-making. It includes an overview of Risk Management Models, Cultural Theory of Risk, The Risk Society Model, Psychometric Approach and Social Judgment Theory.

Risk management models have been used in clinical practice to reduce the risk and to improve the quality of patient care (Scally and Donaldson 1998). They are used to strengthen management practices (Robillard 2001) and to help create a culture committed to managing risk through proactive and continuous development (Braine 2006). PU risk is one of these risks in the health care context. These models can be used to integrate PU risk management throughout continuous process of risk assessment, risk evaluation, and risk management activities. Although these models are committed to providing a comprehensive view of risk and risk management, they do not present an understanding of the relationship between risk, risk assessment and judgments. All these are essential to improve judgments and decisions related to PU risk prevention and management. Thus, these models cannot be used to contextualise the PU problem, but are restricted to framing PU risk management activities in health practice.

On the other hand, risk assessment is influenced by risk perception of individuals who apply it. Therefore, different influential streams of thought were used to describe and analyse risk and risk perception. An example of these theories is the **Cultural Theory of Risk** which argues that all risks are socially constructed and identifying risk requires configuration of ideas about what outcomes would be undesirable and what conditions put us in danger of experiencing those outcomes. The theorists assume that risks pose a threat not only to an individual's well being, but also to the prevailing social order (Casiday 2007, Cultural Theory of Risk 2007 and Thompson et al. 1990). Although this theory is helpful to view the social construct of risk, it lacks empirical support (Casiday 2007) and lacks a convincing rationale of how different beliefs and concerns might affect the relationship between risk and human judgments. The management of patients within a health care community can be framed within such a social construct although it may not provide an understanding on how nurses' judge patient's at risk of PU development nor would it help to improve nurses' decision making abilities in managing PU risk.

Additional focus on sources of risk is presented by **The Risk Society Model** (Casiday 2007). It assumes that a growing awareness of risk is a central part of reflexive interaction with the structures of modernity as its benefits have been accompanied by many dangers inherent to the process of industrialisation. The theory of risk society is predominantly concerned with 'manufactured risks' where there is a potential to assess the level of risk that is being produced, or that is about to be produced (Ericson and Haggerty 1997). According to this model, the risk position is fundamentally dependent on knowledge and access to information, which may or may not be correlated to economic status, but often is.

This model is of limited generalizability across cultures and in fact may only apply to a very particular section of modern industrial society (Casiday 2007). Although this model is helpful to view new sources of risk and contribute to a deeper understanding of risk, it is restricted to examine the information that nurses use to produce different judgment as well as to clarify and improve the process of PU risk assessment. **The psychometric approach** has been acknowledged in exploring risk from a risk analysis perspective in order to understand how people vary in deciding on risk. Early work shows that people use a number of heuristics (are usually useful shortcuts of thinking) to evaluate information, and the experts are not necessarily any better at estimating probabilities than lay people (Slovic 2000). Cognitive theorists suggest that people generally see most risks in society as being unacceptably high. They also found that both expert and lay people had a basically accurate view of which risks are fatal, but use different aspects of risk to perceive it. These aspects are a dread risk (i.e. uncontrollable, catastrophic, fatal and involuntary) and unknown risk (i.e. delayed, new and unknown to science) (Slovic 2000 and Casiday 2007). Affective theories influence risk perception assuming that affect causes evaluations of an object's riskiness. A key finding in support of this theory is the strong negative correlation between people's judgments of the risk and benefit of an activity. That is, activities judged to have a high risk are nearly always seen as having low benefits, and vice–versa (Slovic 2000). This approach is useful to understand how people perceive risk through risk analysis approach. It has been criticized in that it fails to take into account interactions among people, culture and politics which probably limit its usefulness (Casiday 2007). In the case of PU risk, where it is important to clarify how nurses perceive the risk of PU, the process of how they

identify people at risk, how they define that risk, and the relationship between risk and judgment, the information used to feed these processes are not fully explained.

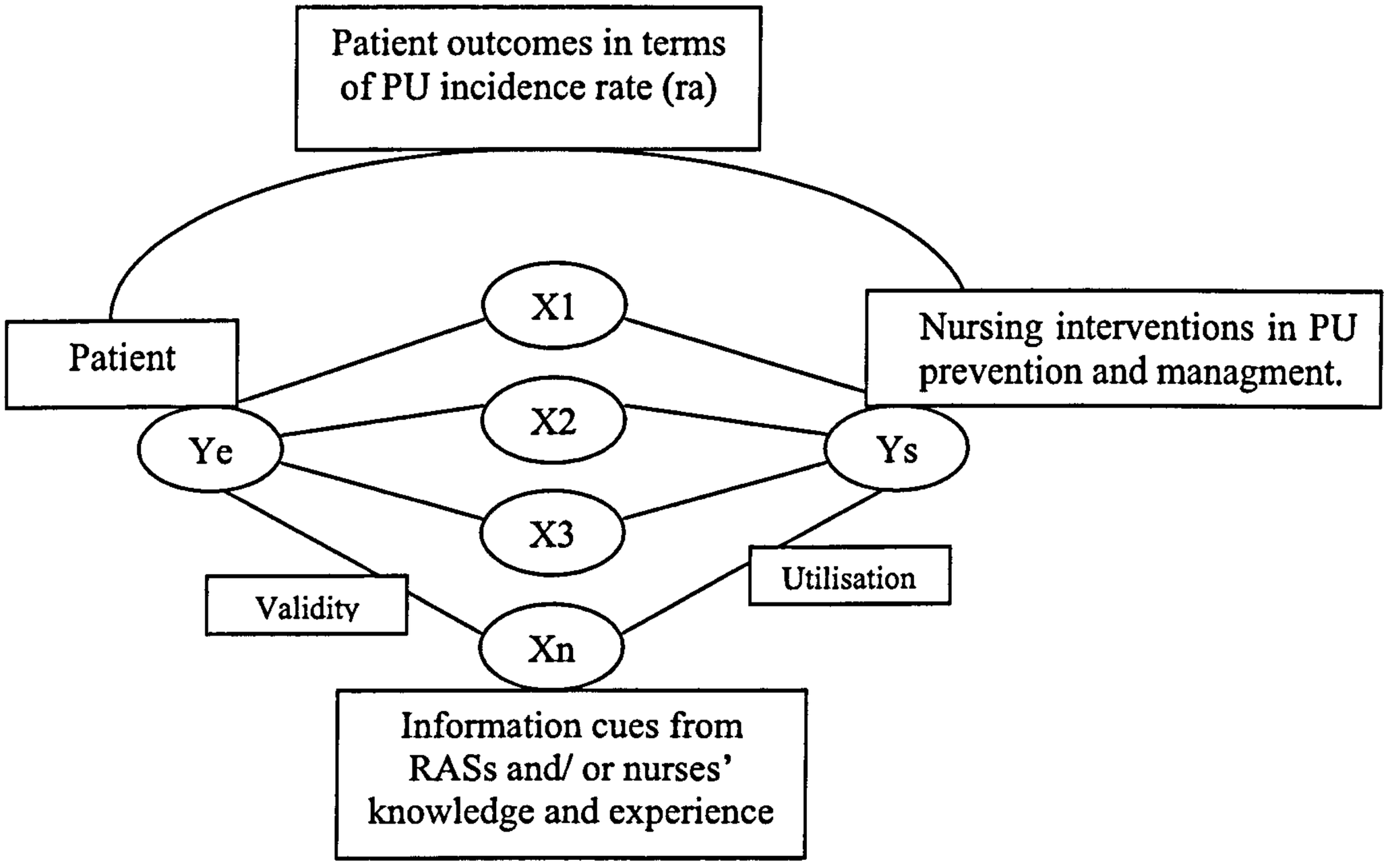
The previous approaches and theories of risk assessment and management described so far have strengths and weaknesses for examining the nurses' judgments in relation to those patients at risk of PU development. PU risk assessment is a key to these judgments in order to improve patient's care and reduce PU occurrence.

The **Social Judgment Theory (SJT)** examines the relationship between risk, risk assessment and how available information can affect judgments and decision making. It provides a venue to enhance our understanding of cognitive processes between individuals. The SJT is built on the early work of the psychologist Egon Brunswik who found the principles of probabalistic functionalism and the core of SJT which is the Lens Model (Rand 1967, Ashton 1973, Louis 1983, Picart 1990 and Thompson and Dowding 2002). The SJT suggests that human judgment relies upon probabilistic information in making judgments about some relevant part of an uncertain environment (Ashton 1973).

The SJT assumes that people make judgments from information that is probably relevant to the judgment objective, based on predictive validity, and can be organized and patterned in different ways (Picart 1990). Thompson and Dowding (2002) and Ashton (1973) have described Brunswik's lens model, which was originally taken from Hammond et al. (1964), as follows: It divides the world into two parts: the environment (ecological or real situation) (represented by the left side of the lens model) and the judgmental system (represented by

the right side of the lens model). A variety of different information cues are directly linked to the environmental side. Each of these cues has a different degree of validity attached to it. Individuals use these cues to make judgments based on their weighting system. As a result, the way the information cues have been used, the judgment may or may not reflect the ecological situation. The multiple regression analysis has become the most common methodology to model the association between information cues and individual judgment (Ashton 1973 and Thompson and Dowding 2002). The SJT can be employed as congruent, consistent and a valid way to examine the relationship between risk and judgments in PU problems. It conveys the core work in this study by clarifying the effects of using RASs as a method of PU risk assessment compared to nurses' knowledge and experience (CJ) on patient outcomes in terms of PU occurrence. It helps to conceptualize the main concepts under investigation and suggests ways to improve nurses' judgment and decision making in PU risk management. As the PU problem is multifactorial and can be viewed from different perspectives in clinical contexts, the SJT is flexible to model this problem addressing psychological, social, cultural and physical perspectives of it. The SJT has been acknowledged in the literature for the systematic examination of the accuracy of judgments and captures the accuracy of instruments designed to enhance professional judgments such as PU RASs (Thompson and Dowding 2002).

Figure 2.1 Brunswik's lens model in assessing risk of PUs development adopted from Thompson and Dowding (2002) which was originally taken from Hammond et al. (1964)



- *Ye* = The actual patient state in terms of signs and symptoms of PU such as inability to respond meaningfully to surroundings and skin maceration.

- *X1-Xn* = Cues of information that are related to the patient state which may be used to judge the current state of the patient, or to predict the future state. The sources of this information are RASs and/ or nurses' knowledge and experience. It may vary in weight (For example, 2 points for obese patients and 3 points for those patients their weight below average by using Waterlow scale) or importance (For example, the degree of physical activity). It may represent the risk factors in RASs.

- *Ys* = The nurse's judgment (clinical decision) about the level of risk of PUs developing, based on the way the information cues (*Xn*) have been used. This judgment is followed by nursing interventions in PU prevention and management.

- *ra* = The achievement which shows the accuracy of the judgment made in association with ecological situation. It represents patient outcomes in terms of PU incidence rate.

The application of the lens model in context of PUs risk assessment and risk management (Figure 2.1) may enhance understanding of the relationship between PU risk identification

and judgements or decisions that have been taken to combat risks of PU development. The model presents the actual risk of PUs development that the patient may experience (Ye). A set of cues (X1-Xn) are associated with PU development and actual patient state, with a particular degree of validity. The cues represent either the known categories of risk factors (risk indicators) in RASs such as mobility, activity, nutrition, shear and friction, sensory perception and moisture in the Braden scale, or the factors (risk indicators) that nurses perceive from their experience in PUs development. The risk factors are validated in RASs by using multiple and logistic regression analysis which indicates the degree to which the probabilistic cues can be used as a source of information about the state of risk of PUs development. The way nurses weigh information cues include their experience and the importance of information given, which may influence the judgement. It indicates the degree of relationship between a given risk indicators and nurse's judgment of patients at risk of PU development over a number of trials (utilisation). However, nurses' judgments (*Ys*) of those patients at risk of PU development may be influenced by the number of available information cues (risk indicators in RASs for instance) and the number of these cues that are associated with PUs according to their importance and/ or weight. This may illustrate variances in judgments of patients at risk of PU development when different risk assessment methods (such as RASs and clinical judgment) are used by different nurses. When judgments are made, they are translated into nursing interventions to prevent and manage the risk of PU development. Thereafter, the patients' outcomes (ra) in terms of PU incidence are measured to verify the accuracy of judgments in relation to actual patient status, which presents feedback about the overall relationship between PU risk assessment and nurses' judgments. Thus, the adoption and application of this approach may facilitate

and improve the management of clinical risks including PUs through better understanding of the relationship between risk assessment and CJs and employment of tools that improve nurses' judgments in clinical practice such as continuous training in PU prevention and management.

2.9 Conceptual framework

A conceptual model deals with abstractions (concepts) assembled by virtue of their relevance to a common theme (Polit and Hungler 1999). It broadly presents an understanding of the research problem and reflects the assumptions and philosophical views of the model's designer. It guides the researchers' quest for extension of knowledge by providing both direction and impetus.

In this study, a general model (Figure 2.2) was devised to explain the relationship between concepts within the study. It broadly presents an understanding of the effects of using RASs on patients' outcomes as an area of interest and reflects the philosophical views of the researcher. This model is based on the literature review's finding that there is no clear evidence in relation to the effects of using RASs, compared with nurses' clinical judgment and PU prevention and management training programmes, in improving patients' outcomes in terms of PU incidence reduction.

This model presents assumptions that interlink different concepts. It included the following concepts: The Braden scale for PU risk assessment (Appendix J), PU prevention and

management training programmes (Appendix E), nurses' clinical judgement (*see* chapter 2, section 2.6), nursing interventions such as frequent turning, protective mattresses (*see* chapter 3, section 3.5.3), skin barrier creams and nutritional supplements and vitamins in PU prevention and management, and patient outcomes (the consequences of PU development, *see* chapter 2, section 2.3) in terms of the PU incidence rate.

In this model, the effects of RASs (the Braden scale) have been compared to the effects of PU training programmes and nurses' CJ, all of which are in a complex relationship with each other; this may mask the effect of an RAS itself, as each variable has independent effects on nursing interventions toward PU prevention, which in turn influence patients' outcomes in terms of PU incidence. On the other hand, the implementation of a RAS is clinically associated with nurses using their CJ to identify those patients at risk of PU development and then deciding on PU prevention interventions. This may be pointless without training, which also makes it difficult to provide clear evidence about the effects of RASs themselves. This model therefore suggests a new approach to examining the effects of RASs on patient outcomes. The patients were divided into three groups, and the nurses who provided them with care received different interventions. Group One nurses (the Braden scale group) underwent a mandatory wound care management study day, PU prevention training programme and specific training on the application of the Braden scale. These nurses were required to implement the Braden scale on their patients in the post-intervention stage. Group Two nurses (the training group) also underwent the wound care management study day and PU prevention training including an overview of RASs. These nurses, however, were not required to apply any of RASs and were given the choice of

applying a RAS or using their own CJ in relation to PU prevention. Group Three nurses (the clinical judgment group) undertook the same mandatory wound care management study day as the others, but these nurses continued to use CJ in relation to PU prevention. Thereafter, the patients' outcomes in terms of PU incidence were measured according to Fletcher's (2001) formula (*see* chapter 3, section 3.11)

According to the conceptual model, this approach was presumed to provide clear evidence regarding the clinical effectiveness of using RASs on patient outcomes in terms of PU incidence rates. It also resolves the interaction between the effects of RASs, nurses' CJ and PU training on improving patient outcomes.

2.10 Summary of Literature Review

A critical review of the research literature revealed that there is a lack of national and international consensus on PU definition, aetiology, classification systems, risk factors, risk assessment scales and cut off threshold scores. It showed a lack of consistent and standardised research methods in terms of different populations, data collection methods and patient observation methods, as well as periods of observation. Moreover, most of the studies are of descriptive design.

The literature review showed inadequate training and knowledge, under-reporting of PUs and variations in preventive measures that made it difficult to compare the data collected. This would urge the need for a consistent and standardised research methodology to explore the clinical effectiveness of a PU prevention policy and to clarify which components of prevention are effective in promoting patient outcomes.

Risk assessment scales were reviewed and showed that validity measures in terms of sensitivity and specificity were extensively used to evaluate the predictive performance of RASs in relation to the risk of PU development. It showed also that these measures are highly variable in clinical use due to different threshold scores used, the wide range of preventive measures implemented and users' perceptions of the intended purpose of a given RAS.

The clinical effectiveness of using RASs was discussed in a limited number of studies, all of which examined the Norton scale and/or its modification. The conclusion of these studies was that there is no evidence that RASs are effective tools in improving patient outcomes in terms of reducing PU occurrence.

Despite their limitations, and that fact that no information is currently available to suggest that adaptation of RASs or the assessment of any single risk factor or a combination of risk factors predict risk as well as the overall scores obtained by the RASs, Lindgren et al. (2002) believe that they may be useful for prediction of PU development in clinical practice. Their use ensures systematic evaluation of individual risk factors (AHCPR 1992, Lyne et al., 2000). However, RASs should be used in conjunction with CJ as part of a comprehensive PU prevention programme. Additionally, further refinement and investigation of RASs and their role in PU prevention are suggested.

This literature review reminds us that variability in findings is expected when we attempt to predict and prevent PU occurrence. It is necessary to remember patients' individual characteristics and consider the patient care environment as confounding variables in any RAS prediction model used. Therefore, a suggested valid means of evaluating the clinical effects of using RASs is to measure these effects on patients' outcomes in terms of PU incidence reduction.

The literature review revealed contradictory views about the role of nurses' CJ; it suggested that there was insufficient evidence on the relative accuracy of RASs and nurses' CJ, since

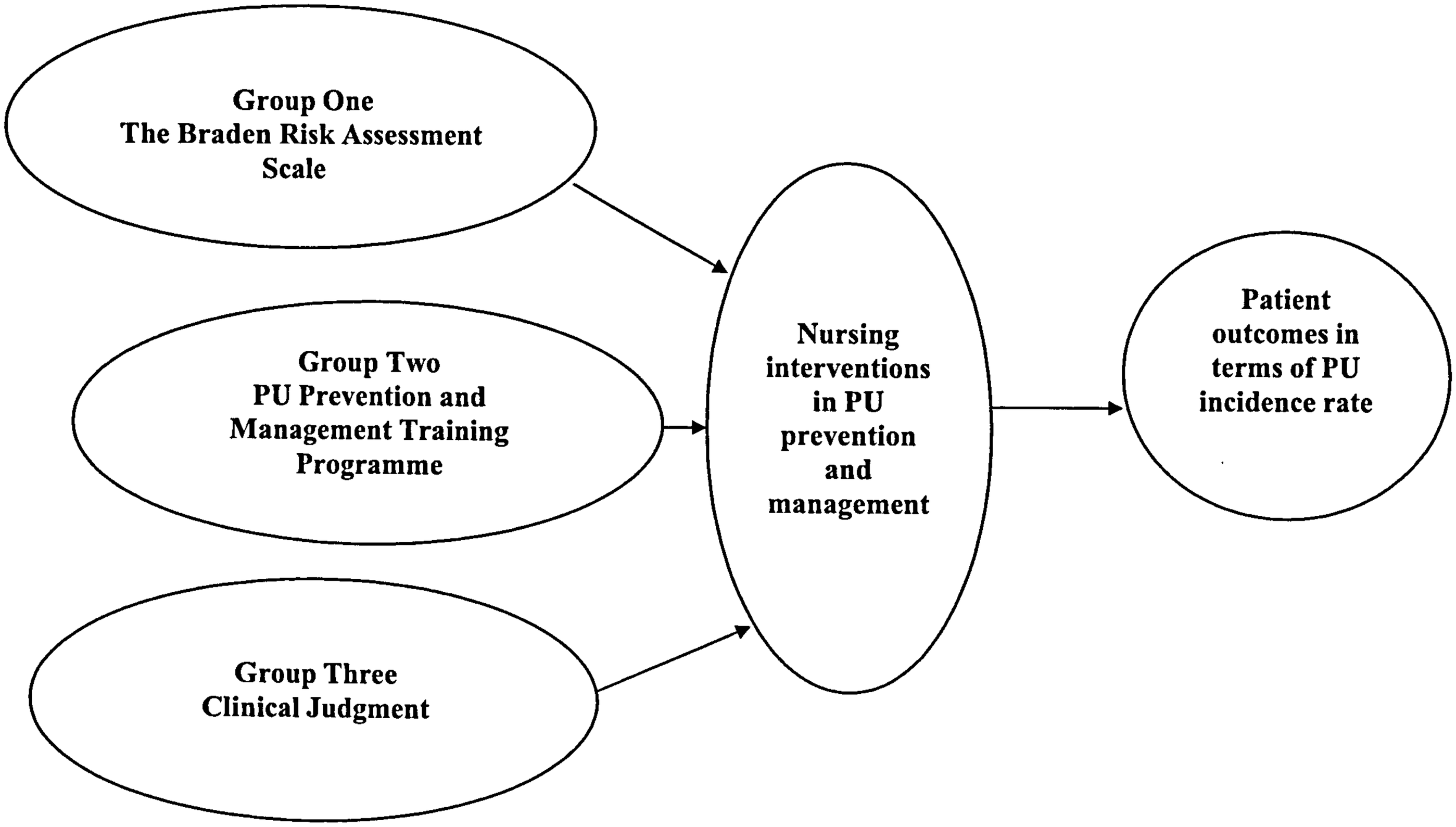
both had poor predictive validity. A need to compare the effects of RASs and nurses' clinical judgment on patient outcomes in terms of PU incidence was suggested.

Based on literature reviewed, it is noted that there is diversity in the level of nurses' knowledge about PU care. Furthermore, in spite of the fact that nurses are knowledgeable about risk factors and risk assessment, they do not always appear to turn their knowledge into practice. However, nurses' knowledge would be improved through continuous training and utilisation of comprehensive PU prevention and management programme. PU training and education may mask the effects of using RASs themselves in improving patient outcomes.

Foundations of risk and risk assessment were reviewed. Different theoretical backgrounds have been described including their strengths and weaknesses. The Social Judgment Theory has been introduced to explain the relationship between PU risk assessments and nurses' clinical judgments. It enhances understanding of the usefulness of using RASs compared to CJ in PU risk management in health.

A general conceptual model was devised to facilitate a greater understanding of the relationships between different concepts used in the study. The conceptual model introduced a valid means of evaluating the effects of using RASs on patient outcomes in terms of PU incidence, a means which resolves the complex interaction between the effects of RASs and nurses' CJ and PU training.

Figure 2.2 General conceptual model to guide the study



Chapter Three: Methodology

Introduction

This chapter introduces the study methodology and includes the usefulness of using a quantitative design, the setting of the study, the study sample design, the instruments employed in the study, the validity and reliability of the Braden scale, the process of data collection, ethical considerations, the plan of data analysis process and the pilot study report.

Research is the process of collecting information about a particular subject, and includes careful or diligent searching, studious inquiry or examination and investigation or experimentation. Research aims for the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts and practical application of such new or revised theories or laws (Merriam-Webster 2001).

This study exemplifies a scientific nursing research process, which is based on a definition of scientific research. Nursing research is a systematic investigative approach to knowledge about issues of importance to the nursing profession. It aims to improve practice and

3.1 A quantitative approach

There is no single way to understand our complex world through using one research method. Hence the main approaches utilised in nursing research are quantitative and qualitative, it is clear that there are several research problems which cannot be fully understood by any method in isolation. Both qualitative and quantitative methods have strengths and weaknesses. Therefore, both are essential to the development of nursing knowledge in such a way that the strengths of one approach complement the limitations of the other. This study adopted the quantitative research approach for the following reasons:

1) The nature of the research problem under investigation required the need to express the effects of using PU risk assessment on patients' outcomes by using a quantitative measurement such as PU incidence rate. The quantitative approach emphasises the objectivity of the data collected, which deal with numbers rather than an individual response.

2) The quantitative approach is efficient in testing hypotheses.

3) The quantitative approach is consistent with the world view of the research problem under investigation.

4) Most studies in nursing research continue to be quantitative.

5) Although several studies have been carried out on this topic, the current level of knowledge regarding the effectiveness of RASs on patient outcomes is scant. The quantitative approach can be useful and relevant to examine the effectiveness of using RASs as a nursing intervention and whether or not it works.

6) The need for evidence-based nursing practice is well recognised. The quantitative research provides a large amount of information and thus a powerful body of knowledge about such a specific research problem.

3.2 Study design

This study aims to clarify and explore the effects of utilising RASs, education and clinical judgment on patient outcomes in terms of PU incidence rate among hospitalised patients at the RMH in Saudi Arabia.

3.2.1 Hypotheses

The following simple non-directional tentative hypotheses were formulated in the null form to achieve the aim of the study, guide scientific inquiry and provide direction to the research design:

- Risk assessment scales (The Braden scale) have no effect on patient outcomes in terms of pressure ulcer incidence rate among hospitalised patients.
- There is no effect for pressure ulcer prevention and treatment training on patient outcomes in terms of pressure ulcer incidence rate among hospitalised patients.

- There is no effect concerning the use of clinical judgment as a way of deciding patients at risk of developing pressure ulcer on patient outcomes in terms of pressure ulcer incidence rate among hospitalised patients.

A hypothesis is a tentative prediction or explanation of the relationship between two or more variables (Polit and Hungler 1999). It offers direction and facilitates understanding and interpretation of the results. The previously stated hypotheses were consistent with previous research findings and may support the evidence for understanding the phenomena under study. The hypotheses were stated in simple, non-directional and null form for the following purposes: 1) to express the relationship between one independent and one dependent variable in each hypothesis; 2) to raise expectation regarding the relationship between variables, but do not expect the nature and direction of that relationship; 3) to provide a capability for testing procedures.

3.2.2 Study design

A research design is a researchers' overall plan for obtaining answers to the research questions or for testing the research hypotheses (Polit and Hungler 1999). It spells out the basic strategies that the researcher adopts to develop information that is accurate and interpretable and incorporates some of the most important methodological decisions such as the data collection plan, the sampling plan and the analysis plan.

A prospective, non-equivalent control group, pre-test post-test, quasi-experimental, quantitative designs have been used to test the hypotheses and achieve the aims of the

study. A quantitative approach allows the researcher to examine the relationships between variables and test the effects of variables proposed in the conceptual model. A quantitative approach was required in this study because it was congruent and efficient in testing the hypotheses, it emphasised the objectivity of data collected (which deals with measurements and numbers), it was consistent with the phenomenon under investigation (most of the studies in nursing research concerning pressure ulcers were quantitative), and it can be useful and relevant in examining the effectiveness of using RASs as nursing interventions whether it works or not, which in turn contributes to an enhancement of evidence-based nursing in this area of practice. The quasi-experimental design was used to test the hypothesis in this study. It involved manipulation of the independent variable, but lacks at least one of the other two properties, either control or randomisation. It is acknowledged in the literature as a useful way of testing causality in settings when it is impossible or unethical to randomly assign subjects to treatment and control groups or to withhold treatment from some subjects (Talbot 1995). In the present study there was manipulation and control but randomisation was lacking. This design was convenient to this study because it is unethical to randomly assign patients under investigation in the same ward (this may prevent a group of patients from receiving adequate PU prevention and treatment facilities such as protective mattresses), and also because it was not suitable to randomly assign the nurses caring for the same patients, as a team, in the same ward. The great strength of quasi-experimental designs lies in their practicality, feasibility, and to a certain extent, generalizability. The basic difficulties in utilising this design are their relative weakness compared to experimental design: they do not allow the researcher to make

casual inferences and increased threats to internal validity (Talbot 1995) and (Polit and Hungler 1999).

Non-equivalent control group pre-test post-test design was used for the following reasons:

1) It involved manipulation and control of two or more groups of subjects.

2) It assumed that the experimental and control (also referred to as the comparison group) groups are not equal, because of the inability to randomise the subjects (Polit and Hungler 1999).

3) It was often used when it was impossible or unethical to withhold treatment from one or more groups - for example, withholding pressure ulcer prevention measures, then observing whether the patients developed PU or not.

4) This design was suitable to this study. The patients were selected on the basis of specific units within the hospital. They were from three groups called A, B and C. The groups were not equal, as no randomisation among patients was used. Manipulation (treatment or intervention) was applied to groups A and B while group C was left untreated and was referred to as control or comparison group.

The pre-test post-test non-equivalent control group design was used, which indicated data collection from all groups including the control group before and after introducing the manipulation (be it treatment or intervention). This enabled the researcher to improve the level of analysis of results. It showed whether the groups were initially similar in relation to

study variables or not. Furthermore, it allowed the researcher to analyse the differences not only between group scores on the pre-test (before intervention) and post-test (after intervention) but also the differences within group scores on these measures. As a result, the effects of different manipulations such as the Braden scale and training would be separated out. The literature acknowledged the use of this design, which may strengthen the results in a way that controls some threats to internal validity such as compensatory rivalry and demoralisation of control/comparison group subjects (Polit and Hungler 1999) and (Talbot 1995).

A prospective design was utilised in the study. Prospective design starts with presumed causes and then proceeds chronologically to the presumed effect (Polit and Hungler 1999; Talbot 1995 and Seers and Critelton 2001). A prospective design was used in this study because the nature of the phenomena (pressure ulcer development) under investigation required it.

In this study, the patients from groups A, B and C were observed weekly for signs and symptoms of PU development (stage one to stage four). The patients were observed longitudinally, for eight weeks in the pre-test and post-test phases to identify the PU incidence rate. PU incidence is the dependent variable constituting the study's main patient outcome measure. The prospective design allowed the researcher to investigate the presumed effects of introducing the Braden scale (the intervention introduced in group A) and the PU prevention and treatment training in group B (the intervention introduced in group B) on the patients' outcomes in terms of PU incidence rate among the three groups

A, B and C. The literature acknowledged the usefulness of using prospective design in providing evidence about the nature of relationships between variables. Although prospective designs are stronger than retrospective ones, they also entail a loss of follow up of subjects over time (also known as attrition or drop-out), a certain expenditure of time for collecting data, and high costs (Polit and Hungler 1999; Talbot 1995 and Seers and Critelton 2001).

3.2.3 The characteristics of the quasi-experimental design

1) **Manipulation,** which is an intervention or treatment introduced by the researcher in an experimental or quasi-experimental study. The researcher manipulates the independent variable to assess the impact on the dependent variable (Polit and Hungler 1999).

A) Interventions applied to group A

The nurses who provided care to patients in this group received the following interventions:

1. Mandatory wound care management study day. The purpose of this study day was to introduce the nurses to contemporary wound management guidelines, which were essential to care for patients with wounds in their clinical settings. This educational activity was intended to provide the nurses with knowledge and skills about evidence-based wound management practice. This study day included sessions on the normal wound healing process, factors delaying the healing process, strategies of wound assessment and wound management, modern dressings, wound bed preparation and wound cleansing and irrigation. It also included case

presentations. PU management guidelines were an integral part to this study day as well (Appendix D).

2. A PU prevention and management training programme, which was intended to provide the nurses with knowledge and skills about PU prevention and management guidelines. It included PU definition, PU physiology and epidemiology, the chronic wound healing process and factors that delayed that process. The programme enabled the nurses to develop PU prevention and management plans through the utilisation of international PU prevention and management guidelines. The programme included detailed discussions about various RASs such as the Norton, Waterlow and Braden scales (Appendix E).

3. The Braden scale training. Nurses in this group had special training on the application of the Braden scale. The training included presentations, demonstrations and a 23-minutes video about the Braden scale. Thereafter, the nurses were required to use and implement the Braden scale on their patients in the post-test phase. The application of the Braden scale assumed to facilitate the nurses' decision making in relation to PU prevention and management. During this stage, the nurses received motivation, support and guidance from the research team and head nurses.

B) Interventions applied to group B

The nurses who provided care to patients in this group received the following interventions:

1) A mandatory wound care management study day.

2) A PU prevention and management training programme. The nurses in this group did not receive special training about the application of the Braden scale, and they were not required to apply RASs (the Braden scale) to their patients. They had the choice of applying RASs or clinical judgement in relation to PU prevention and management.

C) In group C, the nurses had to attend a wound care management study day. They did not undergo a PU prevention and management training programme or any specific training related to RASs. In this group, the nurses continued with the current practice, which included clinical judgement in relation to PU prevention and management.

2) **Control,** i.e. screening out all extraneous influences on the dependent variable to avoid altering the true relationships between study variables (Polit and Hungler 1999) and (Talbot 1995). In this study, the typical application of the control situation was not feasible because it was impossible to isolate a control group and do nothing to their subjects. In the present case, to evaluate the effectiveness of using RASs (the Braden scale) in group A compared to the effects of the PU prevention and treatment training programme in group B on the patients' outcomes in terms of the PU incidence rate, it would be unethical to offer no prevention care for the control group (the clinical judgement group). Therefore, the study required the need to evaluate the new interventions (the Braden and training programme), not against the total absence of care but rather against a control group receiving different methods of care.

Although the patients from groups A, B and C were not identical, they may have shared some characteristics. The nine wards were randomised by using simple random drawing to

be included in the study groups (A, B or C) that may have strengthened the control of extraneous variables. The application of a non-equivalent control group pre-test post-test design may also support the control on extraneous variables as well.

3.3 Setting

This study was conducted at Riyadh Military Hospital (RMH), formerly Riyadh Kharj Hospital (RKH), which is located in Riyadh, the capital of the Kingdom of Saudi Arabia (KSA). The RMH is a flagship of the Medical Services Department (MSD) of the Ministry of Defence and Aviation (MODA). The RMH was officially opened in December 1978. It provides a major portion of the primary, secondary and tertiary medical services for military personnel and their families in the KSA. The RMH includes 1,192 beds distributed in the following wards: Emergency, Gynaecology, Theatres, Neonatal Intensive Care Unit, General Intensive Care Unit, Royal Intensive Care Unit and Medical-Surgical Wards (Appendix F) and 158 beds in Cardiac Centre. There are 7,179 staff in the RMH, one third of whom are nurses from more than 30 different nationalities (RMH 2005). The occupancy rate is nearly 100 per cent and average daily admissions for medical-surgical wards account for 12 to 15 patients. The nursing department at the RMH applies a hospital-wide policy and nursing standards integrated with well-established staff development programmes including mandatory study days that control promotion, hiring and career development. A wound care study day is mandatory for medical-surgical staff, as patients admitted to medical-surgical wards at the RMH show higher rates of PU than other wards. The subject of PUs was not studied either at local RMH or at national level. Nine medical-surgical

wards were selected purposively by the administrators and the researcher for research programme: Female Medical, Neurosurgery, the Isolation Ward, Male Medical, Ortho-Spinal Surgery, Medical-Surgical VIP, Oncology, General Rehabilitation and the Renal ward. These wards were divided randomly into three groups (A, B and C) by simple random drawing. These wards were selected from the RMH because they had shown a high PU rate (Table 1.1) the patients shared some aspects of their nature and backgrounds despite the wards representing different medical specialities, and because, as regarding administrators, these wards were the main areas requiring the reduction of PU incidence rates. More detailed descriptions of the selected wards can be found in (RMH-Nursing Administration/Nursing Unit Profile 2005).

3.4 Sample

This term refers to a subset of the units that compose the population (Polit and Hungler 1999). Sampling designs can be grouped into the categories of probability and nonprobability sampling. Probability sampling involves random selection in choosing elements of the population, while in nonprobability sampling the elements are selected by non-random methods. Probability sampling is the more respected of the two approaches because greater confidence can be placed in the sample's representative nature (Polit and Hungler 1999) and (Talbot 1995). Since the aim of the study was to investigate the effects of RASs on the patients' outcomes in terms of PU incidence among hospitalised patients at the RMH, a non-probability purposive sampling design was used. It was based on the understanding that the researcher had the background knowledge and experience about the

population and the issue under study to select the subjects in the sample. Purposive sampling has been used in certain situations such as the evaluation of newly developed instruments and cases when the researcher wants a sample of experts' opinion (Polit and Hungler 1999) and (Talbot 1995). This sampling design was used because of the nature of the phenomena under study. The investigation concerns the effectiveness of new interventions (the Braden scale) on the patients' outcomes in terms of PU incidence rate. Therefore, a certain population based on nurses' experience with PU to produce better responses was needed. Although probability sampling provides better representativeness due to randomisation, it was not chosen for this study, as many irrelevant subjects might have been included, resulting in flaws and inappropriate outcomes. For example, randomisation of the hospitalised patients at the RMH may have given paediatric and maternity patients who may not have had the same level of PU risk, and whose nursing staff do not have the experience in PU prevention and management, the chance to participate. The use of nonprobability purposive sampling involved the selection of nine Medical-Surgical wards with 237 beds and 264 nursing staff for investigation. These wards were believed to include patients whose health conditions were stable compared to those from critical care units, in order to facilitate the follow up of patients over the eight week observation period. Additionally, it decreased the drop-out (attrition) rate among patients due to death, transfer or discharge. The purposes of selection of these nine medical-surgical wards was considered and discussed earlier in section 3.3

Since the study design was a non-equivalent controlled group design, the nine medical-surgical wards were divided into the three groups A, B, and C. Each group included three

wards assigned by the probability simple random drawing method. Groups A and B were interventional and group C was the control, thus strengthening the monitoring of external factors which may have affected the subjects within groups. Group A included the Isolation Ward, Male Medical and Ortho-Spinal Surgery; Group B included General Rehabilitation, the Renal Ward and Neurosurgery; Group C included the Female Medical Ward, Medical-Surgical VIP and the Oncology Ward.

Eligibility (inclusion) criteria were developed to define the study's population. In order to be included, the patient should have been hospitalised or newly admitted for hospitalisation and conform to a cut off score of ≤ 18 according to the Braden risk assessment scale, and/or have been admitted for hospitalisation with a PU of stage one to stage four according to the AHCPR classification system (1992). The development of such criteria may enhance a homogenous sample as a means of controlling external factors. The nurses who provided care for these patients were asked to complete a clinical judgement rating scale, which describes the nurse's decision on the patient's risk of PU development. The participant nurses were introduced to the study's purpose and were informed that participation was optional and information would be kept anonymous and confidential as per research protocol and best practice guidelines (Polit and Hungler 1999).

Sample size estimation by the use of the power analysis procedure

Estimation of the sample size is one of the major concerns for researchers, especially the estimation of a sufficient sample size needed for the study to demonstrate significant

results. The power analysis procedure is a method for developing sample size estimates (Polit and Hungler 1999). There are three requirements for estimating sample size by using the power analysis procedure: the significance criterion (α); the population effect size; and power (1- β). In this study, α (the risk of Type I error) was specified to 0.05 as a standard for α criterion; power (1- β) was established for 0.80; and the population effect size as medium (0.3) according to Polit and Hungler (1999). When these parameters were entered in the G POWER test (Faul and Erdfelder 1992), the results of the power analysis showed that the required sample size is 108 patients. This figure was arrived at by using an x^2 test, *d.f.* =2, critical $x^2 = 5.99$, and actual power = 0.80 (Appendix H). Although 108 patients were needed for the study, more patients were included to produce more significant power and reliable findings. 719 patients took part in this study, 225 patients from group A, 228 patients from group B and 266 patients from group C. Of the sample, 521 patients completed eight weeks' observation and 198 patients did not. Of those who did, 265 patients were in the pre-test phase and 256 patients in the post-test.

3.5 Instrument

A systematic data collection instrument was developed. The instrument (Appendix I) consisted of the following data collection tools: the Braden scale for pressure ulcer risk assessment, the rating scale of the nurses' clinical judgement, and the pressure ulcer wound assessment and wound management checklist. This instrument was integrated with two written sets of questions to cover one session of focus group discussions. The instrument was constructed in this manner to facilitate the collection of appropriate and relevant data

consistent with the nature of the phenomena under study, and to capture all variables of interest. The areas assessed were PU incidence, PU risk assessment, nurses' clinical judgement for those patients at risk of PU development, PU wound assessment and PU wound management. It also covered the views of nurses who applied the Braden risk assessment scale to their patients in clinical areas.

3.5.1 RASs (The Braden scale)

RASs are structured models consisting of categories of factors that are associated, to varying degrees of reliability, with PU development (Scott 2000) and (Day et al. 1997). RASs were believed to be a useful and practical method to encourage evaluation and facilitate clinical decision making in order to provide pressure relief devices (Flanagan 1995; Maylor 1999 and Tannen et al. 2004). Numerous RASs have been developed. However, none are perfect, as their predictive validity is doubtful, and comparison standards between the scales are absent (Anthony et al. 2004). The inconclusiveness of studies examined the predictive validity of RASs made the choice of a definitive RAS impossible (Flanagan 1995).

Following the RASs review, a well known risk assessment scale (the Braden Scale) was used to assess the patient's risk of PU development (Appendix J). The Braden scale was devised in the USA by Braden and Bergstrom in 1986. It consisted of six categories of risk factors (risk indicators): sensory perception, moisture, activity, mobility, nutritional status and shear/ friction. In the categories of nutrition and sensory perception, there were two

layers of potential responses. Most identified risk factors were rated between 1 (the least favourable) to 4 (the most favourable) except for friction/shear, which was given a maximum rating of 3 .The possible scores ranged from a maximum of 23, representing the lowest risk of PU development, and six, representing the highest risk (Flanagan 1995). Subsequent studies suggested various threshold scores; a cut off score of ≤18 was used in this study to consider patients at risk of PU development. The cut off score ≤18 was found the most predictive score in black patients who were 75 years and older as mentioned by Brown (2004), and as shown in Pancorbo-Hidalgo et al. (2006), who reviewed the use of the Braden scale in long-stay patients in elderly care centres. The Braden scale was chosen for this study because it was based on a theoretical model and because it had been tested extensively in different clinical settings and among different patients' groups. Nevertheless, numerous studies revealed a poor predictive validity for this scale. It was, however, suggested by others as having reasonable sensitivity and specificity compared to currently available scales (Bergstrom et al. 1987; Reed et al. 2001; Brown 2004 and Pancorbo-Hidalgo et al. 2005). It was also chosen because the risk factors indicated by the scale were described and operationally defined. A written permission to use the Braden scale was secured from the authors (Appendix K).

3.5.2 Clinical Judgement rating scale

A clinical judgment rating scale was devised (Appendix I). The nurses were asked to complete the CJ scale and to decide whether the patient was at minimal, moderate, high or severe risk or not at risk according to their experience with patients at risk of PU

development. The rating was completed immediately following research teams' assessment, and placed in the patient's record. The rating was done at the nurse's convenience in the clinical areas. Members of the research team were available for assistance and support.

3.5.3 PU wound assessment and wound management checklist

A checklist for PU wound assessment and management was developed and was based on the current literature (Lindholm 2003; Banks 1998; Thomas 1994; Cutting and Harding 1994; Amanda 2000; Dealy 1994; Manning 1997; and Ramstadium 1999). Wound management experience and available forms of wound assessment and wound management at the RMH were also considered in developing the checklist. This checklist served to ensure the continuity of care to those patients who were admitted with PU and/ or developed PU (referred to as NCPU); to record factors associated with those defined by the study, which may explain variations in PU incidence among different groups such as gender, age and medical diagnosis; and to provide objectivity of the data collected and to eliminate subjectivity as much as possible (Appendix I). The checklist consisted of the following sections:

A. **Patients' general characteristics**, including hospital file number, ward, room number, date of admission, gender, age, and diagnosis.

B. **PU wound assessment**, which included the following:

1. The AHCPR (1992) classification system, used to assess patients' skin. This classification system was consistent with the recommendations of the NPUAP Consensus Development Conference (1989). It was derived from the previous staging system proposed by Shea (1975), the Wound Ostomy and Continence Nurses Society (WOCN) and the International Association of Enterostomal Therapy (1988). It classifies PU in four stages (Appendix L), which were described in chapter 2 (section 2.2). The research team recognised, in relation to the PU classification system, that inpatients with darker skin, discoloration of the skin, warmth, oedema, induration, or hardness of the skin were considered as indicators of stage one PU, and that special consideration was given to patients with casts, orthopaedic devices and support stockings.

2. PU location

   The following anatomical areas were identified: occiput, sacrum, trochanter, ischium, shoulder, heels, elbows, toes, ears, spine, knees, ankle, buttocks, lower legs and metatarsum. The research team specified other observations related to location, including the lack of an evident open wound, for example, stage one with non-blanching erythema of intact skin and /or non specific PU wound area.

3. PU wound size

   The research team was requested to specify the wound measurements if there was an open wound (Stage two, three or four). The wound size was specified by length and width in centimetres (referred to as cm.). The same nurse performed wound measurements to maximise objectivity.

4. Wound tunnelling, undermining and/or sinus formation was assessed. The research team indicated whether undermining was present or not and stated the depth of the undermining wound.
5. Wound necrosis was assessed according to the presence or absence of invisible necrosis or dead tissues, non adherent yellow slough, loosely adherent slough, adherent soft black eschar and/or firmly adherent black eschar.
6. Wound exudate was assessed as to whether it was small, moderate or heavy.
7. Wound assessment also included slight, moderate, or offensive odour.
8. Wound assessment included assessment of whether wound granulation was dusky and pale, bled readily and/or was over granulated.
9. Wound epithelialisation was assessed for pale and dullness, tissue maceration, and/ or fragile and dry wound lining.
10. PU wounds were assessed for scab and/ or hypertrophic scar formation.
11. The patient was assessed for wound pain. He or she was asked to indicate whether the pain occured only at the dressing change, was continuous, or was related to any other source.
12. Wound infection assessment included swab culture (e.g. bacterial, viral, or fungal infection) and local signs and symptoms of wound infection such as hotness, redness, pain, and/or induration.

C. PU Wound management

1. The dressing modality used in the management of PU wound was monitored, including primary dressings such as alginates, hydrocolloids, hydrogels,

hydrofiber, foam and silver-based dressings as well as VAC therapy and medicated wound creams and ointments.

2. Surgical intervention was recorded for wound debridement, PU flaps and/or surgical PU grafts.
3. The patient was monitored for protective measures. This included the following categories:

a) Protective mattresses such as Standard hospital bed mattress (Stryker®, Inc. Canada), Alternating pressure relief system, (Therakair®, Kinetic Concepts, Inc. USA), (Gen Air 8000®, Genadyne, Inc. USA) (Atmosair®, Kinetic Concepts, Inc. USA) and Gel overlay or Air Fluidised Bed (Clinitron®, Hill-Rom, Inc. USA).

b) Skin barriers cream.

c) Vitamin supplements and special nutritional formulas.

d) Patients' turning (positioning) schedules every 2, 3 to 4, or 6 hours.

3.6 Choosing and training the research team

The data were collected by the researcher, who was the Tissue Viability Nurse Specialist (TVNS) at the RMH, and two staff nurses. It was not feasible for the researcher to collect all the data. Hence, two staff nurses have been recruited to the project. Both nurses had medical-surgical nursing experience of six to eight years, as well as being available as part of the RMH nursing team. The two staff nurses received training before they started the actual data collection. They attended the wound care study day, research training

(Appendix M), PU training and the Braden scale training. They were subsequently instructed to the data collection protocol which included patient observation according to the instrument, data recording, data filing and the patient follow up procedure.

Special consideration has been given to the PU classification system, skin assessment and PU location in order to validate the primary outcome measure (PU incidence Stage one to Four) as follows:

- The researcher emphasised the central objective of the investigation to the two nurses who were involved in identifying and classifying PU (Stage One to Four) Therefore, the training courses (mandatory wound care management, PU prevention and treatment and PU risk assessment scales), which included theoretical and practical sessions, have addressed PU staging to satisfy this objective.
- The methods used in the research teams' training included case studies, PowerPoint presentations, video tapes, CDs, internet access to NPUAP and EPUAP and demonstration in clinical wards. About fifty pictures representing different PU stages from patients in RMH were used to develop competency in PU classification by using AHCPR (1992). Demonstrations on patients were conducted, and they were given the opportunity to implement a trial on a group of patients, by undertaking skin observation, inspection and palpation.

- The research team nurses attended TVNS clinical rounds and demonstrated knowledge and practice of PU classification on a daily basis over three months prior to the start of data collection.
- The research team nurses had the ability to distinguish Stage One PU by using a transparent pressure disk, identify the blister formation as Stage Two PU, define involvement of subcutaneous tissues as Stage Three PU and inspect wound tunnelling and sinus formation in Stage Four PU. They also were able to define Stage One PU in dark-skin patients as well as to differentiate between PU and continence ulcers by using EPUAP (1998) guidelines.
- At the end of three months training period, the research team nurses demonstrated independently a satisfactory level of agreement with TVNS's PU classification as they asked to perform PU classification on a group of medical-surgical patients under direct supervision of the TVNS.
- The research team nurses worked closely with the TVNS to collect the data. The patients were initially inspected by the TVNS for skin changes and PU incidence (Stage One to Four) and discussed verbally with the research team nurses, then they performed patient assessments including PU staging. In cases of difficulty and/ or discrepancy in staging, the patient re-assessed and discussed by the team nurses together with the TVNS and then a consensus approach was adopted between the three data

collectors. AHCPR (1992) and (Appendix L) which represents PU classification in RMH have been used as a reference. The TVNS was available closely to the research team nurses to offer them hand-to-hand assistance and support.

3.7 Ethical considerations

Ethical approval was obtained from the Research and Ethics Committee at the RMH (Appendix N), project number 292/2004, and from the Ethics Committee of the Faculty of Health and Life Sciences at De Montfort University in 2004 (Appendix O). Furthermore, written permission from Braden and Bergstrom was obtained to utilise the Braden scale (Appendix K). For purposes of continuity of care, ethical access was considered for those patients involved in the study. The patients were provided with a standardised care irrespectively of whether they developed PU or were admitted with PU by medical and nursing teams. The researcher safeguarded the confidentiality of the participants, whether patients or nurses, by assigning them with identification file number rather than using their names to access actual research information, which was restricted to the research, medical and caring teams. Patients signed a hospital consent form on admission. Written consent was obtained from the patients before they were included in the study. The consent form was signed, in many cases, by a family member who attended the patient, as many participated patients were elderly and/or unconscious. It should be noted that, due to cultural conditions in Saudi Arabia, family members (head of family) are allowed and

authorised to give consent on behalf of their relatives, and the husband is authorised to give consent on behalf of his wife and/or any members of his family. Verbal consent was then obtained from the participant patient or family member every time the patient was accessed for observation.

The aims of the study and the expected benefits were discussed with nursing administration staff. Written consent was then obtained from the head nurses of the participating wards. The nurses who participated by providing their clinical judgement gave their consent verbally. They were given an overview about the study's objectives and benefits, and they were made aware that the research team would check the patients and records unexpectedly. Participation in the study was voluntary. The participants were free to leave the study at any time, and patient participants could refuse inspection by the research team. The nurses who participated in the study were supported and motivated by the research team, head nurses, and nursing administration. The participant nurses were given a day off duty and certificates of participation as incentives.

The wards under study were not anonymous, as the clinical areas in the RMH are divided into single medical specialities, which made it difficult not to identify the wards under study.

3.8 Pilot study

Polit and Hungler (1999) define a pilot study as a small-scale version, or trial run, done in preparation for a major study. It allows the investigator to determine the reliability of the measuring instrument (Talbot 1995).

One Medical-Surgical ward was chosen by the researcher to conduct the pilot study. This ward was a non participating ward in the study. It had 28 beds and provided care for male and female patients of various medical and surgical diagnoses. A written consent was secured from the head nurse of the ward (Appendix P).

Ten staff nurses from this ward were selected by the nurse in charge and the researcher according to their availability on the weekly rota. The selected nurses were asked to perform the Braden assessment once on a single selected patient. The ward staff were involved in group A training, and they received the mandatory wound care management study day, PU prevention and treatment training, and special training on the application of the Braden scale. The nurses were motivated by the researcher's and nursing administration's team to be provided certificates of participation and one day off.

The nurse in charge was asked to choose the patient. Since this patient was unconscious, a written consent was obtained from the patients' family member (the head of family). The chosen patient was examined for eligibility by the researcher (TVNS) and the following information was obtained: the patient was female, 63 years old, bed-ridden, unable to move

in the bed, received feeding via NGT (Naso-Gastric Tube), was incontinent, unable to respond meaningfully to surroundings, and required maximum assistance to move in bed. The patient was free from PUs (Stage one to Stage four according to AHCPR (1992). Moreover, when the Braden scale was applied by the TVNS, it showed that the patient was at severe risk of PU development.

3.8.1 Piloting procedure

The procedure was explained both to the family member who attended the patient and to the selected nurses. As the nurses were on 12 hours' duty, piloting was carried out twice; the first group, including five morning shift nurses, were asked to perform the Braden assessment on the assigned patient independently and under the indirect supervision of the researcher. The nurse who finished the assessment was instructed by the nurse in charge to have a break for 20 minutes outside the ward. The second group, which also included five evening shift nurses, were asked to do the same. The nurses were cooperative. The Braden assessments were returned independently to the researcher. The subsequent inspection of the patient did not bring to light any deficiency in the patients' care.

3.8.2 Pilot study analysis

Inter-rater reliability of the Braden assessments revealed 100 per cent agreement among the participating nurses that the elected patient was at severe risk of PU development. The analysis of participants' responses among the Braden risk factors showed that most of the

assessments were in agreement with the assessment produced by the researcher. It described the patient as having very limited sensory perception, constantly moist skin, being bedfast and completely immobile, receiving adequate nutritional supply, and suffering from shear/friction. The verbal feedback given by the participants after the piloting procedure was transcribed by the researcher thus: The Braden scale could be used to assess patients' risk of PU development. It was not suggested that any categories or risk factors be added to the scale. It was comprehensible and easy to use and training was essential for proper application. Additionally, the Braden scale was helpful in determining patients at risk and in prioritising prevention facilities.

3.9 Reliability of the Braden scale

The reliability of an instrument refers to the degree of consistency with which it measures the attribute under study (Polit and Hungler 1999). The reliability can be assessed in the following ways:

1) Stability refers to the extent to which the same results can be obtained from repeated applications. This can be evaluated by the test-retest procedure.

2) Internal consistency means the extent to which different parts of the instrument are equivalent in terms of measuring the critical attribute. It can be evaluated by using the split-half technique or coefficient alpha (Cronbach's alpha and the Kuder-Richardson formula 20).

3) Equivalence requires determining the consistency of the instrument in yielding measurements of the same traits in the same people. This approach is used when different observers are using the same instrument to measure the same phenomena at the same time. Equivalence can be estimated by inter-rater (or inter-observer) reliability.

In this study, the equivalence approach was used to estimate reliability of the Braden scale because two data collectors collected the Braden scores from the whole sample independently and simultaneously, and also because this approach is typical to observational studies, where there is a greater burden on the observer to produce observation bias or error. The Braden scale has never been used before in the RMH, which raises the need to minimise the possibility of error between data collectors when assessing the risk of PU development by using the Braden scale. Hence, the reliability of this scale should be estimated.

The inter-rater reliability of the Braden scale was supported in the pilot stage, where ten nurses assessed one selected patient in the medical-surgical ward.

Since the reliability of Braden scores depends on the nurses who apply it, the participant nurses at the pilot stage received training about the Braden scale; this enhanced the accuracy of their ratings.

The inter-rater reliability was computed as a function of agreement between nurses' observations. The results indicated 100 per cent agreement that the observed patient was at severe risk of PU development using the Braden scale, which in turn agreed with the researchers' (TVNS) assessment. It should be noted that, although the nurses agreed that the assessed patient was at severe risk as shown by total Braden scores, there were tiny differences such as mobility and sensory perception among the Braden sub-scores. As a result, the reliability of the Braden scale in the RMH showed acceptable levels of variation, which is in agreement with those estimates reviewed in the literature. For example, Pancorbo-Hidalgo et al. (2006) reported high (Pearson's *r*: 0.83-0.99) inter-rater reliability from 22 studies reviewed the Braden scale.

3.10 Validity of the Braden scale

Polit and Hungler (1999) defined validity as the degree to which an instrument measures what it is supposed to be measuring. There are different aspects of assessing the validity of an instrument:

1) Face validity, which refers to whether the instrument appears to be measuring what it is supposed to.

2) Content validity, which evaluates the adequacy of items included in an instrument for the construct that is being measured. It is based on the judgement made by a panel of experts.

3) Criterion-related validity, which establishes the relationship between the instrument and certain criteria. It shows whether the instrument is a useful predictor of subsequent behaviours or conditions.

4) Construct validity is concerned with the attributes of the instrument rather than the scores it produces. The two main approaches to assessing construct validity are known-group technique and the examination of the relationships between the instrument's attributes based on theoretical predictions.

In this study, experts supported the face and content validity of the Braden scale. It was judged by the research supervisors, members of the wound care committee and the nursing administration team in the RMH. All of them acknowledged the usefulness of using the Braden scale in PU risk assessment.

The literature provided a greater supporting degree of evidence on the Braden scale application. Numerous studies reviewed the validity of the Braden scale and the literature acknowledged it as having optimal validation. Among RASs, the Braden scale was the most extensively studied tool. Pancorbo-Hidalgo et al. (2006) systematic review of 33 studies showed 22 with validation data on the Braden scale. They added that this scale was tested in different clinical settings and was found to embody reasonable sensitivity and specificity measures. The Braden scale was also supported to a greater degree of validity evidence by Bergstrom et al. (1987); Reed et al. (2001), Brown (2004) and Halfens et al. (2000).

Based on findings in the literature, no attempt has been made to revalidate the Braden scale, which was employed in this study as a valid PU risk assessment tool. Consequently, other means of validity measures such as criterion-related validity and construct validity were not supported.

3.11 Data collection

In coordination with nursing administration and head nurses of the participating wards, a three-phase plan was developed to collect the data from 1st February 2006 to the end of February 2007; each phase was extended for at least four months to give time to obtain a larger sample size. The data collection process included implementation of the study instrument which was described earlier in this chapter in section 3.5.

The following points should be considered in order to obtain a better understanding of the data collection process:

1) The data were collected from inpatients and newly admitted patients.
2) The patients who met the inclusion criteria of Braden scores ≤18 and/or had PU (stages one to four according to AHCPR (1992) were included in the study.
3) Every patient included in the study was observed every week for eight weeks. Longer observation periods were avoided due to the probable degradation of data quality with the passage of time.

4) Every patient included and completed eight weeks observation in the period from February 2006 until September 2006 has been considered as a pre-test patient.

5) Every patient included and completed eight weeks observation in the period from October 2006 until March 2007 has been considered as post-test patient.

6) All patients included at the beginning of the study who did not completed eight weeks observation because of death, transfer to a non-participating ward or discharge from hospital were dropped from the survey and put in a separate category as excluded patients. The patients who were admitted with PU and then attained Braden scores of more than 18 during the eight weeks observation were also excluded.

The phases of the data collection process were as follows:

1) Phase One included pre-test data collection. During this phase, the patients were included in the study from the first of February 2006 until the end of June 2006. The patients who were included by the end of June 2006 completed the eight-week observation period. The data was collected from 265 patients in this phase.

2) Phase Two included implementation of the interventions (manipulations) to

different study groups (A, B, and C) as described earlier in this chapter in section 3.2.3. This phase extended from July 2006 to September 2006. It also included data

collection from those patients who were included at the end of phase one and had not completed eight weeks observation.

3) Phase Three was extended from the first of October 2006 to the end of February 2007. During this phase, the data was collected after the nurses applied the Braden scale to their patients from group A, and included post-test data collection. The Braden scores independently produced by ward nurses in this phase were separated and kept in patients' hospital files. The data was collected from 265 patients in this phase.

During the first round of data collection, verbal consent was obtained from the head nurse and nurse in charge of participating wards. Verbal consent was obtained individually from inspected patients or a family member every time the patient was inspected.

The decision as to which patients were included was made after Braden scores were obtained from, and skin assessment of pressure points was performed on, all patients in the wards under investigation at the beginning of the first and third phases of the study. Data from the included patients and from newly admitted patients was then collected throughout the study. Detailed PU wound assessment of those patients who were included and had stage one to four PU was carried out by using the PU wound assessment checklist.

All patients' assessments were produced by the research team in the presence of the ward nurse. Each patient had an individual study record, which included Braden scores, a protective measures record and a checklist of wound assessment and wound management if

they had PUs. All patients' records were kept in the research teams' office, including those for patients dropped from the study.

Patients included in the study were observed weekly for eight weeks for Braden scores, skin assessments, protective measures, and wound healing in patients with PUs. During the visits, the routine nursing care was followed and PU prevention plans were not replaced by the research team, unless they were consulted to do so. Among those patients with PUs, regular wound care protocols were followed.

When patients developed new PUs (NCPU) (stage one to stage four PU according to AHCPR (1992)) at any time in the observation period, the ward nurse was informed and these changes were added to the observational checklist. The patients who developed new PUs continued a weekly assessment until they completed eight weeks observation.

The incidence rate was calculated according to Fletcher (2001) who defined it as the percentage of patients who develop a condition within an at-risk population. The operational definition of PU was the presence of Stage One PU at least once during the observation period, as mentioned by Halfens et al. (2000); if the patient developed more than one PU lesion, only the first one was taken into account.

The research team discussed patients' conditions when there were conflicts regarding PU staging and wound assessment.

Data collection methods

The data collection methods included structured observation to gather clinical data from patients, the self-report method to obtain nurses' clinical judgements regarding patients, and focus group discussion with selected nurses from group A to consider their views of the Braden scale.

1) Structured observation

This is a systematic method of selection, observation and recording of behaviours, events and settings relevant to a problem under investigation (Polit and Hungler 1999) and (Seers and Critelton 2001). The patients' observations included clinical data using the structured observational checklist. The observed data included Braden scoring, skin inspection, protective measure recording, and when there was PU wounds, wound assessment and wound management.

Observation procedure was performed according to a programmed plan by the research team; the participating wards were scheduled for unannounced visits.

2) Nurses' Clinical Judgment

The self-report method was used to gather nurses' clinical judgement of PU risk assessment. Verbal consent was obtained from head nurses of the participating wards and the participants on every occasion. A clinical judgment rating scale was introduced. Ward

nurses were asked to decide the patients' risk of developing PU without knowing patients' Braden scores. The Clinical Judgement rating scale was administered by ward nurses and supported by the research team. This scale included a cover letter which introduced and clarified the aims of the study, as well as instructions on how to fill out the rating scale appropriately. The rating scale consisted of the two extremes of no risk and severe risk of PU development, and the nurses were asked to indicate each patient's risk on this scale. The completed questionnaires were thereafter returned to the research team who were available to offer assistance and support.

3) Focus group discussion

A self-report method was used to obtain nurses' views on the application of the Braden scale after the data collection was completed. The focus group discussion method was acknowledged in the literature as a technique that is becoming increasingly popular in the study of health problems (Polit and Hungler 1999). A structured self-report method was used to encourage respondents to define and elaborate different aspects of the study. Ten nurses were chosen from Group A wards to participate in the discussion. They were recruited by the head nurses of the participating wards who asked for interested staff to participate, and the first ten nurses were selected. The interviewer (TVNS) was the moderator of the discussion and he guided it according to a written set of questions which had to be covered. The discussion was about 90 minutes long. Among the points for discussion were the following:

1) Evaluate the concept of risk assessment in PU prevention and the PU management programme.

2) Did the application of the Braden scale made any difference to PU prevention and management?

The interviewer transcribed the notes from the participants' responses and from supplemented transcripts of participants' own notes. The interviewer thereafter included a summary of the important responses, which gave participants the opportunity to clarify, refine and correct some of their responses. The main advantages of this method were that it was flexible, that many views were explored in a short period of time, and that it gave the opportunity for participants to share their clinical experience which could not have been gathered via the questionnaire.

3.12 Data analysis plan

The data analysis is designed to test the hypotheses and aid data interpretation. It answers three questions addressed through this study about the following: 1) The effects of RASs (the Braden scale) on PU development. 2) The effects of PU prevention programme. 3) The effects of RASs (the Braden scale) compared to effects of nurses' CJ on PU development. Data were analysed by using descriptive and inferential statistical procedures (tests). The descriptive analysis aimed to describe the frequencies, measures of central tendency and measures of dispersion for personal and demographic characteristics of the patients. The inferential statistics may be parametric or nonparametric. Parametric tests assume data are

normally distributed and there may be other limitations. Nonparametric tests have fewer requirements or assumptions about population characteristics and most importantly do not assume a normal distribution (Pagano 1986). The main reasons for preferring parametric to nonparametric tests were that the parametric tests were more powerful and more flexible than nonparametric tests, and where appropriate parametric tests were employed. While parametric tests are robust to violations of underlying assumptions, nonparametric tests were used when there was extreme violation of an assumption of the parametric test or where nominal data were being analysed.

Chi-square test was used to test independence of nominal variables. Student *t* test for independent groups and one way ANOVA were not used to test differences between respectively two or more than two groups because the data were not normally distributed.

Mann-Whitney *U* (MW) test and Kruskal-Wallis (KW) test were used to test differences between respectively two or more than two groups with data that were at least ordinal, but not sufficiently normally distributed to warrant parametric testing

Logistic regression analysis was used to produce a predictive model from those recorded variables which are related to PU development. It identified those variables that best explained the occurrence of PU. Logistic regression analysis shows the significance of individual predictor variable and provides a coefficient estimation (*B*) associated with each predictor, which shows the nature of the relationship. Moreover, it provides estimates about the odd ratios (OR) of predictors, which indicates an estimate of relative risk (the risk of the

event occurring in a given condition, versus the risk of it occurring in a given different condition).

While sensitivity and specificity, important measures of a risk tool, are highly dependent on the particular threshold employed, the Receiver Operating Characteristics (ROC) curve analysis enables the researcher to decide whether the RASs (the Braden scale) performance is superior or equal to CJ performance in terms of PU development. The ROC curve analysis draws a graphical plot of sensitivity and specificity of the scores at each possible threshold compared to a reference line, which evaluates the predictive performance of both scales by a given area under the ROC curve. As a result, the findings of the ROC are crucial to select the possibly optimal tool in performing PU risk assessment. ROC curve analysis was used to show the effects of the Braden scale compared to nurses' clinical judgement in relation to PU development, which answers the third question in this study whether there is a difference between using the RASs (the Braden scale) and CJ on patients' outcomes in terms of PU reduction.

All statistical procedures used Statistical Package for the Social Sciences (SPSS).

3.13 Summary

This chapter introduced the study's methodology. A quantitative quasi-experimental design was used. It included a non-equivalent pre-test post-test controlled groups design to

examine the hypotheses and to achieve the aims of the study. The characteristics of quasi-experimental design were discussed; these included manipulation and control of extraneous variables that might distort the relationship between the use of RASs and PU incidence. The study was conducted in the RMH-Saudi Arabia and included 719 hospitalised patients from nine medical-surgical wards; patients were chosen according to eligibility criteria. The instrument included the Braden scale for PU risk assessment, a rating scale to assess nurses' clinical judgement and a checklist to assess PU wounds and to monitor PU wound management. The data was collected by the researcher (TVNS) and two trained staff nurses who were employed in the wound care management team. Ethical access was considered by research and ethics committee in the faculty of Health and Life Sciences at De Montfort University, and by the research committee in the RMH. Consent was also obtained from the authors of the Braden scale. A pilot study was conducted on ten nurses from a non-participating medical-surgical ward to support the Braden scale's reliability and to review the adequacy of the data collection plan. Integrated methods of data collection were used, including patients' observation and nurses' self report. A data analysis plan considered hypotheses testing and interpretation of the findings.

Chapter Four: Findings

Introduction

This chapter describes the findings of the effects of using the Braden scale for PU risk assessment compared to the effects of clinical judgment and training on patient outcomes in terms of PU incidence. It thereby supports and enables nurses to provide better PU management practices.

This chapter includes both descriptive and inferential statistical procedures. The descriptive statistics (Appendix S) include frequencies and percentages to describe the data, and is divided into four main sections: general characteristics of the sample, which includes type, group, age, gender, and diagnosis; PU incidence, prevalence, PU stages and PU location; protective measures, including protective mattresses, patient turning, creams and skin barriers, and vitamins; and the Braden scores and nurses' CJs.

The inferential statistical procedures include the Chi-Square (x^2), Kruskal-Wallis (KW) and Mann-Whitney (MW) tests to examine the effects of the Braden scale, training and nurses' clinical judgements and other recorded variables on PU incidence among different patient groups and within the pre-test and post-test data. Logistic regression analysis is also used to predict the factors that contribute to PU development. Receiver operating characteristic Curve (ROC) analysis is used to represent the predictive performance of the Braden scale

and nurses' CJs on PU development. Analysis outcomes are presented in tables, figures, box plots, histograms and bar charts.

The results show that of the total number of patients observed throughout the study (719 patients), 72.4 per cent (n=521) of the patients completed the eight week observation period and 27.6 per cent (n=198) did not complete this period because of discharge, transfer or death. Of the patients who did complete the period, 265 were observed in the pre-test and 256 in the post-test phases. 31.3 per cent (n=225) of the patients were from Group A, 31.7 per cent (n=228) from Group B and 37 per cent (n=266) from Group C.

4.1 Pressure ulcers incidence

The PU incidence rate (referred to as Nosocomial PU (NCPU)) is defined in chapter three (section 3.11). Of the sample, 22.9 per cent (n=165) of the patients developed Stage One to Four PUs. The findings showed that 31 per cent (83 of 265) of the NCPU developed in pre-test while only 19 per cent (49 of 256) developed in post-test (Table 4.1).

Table 4.1 Pressure ulcer incidence in Pre-test and Post-test phases

Study Phases	Frequency		Percent
Pre-test	0*	182	68.7
	1*	83	**31.3**
	Total	265	100.0
Post-test	0	207	80.9
	1	49	**19.1**
	Total	256	100.0

*Notes: 0 = Patients who did not develop PUs (Stage One to Four) over eight weeks observation
1 = Patients who developed PUs (Stage One to Four) over eight weeks observation

In GA, 24.4 per cent (55 of 225 patients) were reported with NCPU, in GB 23.7 per cent (54 of 228 patients) were reported with NCPU and in GC 21.1 per cent (56 of 266 patients) (Table 4.2).

Table 4.2 Pressure ulcer incidence in the study groups

Study Groups		Frequency	Percent
Group A	0*	170	75.6
	1*	55	**24.4**
	Total	225	100.0
Group B	0	174	76.3
	1	54	**23.7**
	Total	228	100.0
Group C	0	210	78.9
	1	56	**21.1**
	Total	266	100.0

*Notes: 0 = Patients who did not develop PUs (Stage One to Four) over eight weeks observation
1 = Patients who developed PUs (Stage One to Four) over eight weeks observation

Although similar PUs incidence rate has been reported between groups in the overall sample (Table 4.2), it was different when the data were divided into pre-test and post-test phases (Table 4.3). Similar PU incidence rates were reported in Group A and B in the post-test phase (21.6 percent and 22.4 percent respectively), and in Group C only 15.1 percent of the patients developed PUs in post-test phase.

The results also showed reduction of PU incidence rate in the study groups in the post-test phase compared with pre-test phase. 32.4 percent of GA patients developed PUs in the pre-test phase compared to 21.6 percent in the post-test, 29.7 percent of GB patients developed

PUs in the pre-test compared to 22.4 percent in the post-test, and 31.6 percent of GC patients developed PUs in the pre-test phase compared to only 15.1 percent in the post-test phase which demonstrated significant decrease of PU incidence rate in GC compared to changes in other groups in the post-test phase.

Table 4.3 Pressure ulcer incidence in the study groups and in the study phases

Study Groups	Study Phases		Frequency	Percent
Group A	**Pre-test**	0*	53	67.1
		1*	26	**32.9**
		Total	79	100.0
	Post-test	0	58	78.4
		1	16	**21.6**
		Total	74	100.0
Group B	**Pre-test**	0	64	70.3
		1	27	**29.7**
		Total	91	100.0
	Post-test	0	59	77.6
		1	17	**22.4**
		Total	76	100.0
Group C	**Pre-test**	0	65	68.4
		1	30	**31.6**
		Total	95	100.0
	Post-test	0	90	84.9
		1	16	**15.1**
		Total	106	100.0

*Notes: 0 = Patients who did not develop PUs (Stage One to Four) over eight weeks observation
1 = Patients who developed PUs (Stage One to Four) over eight weeks observation

4.2 Inferential analysis

4.2.1 Hypotheses testing

The following hypotheses were statistically tested:

- Using a risk assessment scale (The Braden scale) has no effect on patient outcomes in terms of PU incidence rate among hospitalised patients.
- PU prevention and treatment training has no effect on patient outcomes in terms of PU incidence rate among hospitalised patients.
- The use of CJ as a way of deciding patients at risk of developing PUs has no effect on patient outcomes in terms of PU incidence rate among hospitalised patients.

The α level used was $\alpha = 0.05$, 2-tailed for all tests.

The Chi-Square (x^2) test was used to make inferences about the existence of significant relationships between the group variable and PU incidence. The group variable in this case represented the effects of using a RAS (the Braden scale) in group A, PU training in group B and CJ in group C.

In this study, the group variable was at the nominal level of 1 for group A, 2 for group B and 3 for group C, and PU incidence was at the nominal level of 1 for the presence of a PU and 0 for its absence; this implies that the Chi-square test can be used to answer the core questions of this study concerning whether there is a significant effect for the group variable on PU incidence. The Chi-square test examines the differences between expected

and observed values among groups A, B, and C in relation to PU incidence. Furthermore, it presents the values of variables under study in a contingency table, which facilitates comparisons between groups A, B, and C in relation to PU incidence.

As a result, the findings will separate the effects of using RASs (the Braden scale) on PU development from those of PU training and the use of CJ.

The findings show no statistically significant (Pearson $x^2 = 0.895$; degrees of freedom (*d.f.*) = 2; $P = 0.639$) effect between the groups and PU incidence as shown in Table 4.4.

Based on previous statistical tests, the null hypotheses were accepted: no statistically significant effect for the groups on patients' outcomes in terms of PU incidence was evident.

The following sections explore the effects of recorded variables

1) The null hypothesis was accepted: there is no statistically significant effect detectable between the groups regarding PU incidence. Thus, it is essential to explore other recorded factors which may mask this effect. Besides, it may have an additional effect on PU development.

2) The results show that PU incidence is significantly (*Pearson* $x^2 = 17.023$; *d.f.* = 2; $P <$ 0.001) different between pre-test and post-test phases of the study (*N= 719*). Thus, it

is necessary to explore other recorded factors that may partially explain the significant reduction of PU incidence in the post-test phase.

4.2.2 The effects of recorded variables on group and incidence

This section explores the effects of recorded variables on group and incidence and includes the tests used, the procedure of examination and the findings.

The effect of recorded variables was tested according to their level of measurement which included the following tests:

1) The Chi-Square (x^2) test for nominal variables was used to examine whether groups were different in relation to the recorded variables of PU incidence, gender, diagnosis, protective mattresses, skin barrier creams and vitamins. Furthermore, it examined whether PU incidence was different among other nominal variables.

2) Mann-Whitney *U* (MW) test was used to examine whether PU incidence was different among the recorded variables of age, turning schedules, Braden and CJ scores. Kruskal-Wallis (KW) test was used to examine whether groups were different in relation to the recorded variables of age, turning schedules, Braden scores and CJ scores.

The examination procedure included the following:

1) Of those variables examined by the Chi-Square (x^2) *test of independence for nominal variables,* the association between variables was tested by descriptive cross-tabulation. The group or incidence variables were entered in rows and the recorded variables were entered in columns, and expected and observed counts were indicated. *Pearson x^2 value, d.f., and P value* were calculated to decide the level of statistical significance of the association between variables.

2) Of those variables examined by *KW and MW tests*, the groups and incidence were used as grouping variable and the recorded variables were used as testing variables. The *x^2 value in KW test and U value in MW test*, *d.f.* and *P* value were calculated to elucidate the association between variables.

Results for the groups were different in relation to gender, diagnosis, vitamins, age, protective mattresses, Braden scores and CJ scores, with variable levels of statistical significance, while PU incidence, skin barrier creams, and turning schedules were not statistically significant among group variable as shown in Table 4.4.

They also show that PU incidence was different among patients' diagnoses, age, creams, protective mattresses, Braden scores and CJ scores with variable levels of statistical significance, while gender, vitamins and turning schedules were not statistically significant among PU incidence, as shown in Table 4.4.

Table 4.4 The effects of recorded variables on the group and PU incidence

N = 719

	The effects within the group			The effects within PU incidence		
Variables	**x^2**	**d.f**	**P value**	**x^2**	**d.f**	**P value**
Incidence rate	0.895	2	0.639 a	-------	------	-------
Gender	192.93	2	* < 0.001 a	0.702	1	0.402 a
Diagnoses	286.59	14	* < 0.001 a	22.319	7	*0.002 a
Age	52.134	2	* < 0.001 b	------	----	*0.001 c
Vitamins	10.809	2	* 0.004 a	1.582	1	0.209 a
Skin Barrier Creams	0.542	2	0.763 a	9.000	1	*0.003 a
Protective Mattresses	70.394	4	* < 0.001 a	16.316	5	*0.006 a
Turning Schedule	1.714	2	0.424 b	------	-----	0.969 c
CJ	37.096	2	* < 0.001 b	------	-----	* < 0.001 c
BS	26.704	2	* < 0.001 b	------	-----	* < 0.001 c

Notes * Significant at $\alpha = 0.05$ (*2-tailed*)

a x^2 test

b KW test

c MW test

4.2.3 Logistic regression analysis

This section examines the effects of group variable together with other variables on PU incidence. It also explores the relationship between the recorded variables and PU incidence. It includes logistic regression procedures and the findings.

Logistic regression analysis was used to determine the effect of group variable on PU incidence and whether or not the recorded variables were explanatory factors in PU development. It is a procedure that uses maximum likelihood estimation for analysing the relationship between multiple independent variables and a dependent variable that is categorically measured on a nominal scale as mentioned by Polit (1996).

The logistic regression procedure included entering predictors in the analysis process. The binary logistic regression was chosen as it is suited models where the dependent variable is dichotomous. Nominal predictor variables (recorded variables) were coded (dummy coding) as dichotomous variables. The following variables were transformed and re-coded as different variables in dichotomous level (0, present and 1, not present) before entering in the logistic regression analysis:

1) Diagnoses which transformed into medical, surgical, oncology, renal, neuro-surgery and rehabilitation variables.

2) Protective mattresses which transformed into Standard, Therakair, Alternating,

Genadyne, Atmosair, Clinitron, Gel, and Water variables.

3) The Braden scale was recoded into reversed categories where the high scores coded as high risk and the lower scores represented low risk, while group, age, gender, CJ, turning schedule, skin barrier creams and vitamins variables were left in the same coding. PU incidence was the dependent variable. It was encoded into (0, not developed PU and 1, developed PU).

Although some variables such as gender and turning schedules were not significant within the group and PU incidence variables (see Table 4.4), all of them were entered in logistic regression analysis because:

1) Although these variables have no effect on group or PU incidence, they may have an effect when entered with a group of variables, as logistic regression analysis shows those variables that best explain the occurrence of PUs.

2) Although some studies showed no association between these variables and PU development, others showed such relationships. For example, gender was not found significant in relation to PU occurrence in (Schultz et al. 1999) and (Whittington et al. 2000), but Tannen et al. (2004) found that gender was different among those patients who developed PU.

The logistic regression used the forward conditional method. The probability for stepwise entry was at 0.05 and removal at 0.10 for maximum iterations of 20. Clinitron and water variables were removed from the analysis because they were constant for all selected cases. The logistic regression analysis was produced twice: the first on the sample (*N=719*) and the second time on post-test cases (*n=256*). The analysis report included Wald x^2, B coefficient estimation associated with each predictor, P value, and Odds Ratio (OR) to provide estimated relative risk. Logistic regression analysis was performed at $\alpha = 0.05$ level of significance.

4.2.3.1 Predictors of PU development in the sample

Logistic regression analysis was used to estimate the probability of recorded variables to predict PU development among the study sample. 22 variables were entered in logistic regression analysis and two were removed. Logistic regression, which consisted of seven steps, was performed for the research sample (*N=719*) with no missing cases. As shown in Table 4.5, the outcome of logistic regression analysis showed a predictive model of six predictors which were significantly related to PU development: age, CJ scores, reversed Braden scores, standard hospital-bed mattress, neuro-surgical diagnosis and skin barrier creams. The group variable has neither protective nor predictive effects on PUs development. The creams have a statistically significant protective function in PU development. These factors have a comparable power in the prediction of PU. The risk of PU development was more than two times as great among those patients who had neuro-surgical diagnosis compared to those who have different diagnosis (*OR = 2.669*).

Table 4.5 Logistic regression analysis: Predictors of PU development in the sample

N= 719

Predictor Variable	B	Wald x^2	* P Value	OR
Age	0.124	8.920	0.003	1.132
CJ scores	0.166	3.986	0.046	1.181
Reversed Braden scores	0.147	11.557	0.001	1.159
Standard mattress	0.595	7.818	0.005	1.814
Skin barrier creams	- 0.597	9.036	0.003	0.550
Neuro-surgical diagnosis	0.982	5.759	0.016	2.669

Notes * Significant at $\alpha = 0.05$ (*2-tailed*)

4.2.3.2 Logistic regression: Predictors of PU development in post-test cases

Logistic regression analysis was repeated in order to estimate the probability of recorded variables to predict PU development among post-test cases. This was necessary to test whether the interventions had any effect. The cases were selected from the sample if the type was only post-test ($n = 256$) and the same previous logistic regression procedure, including three steps with no missing cases, was produced. The outcome of the analysis showed a predictive model of only two predictors, reversed Braden scores and neuro-surgical diagnosis, which were significantly related to PU development. These factors also had comparable power in the prediction of the risk of PUs. The risk of PU development

was nine times as great among those patients who had neuro-surgical diagnosis compared with those patients who had different diagnosis (*OR = 9.376*) as shown in Table 4.6 .

Table 4.6 Logistic regression: Predictors of PU development in the post-test

cases

n = 256

Predictor Variable	**B**	**Wald x²**	***P Value**	**OR**
Reversed Braden scores	0.263	9.209	0.002	1.301
Neuro-surgical diagnosis	2.238	8.732	0.003	9.376

Notes * Significant at α = 0.05 (2-tailed)

4.2.4 ROC Analysis of the Braden and CJ performance in predicting risk of PU development

This section compares the performance of the Braden scale and CJ in predicting risk of PU development. It includes the ROC analysis procedure and the findings.

Receiver Operating Characteristics Curve analysis (ROC) is a graphical plot of the sensitivity and one minus the specificity for binary classifier system of a diagnostic test. It is used when sensitivity and specificity of a risk tool (or in this case a risk assessment scale

(The Braden scale) and CJ scale) are highly dependent on a particular threshold score employed (Altman and Bland 1994) and (Anthony 1999). The evaluation of the Braden scale and CJ performance was given by the area under the ROC curve, which enables the researcher to decide whether RASs (the Braden scale) performance is superior or equal to CJ performance in terms of PU development.

The ROC procedure included data entry of the incidence variable as a state variable with value = 1 as a positive value and the Braden and CJ entered as test variables. The Braden variable was recoded in reversed categories where the high scores coded as high risk and the lower scores represented low risk to provide more logic and direction of the ROC curve when compared with CJ. A diagonal reference line, standard error under the nonparametric assumption and confidence interval of 95 per cent, and coordinate points of the ROC Curve were used. The procedure was repeated twice, the first time for the sample (*N = 719)* and the second among selected post-test cases *(n = 256)*.

4.2.4.1 Comparison of Braden scale and CJ predictive performance in the study sample

The ROC curve showed a very similar performance for the Braden scale and CJ among the study sample *(N=719*). The Braden scale and CJ curves were above the reference line which indicated a predictive usefulness as shown in Figure 4.1. The values of area under the ROC curve (AUC) for the Braden scale and CJ revealed very mild differences. It was

0.635 for the Braden scale and 0.592 for CJ, which indicated that both predict the risk of PU occurrence equally for the study sample as shown in Table 4.7.

Figure 4. 1 Comparison of CJ with the Braden scale in the sample

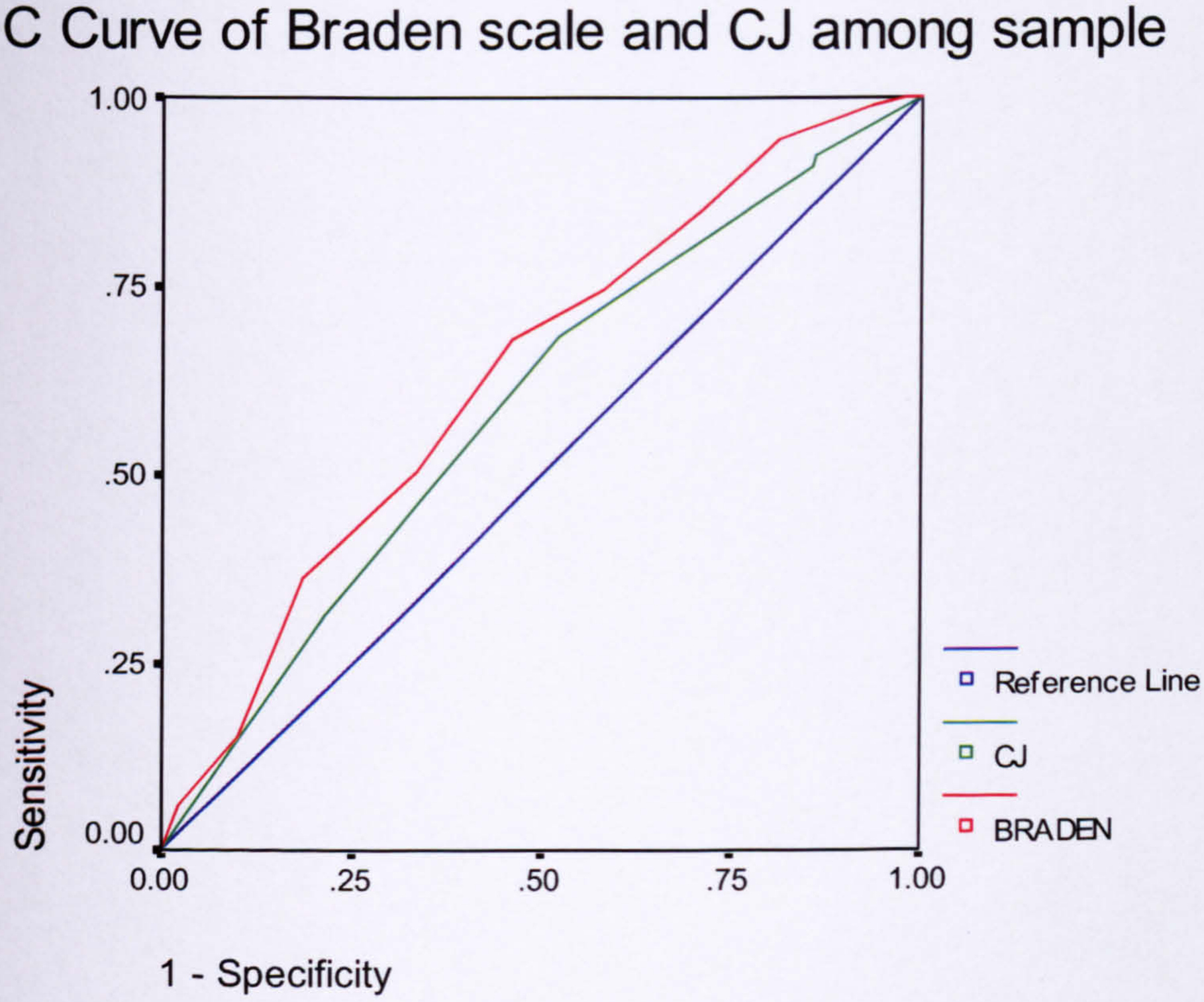


Table 4.7 Area under the ROC curve analysis of CJ and the Braden scale in the sample

N = 719

Variables	AUC	* P Value	AUC lower bound value	AUC upper bound value
Reversed Braden scale	0.635	< 0.001	0.588	0.682
CJ	0.592	< 0.001	0.543	0.640

** Significance level at (α = 0.05)*

4.2.4.2 Comparison of Braden scale and CJ predictive performance in the post-test cases

When the ROC was analysed, the performance of the Braden scale and CJ for the patients post-intervention (*n = 256*) revealed different outcomes compared to the study sample analysis. It showed that the AUC value for the Braden scale was 0.659 compared to 0.519 for CJ. Moreover, the analysis showed that *P* value was (0.001) for the Braden scale and 0.684 for CJ at (*α = 0.05)*. These findings indicate that using the Braden scale is better than random, but CJ is no better than random in this (smaller) dataset.

When the data were split by type and group, the ROC analysis showed that the Braden scale and CJ performance could predict the risk of PU development among each group at

the pre-test and post-test stages of the study. The analysis of pre-test patients revealed a relatively similar performance of the Braden scale and CJ while analysis of the post-test patients ($n = 256$) revealed some differences among GA and GB.

The ROC analysis of the Braden scale performance compared with CJ in post-intervention showed that the ROC curve was very similar in GA (Figure 4.2) and different in GB (Figure 4.3) and in GC (Figure 4.4). The Braden scale and CJ curves were above the reference line in GA and GB, while in GC the Braden scale curve was adjacent to the reference line and the CJ curve was below it, which indicates poor predictive performance for both the Braden scale and CJ in predicting risk of PU development in this group.

The analysis showed that the AUC value of the Braden scale 0.643 and 0.545 for CJ in GA, which indicates similar PU prediction performance. It was 0.806 for the Braden scale and 0.646 for CJ in GB, which demonstrates the best predictive usefulness of both the Braden scale and CJ compared to other groups. That is to say that an improvement was evident in performance in both the Braden scale and CJ. Among GC, the AUC values showed 0.536 for the Braden scale and 0.399 for CJ which indicates the worst predictive performance of the Braden scale and CJ compared to GA and GB.

The analysis also showed that the Braden scale revealed the only significant P value (< 0.001) at $\alpha = 0.05$ for GB when compared with CJ and the Braden scale P values in other groups as shown in Table 4.8.

Figure 4. 2 Comparison of CJ with the Braden scale in the post-test cases

(GA)

Figure 4. 3 Comparison of CJ with the Braden scale in the post-test cases

(GB)

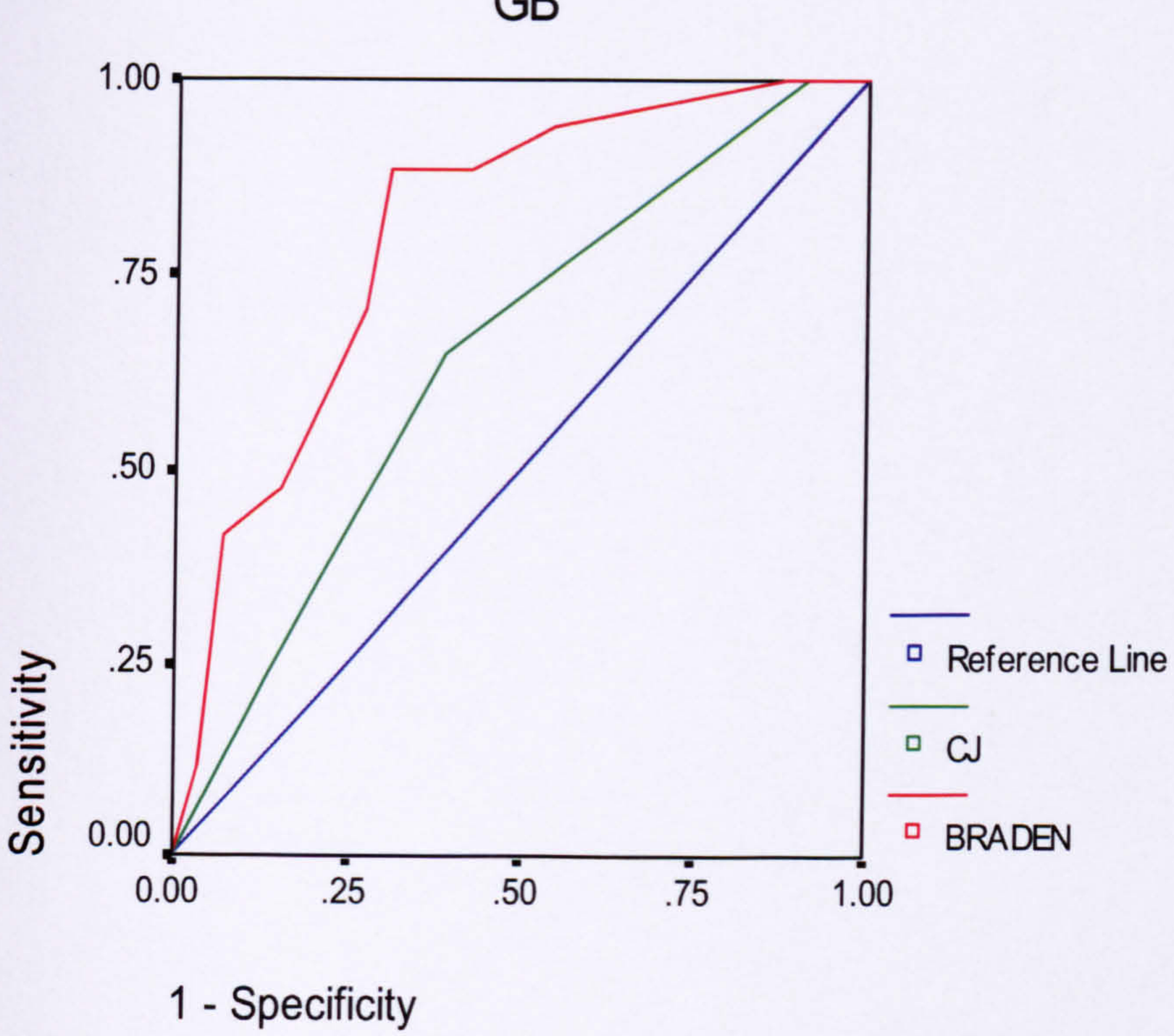


Figure 4. 4 Comparison of CJ with the Braden scale in the post-test cases (GC)

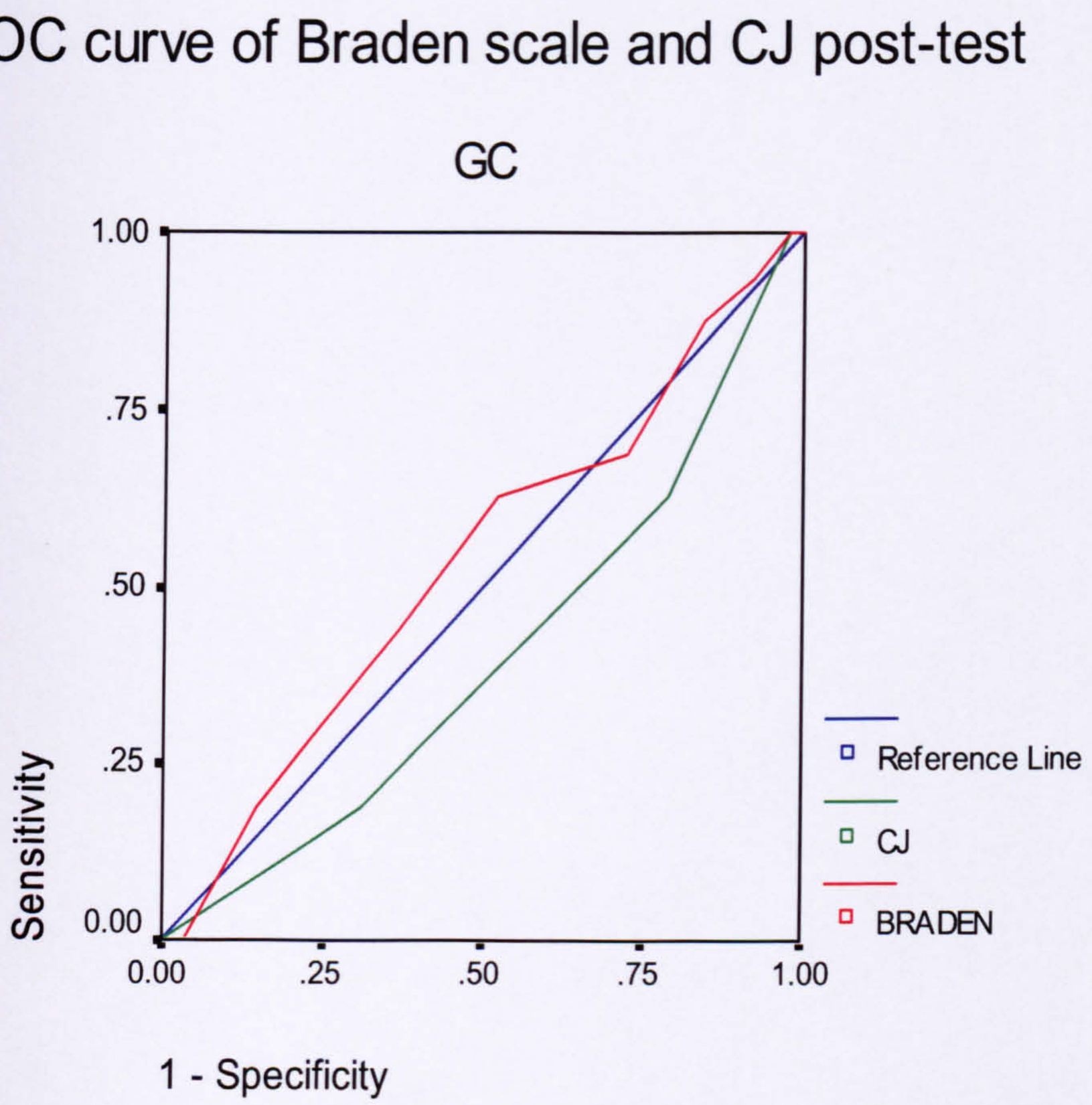


Table 4.8 Area under the ROC curve analysis of CJ and the Braden scale in the post-test cases in different groups

n = 256

Group	Variables	AUC	*P Value	AUC lower bound value	AUC upper bound value
GA	***Reversed Braden scale***	0.643	0.082	0.483	0.802
	CJ	0.545	0.586	0.390	0.700
GB	***Reversed Braden scale***	0.806	< 0.001	0.697	0.914
	CJ	0.646	0.069	0.502	0.789
GC	***Reversed Braden scale***	0.536	0.649	0.380	0.692
	CJ	0.399	0.199	0.248	0.549

** Significance level at (α = 0.05)*

4.3 Summary

This chapter described and explored the effects of RASs (the Braden scale), training, CJ and other recorded variables on PU development among hospitalised patients. A total of 719 patients were included in the study from nine medical and surgical wards at the RMH. The population distribution among groups and study phases was described (Appendix S). Recorded variables of age, gender, diagnosis distribution among the study groups and patient types were also described (Appendix S). The results revealed a 22.9 per cent incidence rate of PU for the whole sample. It was relatively similar between the three study groups. 31 per cent of pre-test patients developed NCPU while only 19 per cent developed among post-test patients. Half of NCPU were Stage One and the majority of them developed in the sacral area. It was noted that 60 per cent of those patients who developed NCPU were over 60 years old.

The findings revealed poor utilisation of protective mattresses, as 56 per cent of the patients were placed on standard hospital-bed mattresses. It also showed that there were no effect for vitamins and changing of the patients' position on PU development.

The findings showed that most of the patients were scored at mild and high risk using the Braden scale while most of them were scored at moderate and minimal risk using CJ. There was correlation between the two scoring methods (Appendix S, Table 1).

The inferential statistical procedures revealed no statistically significant effect for study groups on PU development. Of the recorded variables, age, gender, diagnosis, vitamins, protective mattresses, Braden and CJ were statistically significant within the study groups, whereas diagnosis, age, skin barrier creams, protective mattresses, Braden and CJ were found statistically significant in relation to PU incidence.

Although the logistic regression analysis reveals no effects for study groups on PU incidence, it shows that age, CJ, reversed Braden, standard hospital-bed mattress, skin barrier creams and neuro-surgical diagnosis have a statistically significant effect in predicting risk of PU development throughout the study sample.

When logistic regression analysis was repeated selectively on post-test cases, the predictive model was different. Only reversed Braden and neuro-surgical diagnosis were found statistically significant in predicting risk of PU development.

The ROC analysis reveals a relatively similar performance for Braden and CJ among the study sample, while it shows different outcomes in the post-test selected cases. It shows that Braden has better performance than random, but not CJ. However, the ROC analysis indicates that Braden performance gives the best predictive usefulness in group B compared with other groups. There was evident improvement in the predictive performance of both the Braden and CJ performance in the post-test cases.

Chapter Five: Discussion

Introduction

This chapter discusses the impact of PU risk assessment and risk management on health care. It discusses the study findings of the clinical effects of using RASs compared to nurses' CJ and the effectiveness of using PU prevention programme in the RMH in reducing PU incidence. Additionally, it also interprets and explores PU incidence rate and the effects of recorded variables on PU development among patients at the RMH. This chapter encompasses the attainment of the aims of the study, which examines the effects of using RASs as proactive tools in PU prevention and whether their use improves patients' outcomes or not.

5.1 The impact of PU risk and risk management on health care

This section presents implications of using theoretical backgrounds in risk and risk management to clarify the impact of PU risk and risk assessment on risk management in health care and incorporates this understanding to explain key finding of the study.

Risk is defined according to The Royal Society as 'the probability that a particular adverse event occurs during a stated period of time, or results from a particular challenge' (Thompson and Dowding 2002). Risk is central to nursing practice as nurses demonstrate key roles in health care practices. Nurses experience different clinical risks on a daily basis

from different perspectives and the risk of PU development is one of these risks. Based on this definition of risk, nurses have a responsibility to reduce the adverse effects of PU risks in patients. PU risk assessment is one of the key components in risk management programmes in which the nurses can be proactive to reduce the risk of PU occurrence through early identification of patients at risk of PU development. Therefore, preliminary PU risk assessment is important, as substantial clinical decisions are based upon these initial assessments in order to implement subsequent measures to reduce the risk of PU development such as providing special protective mattresses. Thus, PU risk assessment is one of the most important judgments nurses make in the health care context. Nurses use two methods in PU risk assessment: RASs, which are based on categories of PU risk factors and CJs, which are based on knowledge and experiences in PU risk and risk management. The two methods use different ways to perceive given sets of information to make judgments of PU risk, and then implement appropriate risk management modalities.

The accuracy of their decisions in relation to PU risk and risk management is based on their abilities and competencies to perceive sources of risk and to effectively utilise different sets of information available in RASs and/ or nurses' knowledge and experience (CJs) in association with patient health state. Nurses' decisions should then reflect the actual and potential patient's risk of developing PU. As a result, variations of decisions related to PU risk and risk management are associated with the usefulness of information that is provided in forms of RASs and/ or nurses' knowledge and experiences (CJs). Hence, nurses' should be aware whether RASs are effective tools compared to nurses' judgments in PU risk management.

Several studies evaluate and examine accuracy of RASs in terms of predictive performance (*See* Chapter Two, section 2.5) with no clear or consistent evidence that RASs are effective tools in improving patients' outcomes (Gunningberg 1999), and this raises the question whether sensitivity and specificity are indeed valid measures for the performance of RASs (Edwards 1995 and Defloor and Grypdonck 2005). This also indicates ambiguity of the role of RASs compared to nurses' CJ in PU risk assessment.

In this study, a new approach is introduced to examine clinical effectiveness of RASs compared to nurses' CJ by measuring their effects on patient outcomes in terms of PU incidence instead of using conventional assessment tool's sensitivity and specificity measures. This approach is suggested to be consistent and a valid way to provide evidence on clinical effectiveness of using RASs compared to nurses' CJs in PU prevention.

A key finding of the current study confirms that RASs are not better or more effective than nurses' CJ in improving patient outcomes in terms of PU incidence rate. RASs and CJs are dependent in producing similar predictive performance and demonstrate equal clinical effects on patient outcomes (Figure 4.1). This agrees with limited number of researches such as McGough (2000) and Gould et al. (2004), but disagree with many others such as Pancorbo-Hidalgo et al. (2006), Halfens et al. (2000) and Defloor and Grypdonck (2005). However, it provides new evidence in relation to clinical effectiveness of using RASs in PU prevention programmes, which is essential to suggest PU policy refinement.

In the light of this finding, SJT theoretical approach contributes to interpret, explore and clarify the relationship between PU risk assessment and risk management. In applying the SJT model to the study, using the RAS (The Braden scale) (Figure 5.1) in Group A and CJs (knowledge and experiences in PU risk management) (Figure 5.2) in Group C have produced similar outcomes in terms of PU incidence.

The SJT model is used to explain how nurses use knowledge (information cues) about the risk of PU to develop judgments essential in PU prevention. As highlighted in Chapter Two (Section 2.6), although RASs present structured models, nurses use past experiences when making clinical judgments in PU prevention (Thompson and Dowding 2002 and Defloor and Grypdonck 2005). The nurses use an unknown number of information cues (X1-Xn) (Figure 5.2) when their decisions are based on knowledge and experiences (CJs), and these cues may include those factors used in RASs (Figure 5.1).

Figure 5.1 Application of SJT model using PU RASs (the Braden scale)

Adopted from Thompson and Dowding (2002) which was originally taken from Hammond et al. (1964)

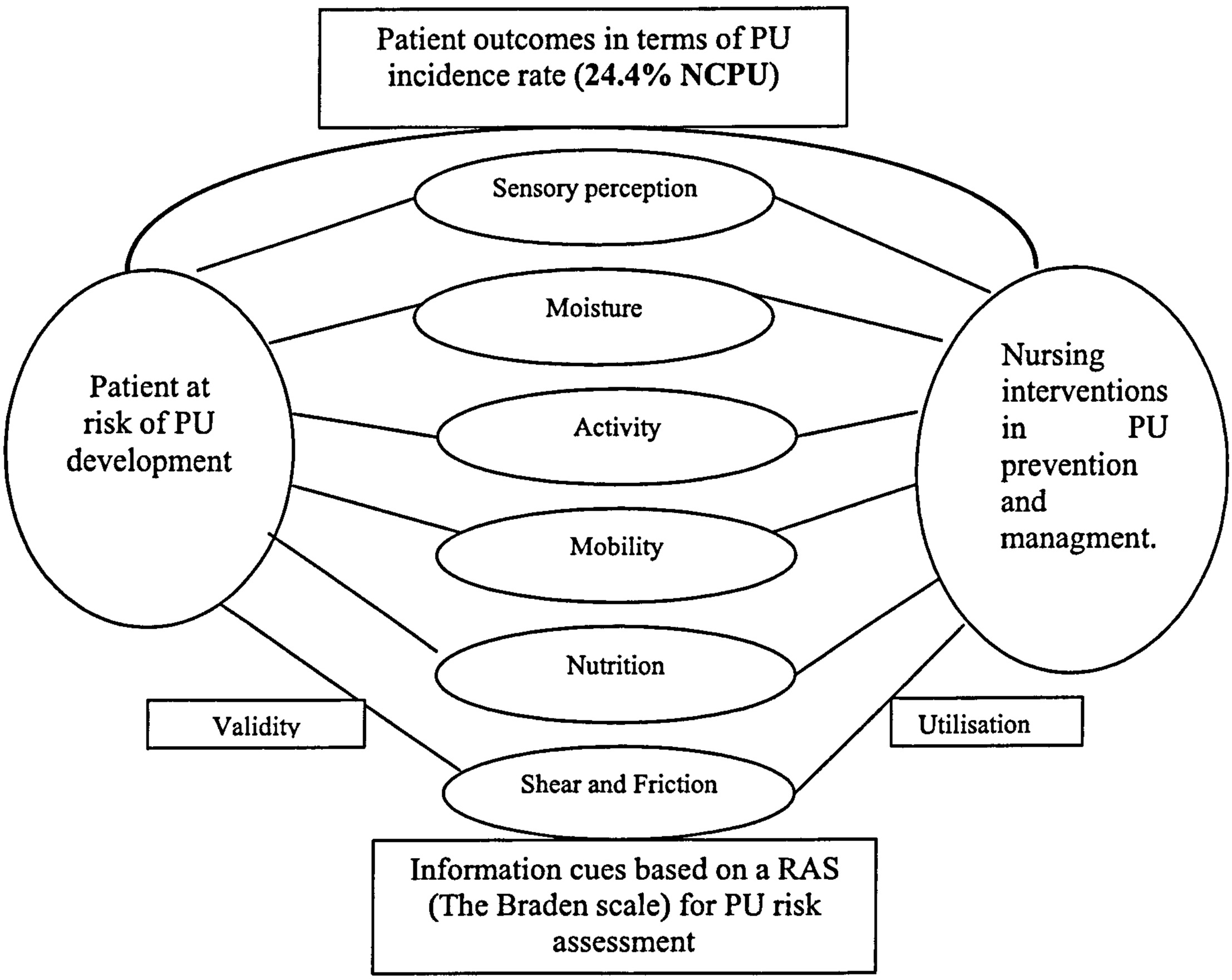
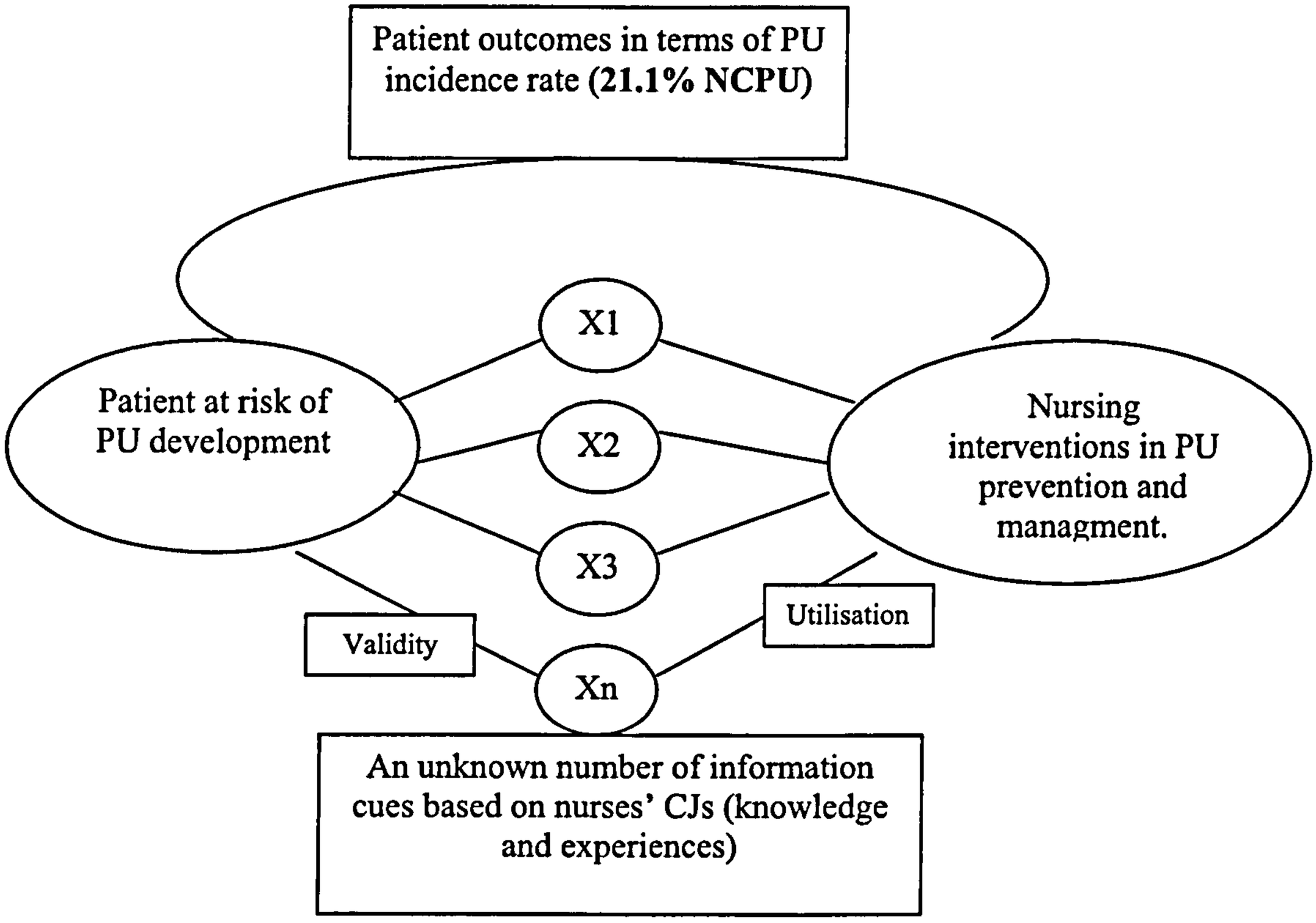


Figure 5.2 Application of SJT model using nurse's CJs (Knowledge & Experiences) Adopted from Thompson and Dowding (2002) which was originally taken from Hammond et al. (1964)



The SJT model is based on assumptions that different nurses reach different judgments (decisions) by using the same information cues. The findings show that nurses were consistent in producing similar patient outcomes (NCPU) based on either using RASs or their own knowledge and experiences (CJs).This demonstrates a consistent way by which

the nurses perceive and consider information cues to perform PU risk assessment. Thus, exploration of these information cues (X1-Xn) (Figure 5.2) that are used in decisions made in Group C (CJs Group) is an area for future investigation.

The SJT model is normative and an objective. It helps to explore how judgments (decisions) are made and suggests ways to improve it. In applying this model to PU risk assessment, the role of the nurses' past experiences in PU assessment and management is clear. Therefore, novice nurses are not fully competent to make relevant decisions associated to PU prevention compared with experienced ones because they lack necessary information cues (X1- Xn) to produce them. This suggests that these information cues would be improved through two approaches: continuous ongoing PU training and effective use of RASs. Although the findings show that RASs are not effective or better tools than nurses' CJs in PU risk prevention, they present a systematic and objective tools that may aid and facilitate PU risk assessment and nurses' CJs associated to PU management. RASs provide a structured set of risk factors (such as Braden scale in Figure 5.1) necessary to remind and improve nurses' perception of PU risk. Therefore, RASs and nurses' CJs are suggested to work together in order to improve patient outcomes in terms of PU occurrence and to help novice nurses to develop their knowledge and expertise in PU management.

Based on this discussion, although the SJT model encourages nurses to think more deeply in the process of risk assessment and associated judgments, it is limited in assuming that information attached to judgments can always be identified and in that information is consistent in association with judgments made. This is applicable in this study, as

information cues (X1-Xn) used in CJs method (Figure 5.2) are unknown. On the other hand, although the information cues used in RASs method (Figure 5.1) are objective, they are changing and continually refined. Thus, the SJT theoretical approach is used as a way to improve awareness to areas of concern in the process of PU risk assessment and associated clinical judgments.

To sum up this section, risk management including PU prevention in clinical practice is an area needs improvement. Accurate risk assessment is one way in which risks would be managed effectively using proactive tools. Application of SJT in PU prevention may demonstrate better use of risk assessment tools which facilitates and improves nurses' decisions vitally important to reduce PU incidence. In this study, using RASs and CJs, which are the two available methods in PU risk assessment, demonstrate similar effects on patient outcomes. Based on this evidence, using current RASs together with nurse's knowledge and experience (CJ) are suggested to improve PU prevention as part of a comprehensive PU prevention programme including an effective risk-based system. Hence, this contributes additional evidence to the knowledge base of PU prevention and management. Furthermore, it may be used to review and refine the policy of using RASs as a key component in PU prevention and management programmes.

5.2 Methodological considerations

This section discusses strengths and weaknesses of the study methodology which clarifies the significance and contribution of the study to the body of knowledge.

The present study contributes to an understanding of PU assessment, because it comes at a time when there is no evidence comparing the use of RASs and CJ in clinical practice. It is not clear whether RASs may reduce PU occurrence, or whether they are superior to nurses' clinical judgment in deciding the patients at risk of PU development (Cullum et al. 1995). Although the present study is quasi-experimental, it is prospective and uses controlled groups in pretest posttest design to enable the researcher to examine and explore the clinical effectiveness of the study variables. The studies on clinical effectiveness of RASs on PU prevention are limited (Whitfield et al. 2000) and restricted to examining the Norton scale or its modifications, while there are no research studies on the clinical effectiveness of other RASs such as the Braden or Waterlow scales (Pancorbo-Hidalgo et al. 2006). Drawbacks to these studies include the use of prevalence as an outcome measure (Gunningberg et al. 1999), the provision of pressure-reducing support surfaces to patients, and prevention intervention (Bale et al. 1995 and Hodge et al. 1990). Another drawback is related to the use of a specific patient subgroup, namely patients with hip fractures (Gunningberg et al. 1999). In relation to this study, the findings concur with those of Gould et al. (2004). Although Gould's study supports nurses' CJ, their findings were limited, as simulation was employed rather than considering actual patients. There are concerns about assessing patients using this method, concerns which include the inability to communicate with patients or to touch them in order to judge the condition of their skin, as well as the need to know the patients before it is possible to assess them.

This study is one of few to confirm the clinical effectiveness of RASs and is the first study to examine the clinical effectiveness of the Braden scale as RAS on PU reduction, used recently in the RMH.

Several studies have reported difficulties in collecting accurate and reliable data about PUs (Anthony et al. 2006 and Gunningberg et al. 1999) due to their multifactorial nature, the uniqueness of individual patients' attributes and the lack of nurses' knowledge.

During the present study, the research team who collected the data was extensively trained so that they could provide highly reliable findings. Training on the Braden scale was restricted to Group A nurses. The research team was responsible for collecting Braden scores for patients, while Group A nurses produced their own Braden scores without knowing the research team's scoring. The research team also did not know which wards were experimental. The patients were observed for eight weeks, and those who did not complete the observation period were excluded from the list of pretest and posttest patients.

The researcher recorded all the known variables such as patients' age, gender, diagnosis, PU protective measures (protective mattresses, skin barrier creams, vitamins and nutritional supplements and patients turning schedules) that may have distorted the findings.

The age, gender, diagnosis, vitamins, protective mattresses, CJ and Braden scores differed significantly between the study groups. When extensive inferential analysis was performed, the age, diagnosis, skin barrier creams, CJ, Braden scores and protective mattresses were

significantly different relative to PU incidence. Logistic regression analysis examined these factors to show those variables which were more likely to predict PU incidence. The results showed that the patients' age, application of skin barrier creams, neuro-surgical diagnosis, standard hospital-bed mattress, CJ and Braden scores were predictive of PU development.

The present study shows that, when the effects of RASs (the Braden scale) have been taken into account, neuro-surgical diagnosis in particular is seen to be particularly relevant: the findings showed that the risk of PU development was nine times as great among those patients who had neuro-surgical diagnosis as among those who had different diagnosis, a result which necessitates the need for further exploration of PU occurrence in this subgroup of patients. The protective mattresses were the confounding variable most strongly in evidence, which may have distorted the effect of RASs on PU incidence (Defloor et al. 2005, Defloor et al. 2004). The findings of this study indicated that the effect of protective mattresses was of limited value in all study groups (the incidence rate was similar among the three groups) because the mattresses did not match the patients' risk severity, especially those at high and severe risk of PU development. Despite its availability in different medical and surgical wards, the protective mattresses were not properly and frequently used.

A controlled group pretest posttest design was used to control external variables. The researcher was aware of the input of other uncontrolled variables, control of which was outside the scope of this study, on the relationship between RASs (the Braden scale) and PU development. For example, the presence of the researcher as the TVNS in RMH may

have encouraged nurses in control groups to provide more PU prevention due to the Hawthorne effect. Moreover, in some circumstances nurses from different study groups may have met with each other to discuss the study interventions.

The sensitivity of the Braden scale is high (94 per cent) at a cut off ≤18 as a threshold, i.e. it was predictive of PU development. The inclusion of those patients with PUs thus increases the level of risk for developing new PU which may encourage the nurses to provide more prevention, and then reduce NCPU (Lindgren et al. 2002 and Defloor et al. 2004), and the use of a cutoff point (≤18) indicated more patients at risk, all of which alters the sensitivity of the Braden scale. The current Braden scale has been supported to a greater degree of validity by Bergstrom et al. (1987), Reed et al. (2001), Brown (2004), Halfens et al. (2000) and Pancorbo-Hidalgo et al. (2006).

However, this implies that this study provides an alternative valid solution by which the effectiveness of RASs in clinical practice can be evaluated by measuring the inference in PU incidence reduction; to a certain extent, findings can be generalized to patients of acute hospitals when similar clinical characteristics have been considered.

5.3 Interpretation and discussion of the main findings of the study

This section discusses the key findings of the current study, which includes the following themes: The clinical effectiveness of using RASs on patient outcomes in terms of PU

incidence rate compared to nurses' CJs and the effects of using PU prevention programmes in RMH.

The clinical effectiveness of the RASs (The Braden scale)

As shown in the methodological discussion, this study offers a valid way to evaluate the effectiveness of the RASs on patients' outcomes in terms of PU incidence rate. The Braden scale was introduced to Group A nurses as a RAS, who were specially trained to use it, and were requested to employ it in their assessment of patients. During the application the research team provided support and motivation to the nurses, and collected the Braden scores from all patients in the different groups. The effectiveness of introducing the Braden scale to Group A nurses should be noted in relation to the reduction of the PU incidence rate, which was collected prior to and after introduction of the Braden scale. The findings show that there was no statistically significant (x^2= 0.895; *d.f.* = 2; *P*= 0.639) effect for the study groups on PU incidence. These findings demonstrate that there was no clinical impact for the RASs (the Braden scale in this study) on patients' outcomes in terms of PU incidence reduction. It also substantiates similar findings of Gunningberg et al. (1999), who find that the systematic, clinical use of RASs (Modified Norton Scale) (MNS) has no effects in reducing PU prevalence; it is in agreement with the systematic review of Pancorbo-Hidalgo et al. (2006) who conclude that there is no evidence that the RASs are in themselves effective tools in reducing PU incidence. Nevertheless the nurses in Group A were more aware of PU prevention, and the use of the Braden scale was expected to increase their PU prevention performance; the patients did not receive more preventive

care. However, the use of RASs and the production of high risk figures might not lead to improvement in prevention strategies (Anthony et al. 2006, Gunningberg et al. 1999, Gunningberg 2005a and Halfens et al. 2000). For example, the findings showed that 44 per cent (110 of 248 patients) of those patients who were rated high risk according to the Braden scale and 42.4 per cent (70 of 165 patients) of those patients who were rated high risk by nurses' CJ were placed on standard hospital-bed mattresses. The nurses provided appropriate protective mattresses to those patients scored at mild and moderate risk according to either the Braden scale or CJ. These findings are also congruent with those of Gunningberg (2005a) and Schoonhoven et al. (2002b), who found that PU prevention strategies were insufficient in all medical care groups, especially in acute care where more patients are at risk.

Based on the findings, nearly half (47.2 per cent) of NCPUs were Stage One. The nurses may not have recognised that Stage One PUs are pressure ulcer injuries and would be a cause of tissue damage. It was suggested that the Stage One PU be used as an indicator of when to start the prevention programme (Vanderwee et al. 2007, Defloor et al. 2004 and Defloor et al. 2007); the nurses may have waited until Stage two to four ulcers have developed before they provided the appropriate protective measures. The patients were followed for eight weeks. Hence, the nurses undertook initial assessments and planned interventions with no further re- assessment of the patients' conditions over the remaining period.

PU prevention training was given to nurses, but may not have been applied in practice. Panagiotopoulou et al. (2002) argue that good nurses' knowledge of PU risk factors and areas at risk was evident. Nevertheless, nurses were not able to translate such knowledge into practice in order to offer related preventive interventions. Clarke et al. (2005) evaluated the implementation of evidence-based nursing practice programmes in pressure ulcers and found that practitioners had increased knowledge of pressure ulcer prevention and treatment strategies, but did not have enough time to implement this knowledge. Gunningberg et al. (2001a) conclude that, even with limited utilisation of available knowledge and research findings in clinical practice, nursing staff knowledge and documentation of risk, prevention and treatment of pressure ulcers for patients with hip fractures could be improved. Based on the study setting, the protective mattresses were made available in medical and surgical wards. Nurses did not use appropriate protective mattresses available in their areas and also made no effort to borrow them from other wards. Nurses were given knowledge about PU prevention, but they were not trained to use that knowledge in patient care. Different educational strategies may be needed to enhance and improve nurses' practical implementation of PU knowledge.

From another point of view, the attendance of the researcher as the TVNS at the RMH may encourage the nurses' from Group C (the control group) to apply more preventive measures, which may reduce number of patients who developed PU in this group compared to other groups. As a result, the effect of RASs (The Braden scale) on PU incidence between different study groups could not be made clear.

One more point should be noted in respect of the lack of effect of RASs on the PU incidence: the study was conducted on different patient groups. The patients may exhibit different characteristics which may not influence all predictors (risk factors) of PU development. These factors were not recorded by the RASs (The Braden scale) itself and were not included in the study instrument. For example, Anthony et al. (2000) found that serum albumin was predictive for PU development, whereas it is not recorded in the present study. Moreover, the factor nutrition in the Braden scale is formulated as the intake of nutrition and not as the nutritional condition of the patient (Halfens et al., 2000).

The effectiveness of the PU prevention programme at the RMH

Although the RASs (the Braden scale) had no effect on PU incidence reduction, and the incidence rate was relatively similar between the study groups, there is a statistically significant (x^2= 17.023; *d.f.* = 2; $P < 0.001$) difference in PU incidence rate between the pre-test and post-test stages. The PU incidence declined from 31 per cent (83 of 265) in the pre-test stage to 19 per cent (49 of 256) in the post-test stage. Although PU prevention was not optimal, as many patients developed NCPUs and did not receive appropriate prevention treatment, the findings reveal that the PU prevention programme based on the AHCPR (1992) guidelines which was applied at the RMH was effective. These findings are in agreement with those of Regan et al. (1995) and Xakellis et al. (1998) Clark (1999), which show that clinical guidelines lead to reduction of PU occurrence after implementation. It is also in accord with Day et al. (1997) who suggest that aggressive prevention and ongoing

continuing programmes have demonstrated significant reduction of incidence and time taken for treatment, as well as dramatic cost savings.

The PU prevention programme at the RMH was developed as a multi-professional, participatory and collaborative team approach. The TVNS position was created in addition to the Wound Care Committee. The PU incidence and prevalence monitoring system was considered, and PU training activities were developed to encourage nurses to change their performance towards PU prevention and management. The programme also utilised the PU wound documentation system and the Braden scale for PU risk assessment. Furthermore, the PU programme at the RMH started a project for supplying and maintaining PU preventive aids such as pressure-reduction mattresses.

The findings are in accord with Gunningberg et al. (2001b) who investigated the incidence of PUs in 1997 and 1999 among patients with hip fractures. They found a significant reduction of the overall incidence of PU from 55 per cent in 1997 to 29 per cent in 1999. Their programme revealed changes in nursing and treatment routines among patients at risk, as well as improved nursing documentation, and indicated general changes in staff performance in relation to PU prevention.

In addition to set a PU management plan by the TVNS at the RMH, which improved PU documentation, the nurses received mandatory wound care training, and the PU incidence results were used as a tool to clarify and highlight the problem (Torrance and Maylor 1999, Klazinga 1994), all of which encouraged the nurses to provide PU prevention and increase

their attention to the problem, which in turn improved their practice towards those patients at risk of PU development.

Gould et al. (2000) review demonstrated that the implementation of a multidisciplinary working party, clinical guidelines, PU prevention equipment, improved documentation and staff education were effective in preventing PUs. Additionally, more systematic use of RASs was recorded as part of PU interventional studies. All of which have been implemented in the RMH.

The RASs are a key component in any PU prevention guideline, being an essential initial step in PU prevention models (Scott 2000, Day et al. 1997 and AHCPR 1992). The Braden scale has been introduced to the RMH as an essential component in PU prevention guidelines in addition to PU education and prevention material; this accords with Halfens et al. (2000), who suggest that using a risk assessment scale is only helpful if it is used as part of a complete risk-based programme. They explain that using a risk assessment scale without knowledge, skills, time and materials to prevent patients from developing PUs will have no effect.

Although the findings reveal that bringing the Braden scale to bear on PU incidence reduction at the RMH was ineffective, the use of RASs is essential to support nurses' clinical judgement in making appropriate decisions about PU prevention (Scott 2000, Edwards 1994 and Brown 2004). In acute hospital settings like the RMH, which involves patients whose health is constantly changing, it will be difficult to assess PU risk correctly

by relying only on clinical judgement because the patients are not well known to the nurses (Defloor and Grypdonck 2005). Moreover, CJ is influenced by level of experience nurses have (Thompson and Dowding 2002), which can be subjective compared to RASs as objective tools However, using RASs would be helpful to improve nurses' documentation (Maylor 1999) and present objective assessments, especially when demonstrated by novice nurses.

Although the findings showed no effects on PU incidence for Group B, where RASs were not enforced while PU training was implemented, the effect of education on PU prevention is well documented (Buss et al. 1999, Suntken et al. 1996, Day et al. 1997, Gould et al. 2000, Whitfield et al. 2000 and Gunningberg et al. 1999) as a strategy in clinical guidelines such as AHCPR (1992) and NICE (2003). The nurses at the RMH receive mandatory wound management education, and the effects of education programmes in general is evident when it is used as an adjunct to other components of a PU prevention programme. The nurses were able to clinically judge most of the patients at risk as the findings showed that of those patients identified as at risk by the Braden scale, with a cut off point ≤18, 0.6 per cent (4 of 719) of the patients were identified as not at risk. This implies that the nurses have the knowledge and skills to decide and define those patients at risk of PU development compared to the experienced research team using the Braden scale for scoring. The area under the ROC gives the best predictive usefulness of both the Braden scale and CJ among Group B patients when compared to other groups, and this highlights the effective role of education and training in improving the performance of PU predictors;

this is in agreement with Defloor and Grypdonck (2005) who suggest that introducing new RASs always needs to be accompanied by training.

The nurses at the RMH had good knowledge regarding PU prevention, but utilisation of such knowledge was limited. The nurses' practices could be improved to reproduce optimal prevention (Panagiotopoulou et al. 2002, Clarke et al. 2005 and Gunningberg et al. 2001a). Nurses at the RMH need more empowerment, support and motivation to implement their knowledge of PU prevention. Different educational strategies are also needed to improve utilisation of this knowledge.

Exploration of the way the nurses make their decisions to prevent PU and the factors that hamper proper interpretation of their decisions in prevention practice are suggested areas for future investigation. It is, however, suggested that PU training be maintained at the RMH until optimum changes in knowledge and skills are achieved, which in turn may lead to better PU prevention.

In respect of the presence of several activities (PU risk assessment, clinical guidelines, PU prevention equipment, PU documentation, and wound care team and staff education) in the prevention programme implemented at the RMH, it seems difficult to decide exactly the activities which most influence PU prevention. However, it is suggested that all components of the programme be considered, paying special attention to significant PU predictors (age, Braden scale, CJ, neuro-surgical diagnosis, protective mattresses and skin

barrier creams) which the present study finds help in the improvement of prevention activities.

The RASs (the Braden scale) and CJ predictive performance

The findings show no significant difference between use of a RAS (the Braden scale) and nurses' clinical judgement on the patient outcomes in terms of PU incidence rate. The incidence rate was 32 per cent in Group A, where the Braden scale was introduced at the pre-test stage, but only 21.6 per cent at the post-test stage. Unexpectedly, this difference does not show that using RASs (the Braden scale) is clinically effective or superior to using CJ or PU training because the incidence rate was 32.6 per cent in pre-test in Group C, where no RAS was applied, but only 15.2 per cent at the post-test stage. These findings suggest that a RAS (the Braden scale) and nurses' CJs were relatively comparable and produced equal effects on patients' outcomes, which is consistent with McGough (2000), who suggested that RASs were not better or more effective than nurses CJs, and with Gould et al. (2004), who found that nurses' clinical judgements were in more close agreement with expert panels than assessment produced by any of the three RASs (Norton, Waterlow and Braden) examined. The findings were, however, at variance with Pancorbo-Hidalgo et al. (2006), Halfens et al. (2000) and Defloor and Grypdonck (2005), who suggest that the use of RASs is better than a reliance on nurses' CJs. It should be noted that the agreement with Gould et al's. (2004) study is less important than disagreement with other studies, as Gould and colleagues examined few patients, relying instead on patient

simulation. There were more comments on the simulation method as rendering impossible communication with patients and the ability to touch their skin to decide its condition.

Although Braden Scores (BS) have been produced by the research team and the Clinical Judgement (CJ) scores produced by ward nurses, relatively similar scores among those patients at high and minimal risk were produced by using both scoring systems. The findings also showed that Braden scores (BSs) and CJs were significant within the study groups and PU incidence. Logistic regression analysis using demographic variables, protective measures, BS and CJ reveal that BS and CJ have a statistically significant prediction function in PU development. The ROC analysis of BS and CJ performance in PU prediction revealed very mild differences in the area under the ROC between BS and CJ (0.635 for BS and 0.592 for CJ) which suggests relatively equal predictive performance of both risk assessment scoring systems among the study sample.

The findings show that 44 per cent of those patients who developed NCPUs were scored at high risk by using BS compared to only 30 per cent scored as high risk by using the nurses' CJ; ROC analysis reveals a small area under the curve for both BS and CJ (0.635 for BS and 0.592 for CJ) in relation to the reference line. These findings demonstrate inadequate performance of both risk assessment systems, a finding which concurs with that of Gould et al. (2004) who suggest that neither RASs nor nurses' CJs should be regarded as very accurate.

However, training has been suggested in order to improve RASs performance (Defloor and Grypdonck 2005). The findings indicate that although the area under the ROC showed relatively similar performance for BSs and CJs among Group A patients, BSs and CJs give the best predictive usefulness among Group B patients, where training was dominant.

When logistic regression analysis was repeated among post-test cases, the results show that only BS and neuro-surgical diagnosis were predictive of PU development, while CJ and other variables were moved out from the prediction model. These findings confirm BS predictive performance compared to CJ which is in agreement with numerous studies validating the BS predictive usefulness (Pancorbo-Hidalgo et al. 2006, Halfens et al. 2000, Schultz et al. 1999 and Defloor and Grypdonck 2005). Furthermore, the ROC analysis (See Figures 4.2 and 4.3) show that the area under the curve of the BS is wider and the ROC curve of the BS is superior to the one produced by the CJ, which portray, admittedly with low power, the usefulness of using BS compared to CJ.

The findings are not sufficient to prove that the use of RASs is superior to CJs. Both risk assessment systems are poor. Although with the conclusions of Gould et al. (2004), it should not be taken as definitive proof to support nurses' CJs on account of RASs because they suggest that both risk assessment methods are not very accurate and the use of the expert model as a standard is not reasonable. The findings could be explained in different ways: the nurses may have become more knowledgeable as they received rigorous wound care training, the whole prevention programme implemented at the RMH may have had an impact on the reduced effects of the RASs, and the attendance of the TVNS may have

encouraged and motivated the nurses to provide more PU prevention. Other factors beyond the scope of this study and which were not recorded may also explain this.

Although the performance of the BS was poor and inadequate and there was no difference between using BSs and CJs in PU risk assessment, the use the RASs (the Braden scale) to aid and facilitate nurses' CJ should continue (Scott 2000, Edwards 1994, Brown 2004, Flanagan 1995 and Mitchell 2004). Nurses' CJs alone cannot be relied upon, because in acute settings they do not have the chance to get to know the patients over a long period of time (Defloor and Grypdonck 2005). The RASs would be used by experienced and novice nurses accompanied with proper training (Pancorbo-Hidalgo et al. 2006 and Defloor and Grypdonck 2005). Furthermore, the RASs are systematic tools and can save nurses time and direct their attention towards providing preventive PU care (Halfens et al. 2000).

The use of available validated scales presenting alternatives for assessing PU risk should continue until new validated risk assessment scales are created. The performance of RASs may be improved when utilising the research findings (Defloor and Grypdonck 2005 and Schoonhoven et al. 2002), taking into account the multifactorial nature of the PU problem. For example the use of non-blanchable erythema as an early sign of PUs (Vanderwee et al. 2007) indicates the importance of PU risk assessment which goes beyond a paper exercise performance in assessing patients at risk. Continuous skin inspection and/or assessment may also improve RASs performance.

The present study describes the role of nurses' CJs in identifying those patients at risk of PU development, but does not scrutinise their performance. The challenge is to explore how they identify patients at risk, the factors that impact on their success and the role that RASs play in this process (Gould et al. 2004). Consequently, many questions in relation to risk assessment of PU and nurses' opinion in assessing patients at risk of PU development remain unanswered until further studies resolve both.

Focus group discussion

The research team also undertook a focus group discussion in order to elicit the views of nurses regarding the research project and its impact on their practice. The nurse participants indicated that they had given careful thought to the problem under study.

Participants were asked about the concept of PU risk assessment and the application of the Braden scale in PU prevention.

The focus group discussion revealed that there had been changes in nurses' knowledge and practice regarding PU prevention. Nurses paid more attention to PU prevention as they received rigorous PU training and as they were requested to apply the Braden scale on their patients. These findings support the effects of the PU programme at the RMH. The nurses stated the importance and usefulness of using risk assessment in PU prevention for the patient and nurses as well; they mentioned that it improved their documentation and communication. According to participant nurses, it would be difficult when risk assessments are not used regularly or initially on patients' admission. Furthermore, they

added that risk assessment may help in making more accurate PU prevention plans. Some nurses commented that risk assessment may help in paying more attention to PU complications where PU wounds exist. Moreover, the nurses suggested that the risk assessment was part of patients' daily physical assessment, which facilitates in identifying those patients at risk of PU development.

The focus group discussion also revealed that the application of the Braden scale had been supported by the participant nurses. It was recognised as an effective tool in identifying patients at risk of PU development and it was understandable and easy to use. The nurses highlighted training as essential strategy to improve their performance of risk assessment.

The discussion revealed that the use of the Braden scale facilitated and aided nurses' decision making. Nurses recognised the benefits of using of the Braden scale as it indicated which risk factors to focus on and the degree of risk; the prevention strategy would then be easy to decide according to clinical guidelines. They added that it also saved their time and effort.

In summary, the focus group discussion found that:

1) nurses realised the value of utilising risk assessment tools in clinical practice. They recognised it as a helpful and essential strategy in a comprehensive PU prevention programme. Risk assessment was acknowledged by nurses as a source of motivation for continuously inspecting patients.

2) the Braden scale was supported by the participant nurses as clinically understandable, easy to use and valid in order to identify those patients at risk. However, they emphasised that more training was required to improve risk assessment performance.

3) the use of RASs (the Braden scale) facilitated the nurses' decision making abilities and focused their attention on specific risk factors.

The focus group discussion findings support the notion that the use of RASs facilitate and aid nurses' CJ, but are at variance with the finding that there was no clinical effect for the RASs on patients' outcomes. The discussion revealed that there is an effect when using RASs on patients' outcomes through the application of a holistic and comprehensive PU prevention programme.

Although the focus group discussion was flexible, it raised many important points and gave the opportunity for participants to share their clinical experience. It reflects the views of participants which may be biased and may have given idealised responses expected of them.

5.4 Interpretation of additional findings of the study

This section presents interpretation of recorded variables in the study in relation to PU incidence which includes: PU incidence and prevalence, the impact of patients'

demographic characteristics on PU incidence (gender, age and diagnosis) and the impact of protective measures on PU incidence (protective mattresses, skin barrier creams, turning schedules and vitamins and nutritional supplements).

PU incidence and Prevalence

Numerous studies have been conducted to estimate PU prevalence and incidence. An overview of these shows a lack of consistency and of standardisation in research methods in terms of different populations, data collection methods, patient observation methods and periods of observation due to a lack of consensus on PU definition, aetiology, classification systems, risk factors, risk assessment scales and cut off threshold scores. As a result, the prevalence and incidence estimates cannot be compared with each other.

The EPUAP method of estimating incidence and prevalence has been acknowledged in the literature. It facilitates the development of prevalence estimates and is sufficiently robust to measure and compare prevalence among different countries according to Gunningberg (2005b) and Vanderwee et al. (2007).

The pressure ulcer incidence rate in this study was 22.9 per cent, and reflects nosocomial ulceration among hospitalised patients at the RMH. This figure is particularly useful in providing a broad view of PU at the RMH and in establishing baseline data for future improvements where national studies and documentation of PU are lacking (Halfens et al., 2001, Klazinga, 1994, Saleh et al. 2006). It may also be used as one measure for the

development of PU prevention strategies within the RMH as a health care facility. The PU incidence rate was the main outcome indicator in this study for the evaluation of the effectiveness of RASs on patients' outcomes (Cullum et al. 1995).

Although the incidence rate improved since the implementation of the wound care programme at the RMH in 2003 (the incidence rate in that year was 36.4 per cent) as shown in chapter one (Table 1.1), it is still high when compared with developed countries (Saleh et al. 2006) such as the UK, the USA and Canada. It was 2.2 per cent per annum to 29 per cent over a maximum of six weeks in the UK and 8.5 per cent over a one- to four-week period to 13.4 per cent for a maximum of two weeks in the USA and Canada (Kaltenthaler et al. 2001).This demonstrates the need for further exploration of different PU incidence figures to show the effectiveness of the prevention programme implemented, a need which is partly addressed through this study. The effect of using RASs, which is the initial step in any prevention programme, was examined in respect of patient outcomes as a key aim of this study.

The PU incidence figures at the RMH seems better than PU prevalence, since 33.7 per cent (242 of 719) of the patients were admitted with Stage One to stage four PU. PU prevalence is high, being comparable with international reports in developed countries such as the UK and Europe. It ranged from 5.1 per cent to 32.1 per cent in the UK (Kaltenthaler et al. 2001) while it was ranged from 7 per cent in Germany to 15 per cent in the Netherlands in 1995 and 28 per cent in Germany to 33 per cent in Netherlands in 2004 (Tannen et al. 2004 and O'Dea 1995).

The PU prevalence figures at the RMH could be explained in regard to the EPUAP statement on prevalence and incidence monitoring of PU occurrence (Defloor et al. 2005). More admissions are to be expected, as the RMH is the central military referral hospital in Saudi Arabia and the prevalence is affected by the presence and effectiveness of PU prevention and treatment programmes. There are no PU prevention programmes implemented among those patients who receive care by home health and community services in Saudi Arabia. As a result, there was no significant variation in prevalence rate between the pre-test and post-test stages.

Prevalence was not included in evaluating the effects of RASs on patient outcomes (Cullum et al. 1995); it gives an insight into the magnitude of the problem of PU which may aid in planning for health resources and facilities rather than making inferences about the effectiveness of PU prevention programmes, in part or as a whole (AHCPR 1992, Defloor et al. 2005, O'Dea 1995).

Although the overall incidence rate in this study (22.9 per cent) is higher than the rate reported in developed countries such as the UK and Europe, the severity of NCPU is consistent with the findings of international studies such as Whittington et al. (2000) and Schultz et al. (1999).The study revealed that nearly half (47.2 per cent, or 78 of 165 patients) of NCPU were Stage One, while only 6.6 per cent (11 of 165 patients) were Stage Four lesions. As opposed to incidence, the severity of PU lesions among those patients admitted with PU was 44 per cent (106 of 242 patients), which increases the risk of developing new NCPU among those patients included in the study. O'Dea (1995) finds that

the source of PU damage was in the hospital, but the study findings imply that this is not so. This may be explained either by the patients receiving protective measures to relieve pressure and tissue damage, or by the possibility that pressure and shearing forces are scrambled with the effect of patients' tissue tolerance, which may reduce the occurrence of severe ulcers. However, more clarification is needed to explore this area.

The AHCPR (1992) classification system was used in this study. Calculating Stage One PU may limit comparability with other studies that indicate Stage Two and higher because there is a debate on the usefulness and accuracy of using Stage One (Bethell 2003). Some researchers (Schoonhoven et al. 2006, Schoonhoven et al. 2002, and Kaltenthaler et al. 2001) omit this stage completely, although this may lead to further complications (Bethell 2002). Inclusion of Stage One is considered in the early diagnosis of PU development, and may result in the reduction of the number of patients needing prevention, which is consistent with Vanderwee et al. (2007); there is no international consensus on specific staging system as mentioned by Bethell (2002) and Harker (2000). Furthermore, Schultz et al. (1999) suggest that the studies report their rates of Stages One to Four inclusive and then report Stages Two to Four in order to resolve the problem of including Stage One.

More than half (50.3 per cent) of NCPUs were developed on the sacral area, which is consistent with previous studies such as Schoonhoven et al. (2006), Schultz et al. (1999), Whittington et al. (2000), Gunningberg et al. (2001), Schue and Langemo (1998) and Defloor 1999).The most severe ulcers (Stage Four) appeared on the sacrum, heels, ankle joints and toes. The majority (53.8 per cent) of patients developed Stage One PUs and nearly half (48 per cent) were admitted with severe ulcers (Stage Four) on the sacrum

challenges the effectiveness of patients' turning programmes and suggests special care when applying preventive measures.

The impact of patients' demographic characteristics on PU incidence

This section discusses the impact of those recorded patient demographic characteristics which may mask the effects of RASs on PU development. This section explores the effects of gender, age, and diagnosis on PU development.

The findings (Appendix S) show that 67.2 per cent (111 of 165) of the patients who developed NCPU were male. Nevertheless, 92.4 per cent of Group A patients were male and the majority (66.2 per cent) of Group C patients were female, which clearly was not associated with PU development because relatively similar PU incidence rates (24.4 per cent in Group A and 21.1 per cent in Group C) was found in both groups. The findings also show a similar distribution of male and female patients in pre-test and post-test stages; this suggests no association with PU development, as there was a significant difference in this development between the two stages. This finding substantiates similar ones in previous studies including Schultz et al. (1999) and Whittington et al. (2000), but contradicts Tannen et al. (2004) who find that more females than males suffer from PUs. Although gender was statistically significant ($x^2 = 192.93$, $P < 0.001$, $d.f. = 2$) within the study groups, it was not in relation to PU incidence. Moreover, gender was not found to be a predictor of PU development, a finding consistent with Anthony et al. (2003) .This implies that gender may

not be a risk factor of PU and should be reviewed in current risk assessment scales such as the Waterlow scale, which may simplify the scale and improve its performance.

Descriptively, the findings (Appendix S) showed that the sample population was mildly skewed toward older patients. Group B patients were younger and showed a similar PU incidence rate compared to group A and C patients. 60 per cent of those patients who developed PUs were 60 years and older. This finding was similar to Whittington et al. (2000) and is supported by Tannen et al's. (2004) conclusion that age had the highest impact on PU occurrence of any variable. A relation was found between PU development and patients' ages. Age was statistically significant in the study groups and PU incidence. Moreover, it was found to be a predictor ($x^2 = 8.920$, $P = 0.003$, $OR = 1.132$) of PU development when logistic regression analysis was performed. Age was also shown as a predictor of PU development in many studies (Anthony et al. 2003, Schultz et al. 1999, Halfens et al. 2000 and Gunningberg et al. 2001b). This finding, therefore, confirms that it is important to consider age as a relevant item in a risk assessment scale for hospitalised patients, a consideration which may improve the RASs predictive performance.

Although 40 per cent (289 of 719 patients) of the sample and 50 per cent of patients developed NCPU had medical diagnosis, it was noted that diagnosis was statistically significant within both the study groups and PU incidence rates. The findings (Appendix S) showed relatively similar PU incidence rates among groups A and C in which medical disorders formed nearly 50 per cent of their patients. When diagnoses were entered in logistic regression analysis with a series of variables (the Braden scale, clinical judgement,

protective measures of PU and demographic variables), neuro-surgical diagnosis was found a predictor of PU development; this is consistent with Halboom et al. (1999). Although only 8 per cent of those patients who developed NCPUs were neuro-surgical, the data confirmed that such patients were at greater risk of PU development. Neuro-surgical patients spend long time under surgery, are immobile and are unable to feel pain or respond to any signs of tissue damage caused by prolonged pressure effects, which is consistent with Defloor's (1999) conceptual model of PUs. It seems that this subgroup of patients do not receive initial PU prevention in the immediate post-operative phase compared to other diagnostic groups who may have a lower risk, better levels of activity and mobility and who may receive better prevention such as ambulation post-operation and PU protective mattresses. The findings (Appendix S) indicate that the turning schedule for the neuro-surgical patients in Group B was either every 2 hours, every 3 to 4 hours or every 6 hours. This was erratic: 50 per cent of patients were turned every 6 hours. Since these patients have been showed to be at severe risk, a consistent turning schedule should have been performed, combined with the use of appropriate protective mattresses.

However, analysing variations of incidence among such subgroups is beyond the scope of this study. Further research is required to explore risk factors among specific diagnostic groups.

The impact of protective measures on PU incidence

The study was performed on inpatients at the RMH, where a range of protective mattresses are available for use. Protective mattresses were considered in patients at risk of PU development (Lindgren et al. 2002) and in accordance with the AHCPR (1992) guidelines. Special mattresses and beds or overlays were used to prevent PUs in those patients at high risk, as well as in PU treatment (Cullum et al. 1995). However, their use may potentially distort the effects on PU incidence among different patient groups and may decrease the predictive value of the RASs (Defloor and Grypdonck 2005); (Defloor et al. 2004). Apparently, PUs continue to develop despite the use of protective mattresses, which implies that the effectiveness of these mattresses is limited, in general, in the study groups. For example, although 52 per cent of Therakair mattresses (the most expensive type of protective mattress) were used in Group A where the Braden scale was introduced, the incidence rate was relatively similar between study groups.

However, nurses in Phase Three (the post-test stage) used more protective mattresses, and here the incidence rate was significantly decreased. For example, 53 per cent (69 of 130) of Therakair mattresses were used in the post-test stage, while only 28 per cent (37 of 130) of these mattresses were used in the pre-test stage (Appendix S). Moreover, 51 per cent (282 of 554) of those patients who did not develop NCPU used one of the protective mattresses and only 39.3 per cent (65 of 165 patients) of those patients who developed NCPU were placed on one of protective mattresses (Appendix S). Patients placed on standard hospital mattresses have a higher risk of developing NCPU, as shown by logistic regression

analysis, a statistic that is congruent with Cullum et al's (1995) findings, which suggest that the standard hospital mattress is less effective in PU prevention than some other protective mattresses. These findings suggest that using protective mattresses is an essential part of the prevention programme implemented at the RMH, which is consistent with the recommendations of international clinical guidelines such as AHCPR (1992) and NICE (2003).

The present study does not demonstrate a protective function for the mattresses in PU prevention. The logistic regression analysis revealed no predictive effect for any protective mattresses on PU development; it was even different within the study groups and initially for PU incidence. Limited effects of protective mattresses among study groups may be explained by their appropriate utilisation. The nurses were not able to distinguish the use of different protective mattresses according to patient risk categories in order to provide the optimum effect. It is presumed that Therakair mattresses are used for patients at severe risk and the alternating one for the other risk categories. For example, introducing the Braden scale to Group A patients encouraged the nurses to use Therakair mattresses (52 per cent), while only 34 per cent (84 of 248) of those patients rated as high risk according to the Braden scale were from Group A (Appendix S).

The link between scores and types of protective mattresses should be investigated further, as there are too many types of protective mattresses available in clinical practice.

Skin care is one of the major issues in PU prevention, as dry or moist skin has been shown to increase PU development. The intensity of shearing force is influenced by wet and dry skin, which fosters the occurrence of PU (Defloor 1999).

Preliminary data analysis (Appendix S) showed that 52 per cent of those patients who developed PU used skin barrier creams. Also it showed that skin barrier creams were not significant within the study groups but they were significant for PU incidence. Hodgkinson et al. (2007) reviews the poor evidence regarding interventions (included topical skin care) that may improve the skin condition in older people. Logistic regression analysis revealed that skin barrier creams have a significant protective function in PU development. It implies that skin barrier creams can be used as an adjunct as part of an overall PU management programme. There is consistency with most PU prevention clinical guidelines, which include a reference guide on skin care. For example, AHCPR (1992) guidelines indicate the use of topical agents that act as barriers to moisture, and EPUAP (1998) guidelines include skin dryness and moisture as elements of skin assessment in order to maintain and improve tissue tolerance to pressure so as to prevent injury.

Although the AHCPR (1992) PU guidelines were adopted for the RMH PU prevention programme and positioning devices were suggested to keep bony prominences from direct contact with one another, the data showed that turning was not significant among the study groups and in PU incidence. Furthermore, logistic regression analysis shows that turning patients is not a predictor of PU development. Such findings are strange when turning is

suggested by most international PU prevention clinical guidelines such as AHCPR, European Pressure Ulcer Advisory Panel (EPUAP), the National Institute for Clinical Excellence (NICE) and The Dutch consensus guideline (Defloor et al. 2004). It is inconsistent with Defloor et al. (2004) and Defloor and Grypdonck (2005) and Cullum et al. (1995), who find that turning does decrease the PU incidence when used in combination with pressure-reducing materials. These inconsistent findings may need more exploratory studies. However, it could be explained as follows: because the majority of developed NCPUs were of the Stage One category, the non-blanching erythema was not stable and was not caused by pressure and shearing forces in most cases. Another possibility is that the turning procedure itself may not have been applied properly, and therefore has no effect on PU incidence.

Assessment of nutritional intake and nutritional support was suggested as a factor in maintaining skin integrity and preventing PU development (AHCPR 1992). This was supported in Defloor's (1999) conceptual scheme of PU development, which states that proteins and vitamin C may encounter reduced tissue tolerance and the risk of tissue damage. Although the role of vitamins and nutritional supplements are obvious in PU prevention and wound healing, the findings of this study show that they are not significant in reducing PU incidence and are not predictors in PU development. These findings do not agree with Stratton et al's (2005) systematic review, which shows that enteral nutritional support, particularly high protein, can significantly reduce the risk of developing PUs by 25 per cent and may improve healing of PUs as well. It is also incongruent with current Cochrane review findings conducted by Langer et al. (2003). A possible explanation for

these contradictory findings is that perhaps nutrition and vitamin intake are observed in patients who may already be in good nutritional condition (Halfens et al, 2000). Consequently, these patients may have good tissue tolerance to the development of PUs. However, further study is needed to explore the effects of nutritional supplements on PU development among the RMH patients.

5.5 Summary

This chapter incorporates interpretation, explanation and discussion of the study findings. It explores the impact of utilising theoretical knowledge of risk and risk management to improve patient outcomes associated with PU risk management in health care. It also presents the methodological discussion and interprets the contribution of this work in PU risk management. It has discussed the main findings of the study, the usefulness of using PU prevention programmes in the RMH, the clinical effectiveness of using RASs on patients' outcomes and the similar effects of using RASs and nurses' CJs in improving patients' outcomes in terms of PU incidence. Additional findings of the study interpreted, discussed and incorporated to PU prevention and management. The study addresses the importance of utilising age, and reviewing gender variables in patient risk assessment. It also presents the usefulness of using skin barrier creams and protective mattresses in PU prevention. The discussion provides evidence of the risk factors associated with PU development. The PU risk is nine times as great among those patients who had neuro-surgical disorders compared with those who had different diagnoses.

The focus group discussion was analysed, interpreted and incorporated into the study's findings. It reveals agreement and support to the study findings in that the use of RASs facilitates and aids the nurses' CJs. The nurses believe that RASs may have a clinical effect on PU prevention through a holistic prevention programme.

Chapter Six: Limitations, Recommendations and Conclusions

Introduction

The present study explores the effects of using RASs (The Braden scale) on patient outcomes in terms of PU incidence reduction, and its findings can be applied to national and international nursing communities. Although it is the first study conducted in Saudi Arabia, it contributes to the national and global body of knowledge. It is one of few studies to examine the effects of RASs on patient outcomes and the first to examine the effects of using the Braden scale on patients' outcomes, all of which yield a new approach to evaluating RASs compared to conventional methods of using their predictive value. Additionally, it provides the local hospital with baseline data and recommendations for future developments in improving the quality of care provided to those patients at risk of PU development at the RMH and other health care facilities in Saudi Arabia.

This chapter encompasses the usefulness of the study findings in terms of limitations, recommendations and conclusions which are given in order to enable practitioners,

managers and researchers to broaden their understandings about PU risk assessment, and to change their practice towards optimum PU prevention.

Although the researcher used the best accessible design to manage this research, it is important to mention several limitations which were encountered throughout the course of the study. The limitations included methodological design, study sample and data collection process.

This chapter also suggests recommendations for future research, implications for nursing practice and for policy change; all of which incorporate optimum PU prevention through the development of nurses' skills to identify those patients at risk of PU development.

6.1 Study limitations

Although this research shows considerable strengths as an initial study in the field of PU risk assessment, several limitations are evident:

1) It uses a quasi-experimental design and lacks randomisation, which may imply concerns about the generalizability of the findings compared to experimentally designed studies because of weak casual inference and an increased threat to internal validity (Talbot 1995 and Polit and Hungler 1999). In this study, the researcher examined the effects of RASs (the Braden scale) on patient outcomes in

terms of PU incidence reduction, which introduces a valid and new approach to evaluating the effectiveness of RASs. Additionally, the researcher integrated prospective control groups and pre-test post-test designs. This restricts the effects of external factors and strengthens the validity of the study's findings. Proper methodological procedures were applied and nevertheless the generalizability of the findings was considered with caution. The PU is a problem of multifactorial nature where it is difficult to report and collect reliable data (Anthony et al. 2006 and Gunningberg et al. 1999). However, although the study adds cumulative evidence to the effectiveness of RASs on the patients' outcomes, it suggests the desirability of more studies of mixed nature (qualitative and quantitative) to answer different questions about the clinical usefulness of risk assessment on patients' outcomes.

2) A non-probability purposive sampling design was used to select the study sample. The probability sampling is a more respected approach than non-probability because greater confidence can be placed in the representativeness of the sample (Polit and Hungler 1999 and Talbot 1995). Although the researcher was not able to randomise the aggregate patients and nurses at the same ward level due to ethical considerations and the nature of PU problem, the wards were randomised for inclusion in different study groups. Even though a sound rationale behind using the sampling design and adjunctive procedures was clearly cited to give the findings more validity, the generalizability should be handled with caution. Furthermore, the study was from one referral military hospital in Saudi Arabia. This also limits the generalizability of the findings to similar settings. It should be noted that the

sample size was adequate according to statistical procedure by using the G power test (Faul and Erdfelder 2006) and the effect size was 0.3, between a medium and small effect.

3) The inclusion criteria for those patients considered at risk was the Braden scale cut off point of ≤18. The use of such a cut off point indicated that there were more patients at risk, which was one of the main reasons for distorting the sensitivity of the Braden scale. The literature reviewed indicated different cut off points among different populations; the use of the ≤18 cut off was acknowledged by Brown (2004) and Pancorbo-Hidalgo et al. (2006). Although the inclusion criteria encompassed those patients admitted with extant PUs (Stages One to Four according to the AHCPR (1992), which added more objectivity and captured more intrinsic and extrinsic factors that might affect the results, they may also have led to bias because these patients may have received more preventative treatment.

4) The study reveals a number of issues with regard to the data collection process.

Firstly, the study used different data collection methods: the majority of data was collected through patients' observation, but self report and focus group discussion was also used. In this study, patient observation included inspecting the skin for the presence of NCPU according to the AHCPR (1992) PU classification system which includes Stage One PUs. Although several researchers indicated Stage Two and higher in their studies such as

Schoonhoven et al. (2006), there is no international consensus on specific staging system to be used (Bethell 2002 and Harker 2000). Difficulty in observing patients with darkly pigmented skin was reported in some instances. Self reporting was used to collect ward nurses' CJs among included patients; the ward nurses did not know the patients' Braden scores. The method by which the nurses' made their decisions was not described or observed. Furthermore, although the focus group discussions supported the study findings, they reflect the viewpoints of the participant nurses, who may have given idealised responses.

Secondly, the patients were observed on a weekly basis. With such a long interval period between skin inspection, PU changes over a shorter period of time could have been missed. Furthermore, the eight week observation period was relatively long as the patient may develop several PUs during this period.

Thirdly, the researcher was the TVNS for the RMH, which may have encouraged the ward nurses to use more PU prevention measures.

5) The scale used in this study (The Braden scale) has not been previously tested and/or used in Saudi Arabia. The Braden scale was extensively studied and has been acknowledged as providing optimal validation. The face and content validity were maintained by experts. The reliability of the instrument was tested throughout the

pilot stage of the study, yielding a complete agreement of total Braden scores between ten nurses who assessed one patient with a very tiny variance among the scores of the Braden subscales. The Braden scale was chosen because of the reasons mentioned previously in chapter three (section 3.5).

6) Another limitation is related to staff turnover and newly employed nurses, which is a well-recognised problem in such large clinical settings. This problem had a very limited effect on the study as the training and education system is a mandatory activity and policy at the RMH.

7) The limited resources influenced the number of nurses who could contribute to the research and the numbers of patients that could have been observed. Patients in many parts of RMH were not studied.

6.2 Recommendations

The current study draws attention to PU risk assessment as a preventative strategy. At the same time the true scale of the PU problem is unknown, but it is certain that it has been vastly underestimated. Numerous studies on PU risk assessment scales have been conducted, all of which revealed variations in the study population, different data collection methods, a lack of national and international consensus on PU staging systems, risk

assessment scales used and inadequate documentation of prevalence and incidence as outcomes. All of this lead to a lack of comparability between data sets collected and cast doubt on the quality of the findings. The present study supports the comprehensive PU prevention programme implemented at the RMH and helped to achieve some of its long term objectives:

1) The quality of nursing care improved among those patients at risk of PU development, as was evident through the reduced figures of PU incidence among hospitalized patients.

2) It provided base line evidence which contributes to the development of the body of nursing knowledge in this area of specialization. This development was strengthened by the unique opportunity presented by the Braden scale's recent introduction into the RMH to research the clinical effectiveness of RASs. As a result, this study tried to provide a valid and reliable scale of data regarding PU risk assessment. It tried to overcome other studies' methodological flaws, and attempted to shed light on risk assessment, which plays a significant part in PU prevention.

Although the study did not offer a solution to the PU problem, it contributes to future improvement and provides suggestions for future research.

PU prevention remains an important area of patient care in acute and community health settings. Hence, risk assessment is essential to any PU prevention strategy.

The study suggests recommendations for practitioners working with patients. It also provides recommendations for policy makers who have a responsibility towards the improvement of PU prevention policies. Additional recommendations are made for further research in this field.

6.2.1 Recommendations for nursing practice

The study produces recommendations to improve nursing practice in relation to PU care and prevention, including PU risk assessment. These recommendations fall into two main themes:

1) The implementation of RASs as a tool for assessing risk of PU development. There is national and global consensus on using RASs as key components in any PU prevention guideline such as AHCPR (1992) and EPUAP (1998). RASs are structured models of PU risk factors which present systematic and objective sets of information that are suggested to aid and facilitate nurses' CJs associated with PU risk assessment and management (Scott 2000, Edwards 1994, Brown 2004 and Flanagan 1995). These scales offer an objective alternative in assessing the risk of PU development, as no other options are superior. They are dynamic to change and maintain a reasonable degree of validity through continuous investigation, refinement and critical review. The RASs should not

be used in isolation, as they are central in a risk-based system implemented in clinical practice. For example, RASs can be used as clinical audits to monitor patient's state of risk and to ensure that these patients receive appropriate PU prevention.

Implications of using RASs into practice

a) PU training and education programmes. The successful implementation of RASs cannot be achieved across the RMH unless there is sufficient preparation of nurses who are expected to use the tool. A systematic and organised PU training programme will provide consistency and broaden nurses' knowledge and understanding of PU risk factors which are essential for effective and appropriate application of RASs. Mandatory PU training including RASs and use of different educational strategies need to be implemented to enhance and improve nurses' utilisation of knowledge.

b) Nurses' should be deemed to be competent for the effective implementation of RASs into practice. Hence a continuous ongoing PU training programme should be put in place to ensure that practice remains up to date and competency is checked

c) Managers have to be involved in decisions associated with implementation of RASs. Managers can be instrumental in maintaining a cooperative environment, allocating time and resources necessary of using RASs. Furthermore, managers should take the responsibility for ensuring that staff

are motivated, as lack of motivation may result in an inappropriate implementation of RASs. Additionally, managers should monitor the application of RASs as it is also essential to sustain appropriate and effective use of RASs into practice.

d) A Tissue Viability Team (TVT) should be set up to oversee the overall programme of PU prevention at clinical level. TVT and managers should be in agreement on the composition of the team. The TVT can improve the application of RASs through dynamic and continuous monitoring of using these tools in clinical practice. Furthermore, the TVT can provide further refinements of RASs through active examination of their effectiveness in clinical use.

e) The setting up a two phase pathway for the management of patients: In phase one, an assessment will be carried out on all patients on admission by the nurses Those patients who are identified as 'high risk' should proceed to phase two in which the patients will undergo a more comprehensive PU assessment by the TVNS for expert advice on prevention and management strategies.. This approach may facilitate the application of RASs and clinical decisions related to PU risk assessment, prevention and management through better understanding and perception of information related to risk and risk management.

2) Better use of available resources in PU prevention

The nurses need to know what PU prevention resources are available that can be used in their clinical areas, when to use them, how to use them and in what basis these measures are evaluated. **This demonstrates the following implications:**

a) a need to review and revise protocols and guidelines of using PU prevention measures in the RMH. This includes clear and flexible guidelines of what PU prevention measures are available and when and how to use them. These guidelines should clarify what prevention strategies are required for the different categories of risks. For example, a patient at severe risk and scored at (9-10) by using the Braden scale has to be placed on a low air loss mattress such as Therakair. These guidelines should be based on research evidence which enhances accuracy and effective use of prevention measures and minimises their misuse.

b) Availability of protective measures. The nurses need to know what protective measures are available in RMH to reduce risk of PU development. Managers should ensure that adequate resources are available in clinical practice. Hence a financial plan is necessary to support the purchase of necessary equipments/ resources. These measures should

meet and satisfy the needs of patients at risk and evaluated in the light of new research evidence.

c) Nurses' accountability and empowerment. Managers should encourage nurses and empower them to sustain professional accountability and support autonomous decision making in relation to PU prevention and management through decision analysis and evidence-based approaches.

6.2.2 Recommendations for policy improvement

A Risk management strategy (RMS) should be developed in order to improve policies in relation to PU prevention and management at the RMH. RMS refers to a systematic approach that integrates recognition of risk, risk assessment and activities to manage risk (Robillard 2001). RMS should be based on theoretical understanding of risk and risk management models as described earlier in Chapter Two. Clinical governance including RMS can be used as a broader framework in order to maintain and improve the quality of patient care within a health organisation. RMS aims to reduce not only PU risk but also other risks (risks to patients, practitioners, organisation) using organisational resources. The implications of applying RMS are:

a) The appointment of risk manager responsible for implementation of RMS through: making sure that RMS process is applied effectively, ongoing consultation and communication with management board and

ensuring that RMS activities are integrated in decision making and clinical governance systems. The risk manager aims to incorporate the infrastructure of risk management activities, correlate RMS to be aligned with organisation's overall objectives, provide clear direction for senior management and get their financial support, and contribute in refining the existing risk management policies. Building staff capacities in risk assessment and management, establishing training plans and using risk assessment and management tools can be additional functions of risk manager.

b) Risk culture environment. RMS cannot be applied in isolation. A cultural shift towards risk awareness is an essential element in order to implement RMS activities in RMH. A sustained commitment and proactive assessments of risk are required in order to manage risks created by rapid changes in health care. A cultural shift towards better awareness of risk through equity, transparency and openness is necessary in order to secure a higher quality of care for patients.

c) Staff empowerment. Staff have to work together and with the risk managers to inspire a shared vision and objectives of a risk management strategy which creates a sense of organisational ownership. Furthermore, managers in RMH have to support staff by developing a reward system and encourage team work. The engagement of staff in these activities will encourage ownership and act as a powerful driver for change.

The implementation of a PU prevention programme in RMH can be part of RMS. Although the programme resulted in a reduction of the PU incidence rate, it needs to be in alignment with vision and objectives of RMS in order to maximise its potential effectiveness. For example, the PU prevention programme should have a broad scope of PU risk management including patients in the community and home health care together with those patients in RMH as an acute health care institution. Furthermore, the components of the programme have to be refined in the light of updated research evidence to inform effective prevention which implies, at the end, an effective outcome from using RMS.

6.2.3 Recommendations for future research

The study of PU risk assessment is a challenging and controversial area of research because of the multifactorial nature of PU problems and the difficulty of collecting valid and reliable data about PUs. Further research is needed to explore entire variables which interact to cause the problem. PU risk assessment is essential for prevention; this makes it necessary to conduct more studies in this field in order to explore its role in PU prevention and its impact on patients' outcomes through cumulative research evidence that will in turn lead to generalised findings and improvements in practice. However, more studies are needed on this topic that take into account the present study's limitations.

The following areas of research will add more to the evidence base, which in turn may result in the improvement of PU risk prevention and management practices and the reduction of patients' suffering:

1) Developing RASs for better risk assessment of PUs

Numerous RASs have been developed and evaluated, with no clear conclusion on their effectiveness and their protective effects in reducing PUs occurrence. These studies have used different designs, populations and outcome measures. Furthermore, the absence of national and global consensus on PU definition, classification, and threshold scores of RASs make it difficult to draw conclusive evidences in relation to effects of using RASs in health care. Although these studies have suggested a variety of refinements and modifications of existing RASs (Anthony et al. 2003, Halfens et al. 2000, Gunningberg et al. 2001b and Tannen et al. 2004), they demonstrate limited clinical effects on patient's outcomes (Gunningberg et al. 1999). Less is known about reasons for these limitations and scope of improvement (Papanikolaou et al. 2007) in dynamic and rapidly changing health care organisations. Thus, there is a need to develop robust RASs in order to facilitate and aid PU prevention and management.

Risk assessment models (Chapter two, Section 2.8) should be used as a framework in the development of RASs as it will allow the problem to be contextualised. It is also important to understanding how risk factors, which are the fundamental units of

RASs, reflect the real state of the patient in relation to risk of PU development. It is crucial and timely for further research to be conducted in developing RAS which will enhance greater sensitivity and be more effective at reducing PU.

The current research findings, valid research evidence, modern knowledge in PUs and known models of the PU development process such as Defloor's model (1999) can be used together to develop new RASs. All of these provide essentially needed risk factors associated with PU development which are the core structure of RASs.

Several restraints may limit researching the development of RASs such as the absence of consensus on PU classification. A more comprehensive model for researching PU RASs would be to base them on real physiological changes that are fundamental in physiology of PU development process. This ensures better understanding of changes reflecting the real state of the patient in relation to PU development. For example, Vanderwee et al (2007) have selected such an approach to examine whether the use of non blanching erythema can be used as an indicator to start preventative care resulting in better outcomes in terms of PU occurrence rather than conventional use of RASs. It also supports the clinical value of using RASs beyond a paper exercise in assessing patients at risk of PU development.

A suggested approach in developing RASs is to structure PU assessment in two phases, as described in (Section 6.2.1), which may facilitate the application of RASs in clinical practice.

A continuous, ongoing researching of RASs is suggested to provide evidence in relation to effective use of newly developed RASs which can be used to sustain improvement of the clinical value of using RASs in health care and to meet the needs of policy changes associated with risk and risk management.

2) Improvement of nurses' CJs

A limited number of studies have been conducted to study the role of nurses' knowledge and experiences (CJs) in relation to decisions made to prevent and manage PUs such as Gould et al. (2004). Future research is required to study this complex area of decision making in relation to PU prevention. For example, to explore what factors nurses use when making CJs in PU risk assessment and what is the role of nurses' experience in the CJ process.

Several constraints may arise when researching CJ as practitioners will have to be more explicit and be able to articulate how they are making decisions. Additionally, there is no definite framework that explains the process of human judgment itself and/ or explains the role of knowledge and experience in clinical decision making.

6.3 Conclusions

After fifty years of using more than forty RASs in clinical settings, the clinical evidence on the effects of RASs on patients' outcomes is scanty. The current study contributes to the

body of nursing knowledge in PU prevention and management and adds additional evidence about the use of RASs. The study achieves its main objectives in examining the impact of using RASs (The Braden scale) on patient outcomes in terms of PU incidence. The outcomes of the study are important and have implications for practitioners, administrators and researchers. The study results in the following valuable conclusions:

It confirms that there is no significant clinical impact for using RASs (The Braden scale) on patients' outcomes in terms of PU incidence reduction. The findings suggest the clinical effectiveness of the comprehensive PU prevention programme implemented in the RMH to reduce the PU incidence rate. The components of the prevention programme, including the use of RASs (The Braden scale), preventive measures and PU training and education programmes should be considered consistently and collectively.

Although the study concludes that there is no significant difference between using RASs (The Braden scale) and nurses' CJ on the patients' outcomes in terms of PU incidence reduction, the study supports the use of RASs to aid and facilitate nurses' CJ in order to produce better PU prevention outcomes as currently recommended by EPUAP (1998) and AHCPR (1992).

The PU training programme had limited effect in reducing PU. Therefore a continuing professional development programme should be implemented to ensure staff having the necessary up to date knowledge on the management of patients at risk of developing PUs.

To sum up, the present study provides an opportunity to examine the clinical effectiveness of RASs (The Braden scale). It supports the conceptual framework which was suggested in Chapter One and adds strength to the claim that clinical effects for using training, RASs, and CJ should be used equally to improve patients' outcomes in terms of PU incidence rate. It also emphasised some potential applications of RASs as discussed throughout the literature. The study suggests new venues for future research to decide the improvement of RASs and nurses' CJ until new clinically effective risk assessment system has been created. All of these can be employed as input in a broader context involving better understanding of risks and risk management in relation to decisions made to improve PU prevention and management. The study goes beyond the scope of PU risk assessment and management to suggest implications applicable to improve practice, research and management of other risks in health care.

6.4 Summary

This chapter discussed the study limitations that were encountered during the course of the study. The methodology, sampling and data collection process were critically analysed. This chapter also suggested recommendations for further research, implications for practitioners and policy changes for administrators. These recommendations are based on a broader understanding to the concepts of risk and risk management in health which incorporates more PU prevention in identifying those patients at risk of PU development, and in turn reduces patients' suffering and complications resulting from newly developed

PUs. The study concludes by recommending the use of risk management strategy in RMH to satisfy the clinical effectiveness of using RASs (The Braden scale) on patient outcomes in terms of PU incidence reduction and implementing the comprehensive PU prevention programme

Researcher work through the study period

(2003 – 2007)

Saleh YNM (2003) Comprehensive wound management survey -RMH-Saudi Arabia. *Insight RKH News* 1(1), 2-3.

Saleh YNM, Parboteeah S., Anthony D., (2006) (Pressure Ulcer Prevalence and Incidence among Hospitalised Patients at Riyadh Military Hospital – Saudi Arabia from 2003 to 2006) *Poster Presentation.* 9th. EPUAP Meeting, Berlin-Germany 2006. (Appendix R)

Saleh YNM, Parboteeah S., Anthony D., (2006) (Pressure Ulcer Prevalence and Incidence among Hospitalised Patients at Riyadh Military Hospital – Saudi Arabia from 2003 to 2006). *Insight. RKH News.* http://www.rmh.med.sa/nursing/index_files/insight/.

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APPENDICES

Appendix A

Comprehensive Wound Management Survey Results (2003)

Table 1
Demographic Data

No	Wards	Location	Total beds	Total staff	Occupancy rate
1.	**Male ward**	Al-Kharj	27	17	48.1%
2.	**Surgical Male**	BL.100	30	24	100%
3.	**Surgical Female**	BL.100	23	20	65.2%
4.	**Isolation**	BL.70	14	19	64.2%
5.	**Orthopaedic**	BL.100	32	24	81.2%
6.	**Neuroscience**	BL.100	15	21	93.3%
7.	**GICU**	BL.100	26	73	69.2%
8.	**Male Medical**	BL.100	30	29	100%
9.	**OR.**	BL.100/111	11	21&48	78.65/wk
	TOTAL		**197 /OR excluded**	**296**	

Table 2

The level of using wound management documentation

	Risk assessment tools (Norton scale)	**Wound assessment tools** (If present)	**Wound follow up tools** (If present)	**Nurses notes on wound management**
Yes	25 %	12.5 %	37.5 %	75 %
NO	75%	87.5 %	62.5 %	25 %

Table 3

Prevalence rate according to wound type

Wards	**Pressure ulcers** (Stage one included)	**Leg Ulcers**	**Diabetic Foot Ulcers**	**Post operative**	**Fungating Wounds**	**Burns**
Male ward	4	0	1	0	0	0
Surgical Male	6	0	1	11	0	0
Surgical Female	2	1	3	5	0	0
Isolation	8	0	0	0	0	0
Orthopaedic	8	0	0	3	0	0
Neuroscience	0	0	0	0	0	0
GICU	6	2	0	0	0	0
Male Medical	12	0	2	2	0	0
OR.	**46**	**3**	**7**	**21**	**0**	**0**

Table 4

Staff Awareness about wound management

Wards	Awareness level
Male ward	65%
Surgical Male	67.5%
Surgical Female	72.5%
Isolation	57.5%
Orthopaedic	66.6%
Neuroscience	67.5%
GICU	67.5%
Male Medical	60%
OR.	66.2%
TOTAL	66.1% (Response Rate= 96%)

Table 5

Description of demographic data of participants in educational awareness

Gender		Age group					Experience					In service education			
M	F	20/24	25/29	30/34	35/39	40	2/4	5/10	11/15	16/20	20	1yr	1/2yr	2yr	Never
29%	70.9%	3.2%	16.1%	12.6%	12.6%	51.6%	9.6%	32.2%	25.8%	16.1%	12.9%	35.4%	9.6%	9.6%	41%

Table 6
Pressure ulcer description :

1. **Depth :**

Partial thickness	Full thickness
89.4 %	10.5 %

2. **Exudates drainage:**

YES	21%
NO	79%

3. **Position:**

Occiput	5.2%	Shoulder blades	5.2%	Ischial tuberosities	26.3%
Knee	15.7%	Ankle	10.5%	Back of the head	15.7%
Heels	15.7%	Sacrum	42%	Shoulder	0
Hip	0	Buttocks	15.7%	Ear	5.2%
Spine	0	Thigh	15.7%	Elbows	0
Toes	0				

4. Pressure ulcers appearance:

Necrotic	Infected	Sloughy	Granulating	Epithelialising
15.7%	31.5%	0	36.8%	36.8%

Table 7

Description of Leg Ulcers

Venous	Arterial	Mixed	Neuropathic
100%	0	0	0

Table 8

Description of Diabetic foot ulcers:

Necrotic	Infected	Sloughy	Epithelialising	Granulating
28.5%	42.8%	0	14.2%	28.5%

Table 9

Description of post operative wounds:

Infected	Use of surgical clips	without complications
4.7%	47.6%	95%

Table 10
Preventive strategies used to prevent pressure Ulcers in RMH
(*According to Head nurses / charge nurses opinion*)

No	Task / Item	Percentage of use	Comments
1.	Provide clean ,smooth and dry bottom sheet	75%	Clean but not smooth
2.	Maintain good hygiene	100%	
3.	Treat nutritional deficiency	100%	If dietician referral done
4.	**Palpate and inspect the skin daily**	**62.5%**	**Mainly on admission**
5.	**Repositioning at least once every 3 hours**	**100%**	**Done 2 hourly/ in appropriate positioning noted**
6.	**Assess pressure ulcers using a risk assessment tool**	**25%**	
7.	**Use of foam mattresses and /or pillows**	**0 %**	
8.	**Use of water mattresses and or pillows**	**12.5%**	**Gloves filled water sometimes used**
9.	**Use of air mattresses and or pillow**	**25%**	**Unless provided by family**
10	**Use of gel mattresses and or pillows**	**42.9%**	
11	**Adhesive pressure relieving material to stabilize heels/elbow**	**28.6%**	
12	**Compression therapy for leg ulcers**	**16.7%**	
13	**Vacuum assisted closure with open wounds**	**0%**	
14	Creams to protect skin dryness	71.4%	
15	Paramedical consultation /dietary –physiotherapy	85.7%	
16	**Use of donuts/cushions**	**28.5%**	
17	**Use of urinary catheters in cases of wound maceration**	**28.5%**	
18	Use of massage	57.1%	
19	**Pain and sleep measures given appropriately**	**42.8%**	
20	**Albumin level checked regularly for high risk patients**	**71.5%**	**Done upon doctor request, mainly initial on admission**

Table 11

Barriers of good practice
(According to staff opinion)

No	The barrier to effective wound management	Degree of agreement
1.	Lack of staff	12.5%
2.	Overcrowded ward	62.5%
3.	Lack of equipments	75%
4.	Lack of disposable material	12.5%
5.	Lack of cooperation with other health professionals	75%
6.	Lack to access relevant research findings	75%
7.	Unfamiliar with wound risk assessment tools (if available)	87.5%
8.	Unfamiliar with pressure grading scales(if available)	87.5%
9.	Others: - lack of knowledge about modern dressings - Un available dressing room	

Table 12

Description of commonly used dressings

No	Item	Frequency of use
1.	Swab gauze	9.6%
2.	Kaltostat	12.9%
3.	Mepore	3.2%
4.	Douderm	22.5%
5.	Mefix	12.9%
6.	Opsite	3.2%
7.	Allevyn	6.4%
8.	Inadin	3.2%
9.	Aquacel	12.9%
10.	Tielle	3.2%
11.	Intrasit gel	3.2%
12.	Sorbsan	3.2%
13.	Primapore	3.2%
14.	Meloline	6.4%
15.	Bactigras	3.2%

Table13

Description of commonly used antiseptic solutions

No	Cleansing antiseptic	Frequency of use
1.	Povidin-iodine	31.8%
2.	Chlorhexidin	22.7%
3.	Hydrogen-peroxide	13.6%
4.	Normal saline 0.9%	36.3%

Description of further observations related to wound management:

- Air mattresses brought by relatives in most cases.
- Repositioning done sometimes by relatives
- No standard protocols for dressing.
- Conflict with doctors about frequency of changing dressing, cleansing solutions and type of dressing.
- Staff follows doctor order as it is regarding wound management protocol.
- Time given for dressing is not enough to provide maximum healing (exposed frequently).
- Poor liaising with community support system.

Table 14
Description of wound management in Operation Theatre:
(According to staff opinion)

No	Wound management measures	Yes	No	N/A	Comments
1.	Patients assessed for pressure ulcers prior to surgery	4%	96%		
2.	Risk assessment tool of pressure ulcers used in patient assessment		100%		
3.	Special attention given to high risk patients who spend more than 2-3 hours in operation theatre for pressure ulcers	28%	72%		
4.	Patients inspected during surgery for pressure ulcers especially high risk cases	12%	88%		
5.	Patients inspected post operatively for pressure ulcers	31%	69%		
6.	Post operative analgesics given as prescribed	100%			
7.	The nurse has the role to decide on wound dressing post operatively	12%	88%		sometimes
8.	Modern dressings used appropriately	61%	39%		According availability

Table 16 Wound Management Action Plan

	TASK	Action
1.	Availability of resources/dressings- preventative measures ,high technology	2003-2004
2.	Wound management system& patient follow up system: - Risk assessment - wound assessment - wound follow up - wound referral - Surveillance audits and records	2003-2004
3.	Education &training calendar	Nursing academic affairs 2003-2006
4.	Wound care management committee	Nursing Quality assurance 2003-2006
5.	Wound care management guideline/ protocols /policy &procedures: - Risk assessment - Pressure Ulcer Management - Diabetic foot - Leg ulcers - Post operative wounds.	2004-2007

APPENDIX B

Different forms used in RMH for wound assessment and wound management including PU assessment forms

Form 1

Patient Name: ______________________________ **Patient Number:** ____________________

Attending Doctor: ______________________

Wound Site: ____

Special Instructions: ____

____

____

Date	Wound Progress Notes	Type of Dressing	Swab Taken	Sign

FORM 1

FORM 2

WOUND CARE PLAN

GOAL: To promote quick wound healing process and to prevent complications.

NURSING ACTION:	CLEANIG DETAILS:	DATE:
		PATIENT NAME:
		PATIENT NUMBER:
a. Prepare patient for change of dressing.	a. Cleaning agent:	CONSULTANT:
		WOUND SITE:
b. Give analgesia as prescribed 30 minutes prior to do dressing.	b. Cleaning procedures: (soak,irrigate, clean)	DESCRIPTION OF WOUND:
c. Prepare dressing trolley and collect all equipment and dressing needed.	c. Frequency:	
d. Assess progress of wound.		
e. use aseptic techniques at all times.	d. Type of dressing:	

TREATMENT RECORD			
DATE SWAB TAKEN	RESULTS	INTERVENTION	SIGNATURE

FORM 3

Patient's Name **SAMPLE**	WOUND ASSESSMENT SHOULD BE CARRIED OUT WEEKLY.
Number 798479	**PLEASE TAKE A WOUND SWAB FOR C&S AT FIRST VISIT.**

		ASSESS	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Date		6.5.02	11.5.02	18.5.02	25.5.02				
Wound condition	Clean (Granulating)				✓				
	Necrotic (Black)								
	Sloughy (Yellow / Green)	✓ Yellow	✓ Yellow	✓ Yellow	✓ Yellow				
Odour	Yes / No	Y	Y	N	N				
Exudate	Yes / No	Y	Y	Y	Y				
Size -cms.	Length Width Depth	6 3 2	6 3 2	6 3 2	6½ 3½ 1½				
Surrounding Skin Temperature	Normal	✓	✓	✓	✓				
	Hot								
	Cold								
Surrounding Skin Colour	Normal	✓	✓	✓	✓				
	Red								
	Blue								
Swab Taken	Yes / No	Y.	N	N	N				
Healing	Yes / No	N	N	Y	Y				
Doctor Informed	Yes / No	N	Y	N	N				
Needs Referral	Yes / No	N	N	N	N				
Nurses Signature		GR	GR.	GR	GR.				

		Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14
Date								
Wound condition	Clean (Granulating)							
	Necrotic (Black)							
	Sloughy (Yellow / Green)							
Odour	Yes / No							
Exudate	Yes / No							
Size	Length Width Depth							
Surrounding Skin Temperature	Normal							
	Hot							
	Cold							
Surrounding Skin Colour	Normal							
	Red							
	Blue							
Swab Taken	Yes / No							
Healing	Yes / No							
Doctor Informed	Yes / No							
Needs Referral	Yes / No							
Nurses Signature								

FORM 4

Appendix 1

MSD Wound ASSESSMENTS Chart

Directions:

1. *Complete the Wound Assessment Chart.*
2. *Document the findings in the NURSES "Progress Notes".*
3. *Initiate an appropriate plan of care.*

PATIENT'S NAME: _____
M/R No.: _____
AGE / SEX: _____
ROOM No.: _____
ASSESSMENT DATE: / /

- **PATIENT INFORMATION:**

Primary Diagnosis:

Past and Present Medical History:

Medications:

- **ANATOMIC LOCATION OF WOUND**

Site: _____

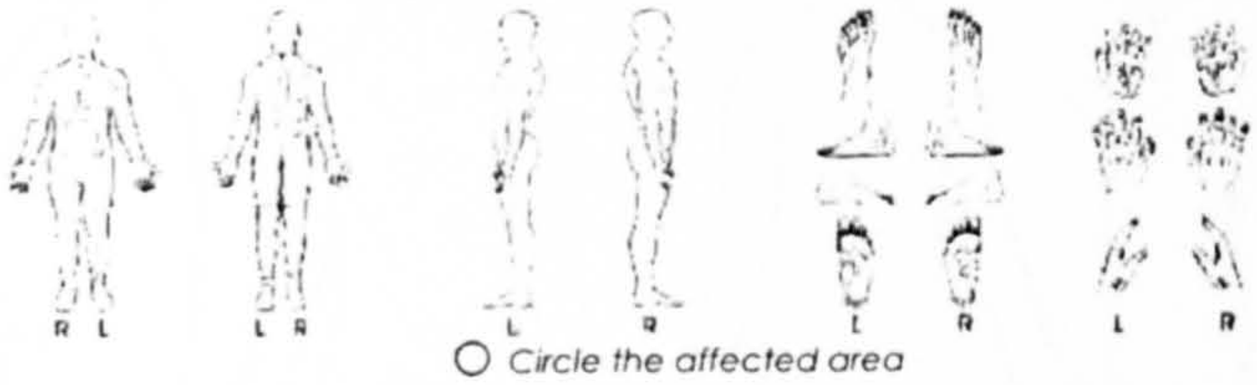
Date of Onset: / /

Wound etiology:

☐ Surgical ☐ Arterial ☐ Venous

☐ Pressure ulcer

☐ Diabetic or Neurotrophic ulcer ☐ Other



○ *Circle the affected area*

AGE OF WOUND

☐ Acute: Post op < 7 days ☐ Acute: post op> 7 days

☐ Chronic: < 1 month

☐ Chronic: > 1 month _____ days / months

SIZE, SHAPE AND STAGE

_____ cm width _____ cm length _____ cm diameter

SHAPE: ☐ Oval ☐ Round ☐ Irregular ☐ Other _____

STAGE: Stage of pressure ulcer (*PU)

☐ I ☐ II ☐ III ☐ IV ☐ Unable to stage; ulcer necrotic

Wagner ulcer grade for neurotrophic ulcers (*NU)

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

Classification of venous disease (*VD)

☐ 0 ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6

Classification of skin tears (*ST)

☐ 0 ☐ 1 ☐ 2 ☐ 3

SINUS TRACT, TUNNELING, UNDERMINING, FISTULAS

☐ None ☐ Present: located _____
at _____ o'clock, _____ cm depth

EXUDATE

Amount: ☐ None ☐ Scant ☐ Moderate ☐ Large

Color: ☐ Serous ☐ Serosanguineous ☐ Sanguineous

Consistency: ☐ Thick ☐ Purulent ☐ Milky

SEPSIS

☐ Systemic ☐ Local ☐ Both ☐ None ☐ Odor present

SURROUNDING SKIN

☐ Intact ☐ Erythematous ☐ Edematous ☐ Induration

☐ Warm ☐ Cool ☐ Discolored ☐ Dry ☐ Other

MACERATION

☐ Not present

☐ Present: _____ cm, location: _____

EDGES, EPITHELIALZATION

☐ Edge attached ☐ Edge not attached ☐ Edges rolled

☐ Surgical incision approximated ☐ Surgical incision open

☐ Sutures/ staples intact ☐ Epithelialization not present

☐ Epithelialization present: _____ cm

NECROTIC TISSUE ☐ Not Present ☐ Present

Type:

☐ Yellow slough ☐ Black ☐ Soft ☐ Hard ☐ Stringy

Percentage of wound (check closest percentage):

☐ 100% of wound ☐ 75% of wound ☐ 50% of wound

☐ 25% of wound ☐ Other: _____ %

TISSUE BED

☐ Moist ☐ Dry ☐ Granulation tissue not present

☐ Granulation tissue present _____ amount %

Tenderness or pain (0 being no pain, 10 being intense pain)

PAIN SCALE SCORE *(Circle appropriate number)*

0 1 2 3 4 5 6 7 8 9 10

Pain present:

☐ On touch ☐ Anytime ☐ Only when performing wound care

☐ Other (specify) _____

Pain management: Specify method _____

☐ Not effective ☐ Effective

STATUS

Wound status: Initial assessment date / /

☐ Improved: date _____ ☐ Unchanged: date _____

☐ Healing: date _____ ☐ Deteriorating: date _____

☐ Supportive therapy ☐ Compression ☐ Off-loading

☐ Pressure relieving matters ☐ Other _____

INITIAL ASSESSMENT:

Name: _____ **Title:** _____

Signature: _____ **Date:** / /

FORM 5

MSD	NURSING DECUBITUS ULCER REPORT	Name M/R No : Age/Sex : Room No.:

STAG I:

INFLAMATION OR REDNESS OF THE KIN.

STAG II:

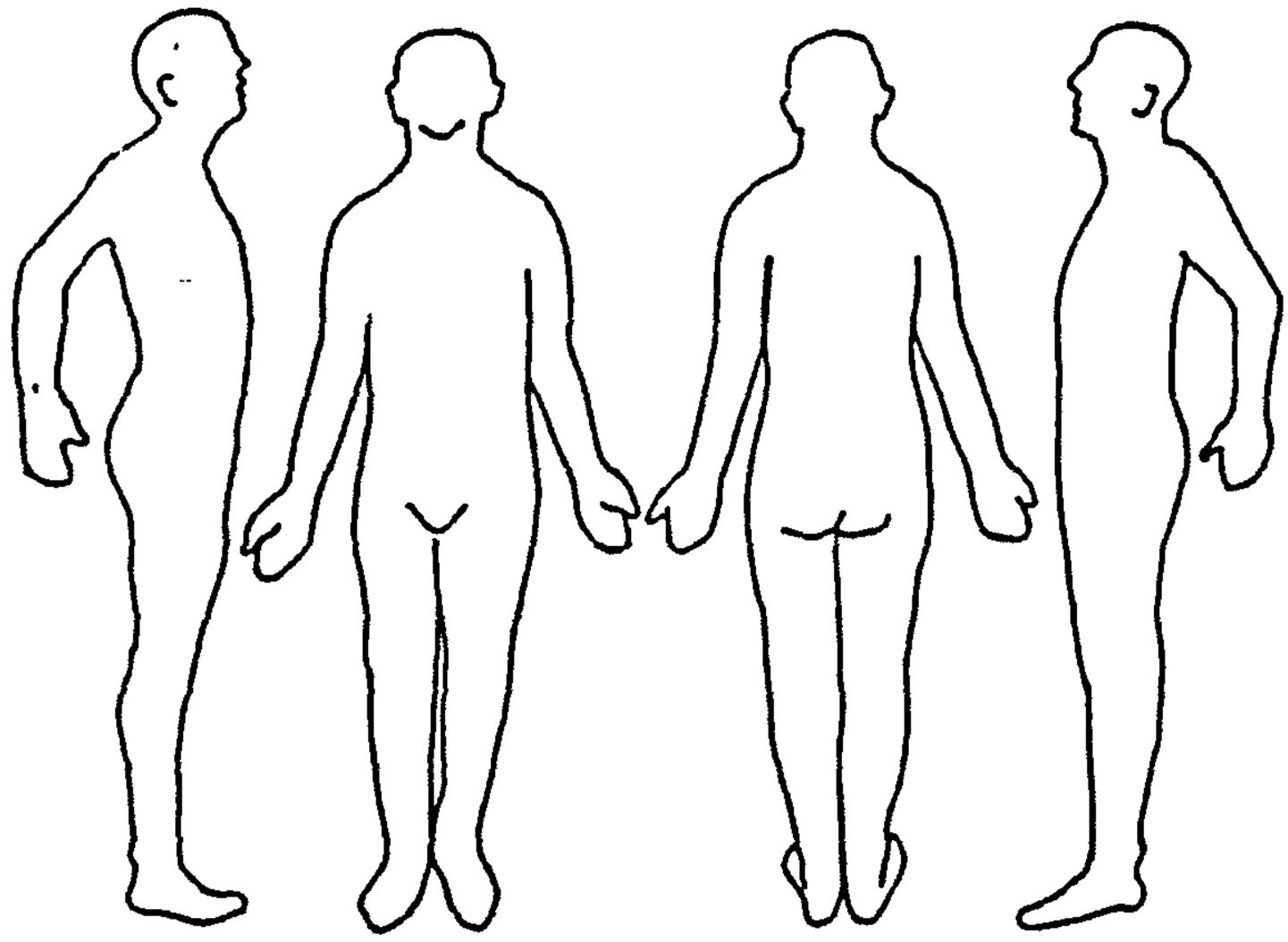
SUPRFICIAL SKIN BREAK WITH REDESS OF SURROUNDING AREA

STAG III:

SKINBREAK WITH DEEP TISSUE INVOVEMENT

STAG IV:

SKINBREAK WITH DEEP TISSUE INVOVEMENT WITH NECROTIC TISSE PRESENT.



ADMSION DATE:

Date / Sit	Site	Stage	Size(cm)	Drainage	Odour	Treatment	Progress	Sign.

220126

MSD

NURSING

DECUBITUS ULCER REPORT

Name :

M/R No :

Age/Sex :

Room No. :

Date / Shift	Site	Stage	Size(cm)	Drainage	Odour	Treatment	Progress	Sign.

FORM 6

RKH

DRESSING REQUEST

NAME:

DEPT. - WARD	CODE	DATE

PATIENT NUMBER

CONSULTANT NAME | NUMBER

TYPE / CONDITION OF WOUND (√) AS APPROPRIATE

SURGICAL OPERATION		CLEAN		REMOVAL OF SUTURES/CLIPS	DATE OF REMOVAL / /
ABSCESS		INFECTED		TYPE OF DRESSING	
TRAUMA		NECROTIC			
BURN		DEGREE OF BURN		FREQUENCY	
ULCER		DISCHARGE EXUDATE		DURATION	DAILY ☐ ALTERNATE DAYS ☐ 2xWEEKLY ☐
SITE OF WOUND				NEXT APPT. WITH REFERRING DOCTOR: DATE: / /	

INSTRUCTION

TYPE OF SUTUR/CLIPS

OTHER PROCEDURES:

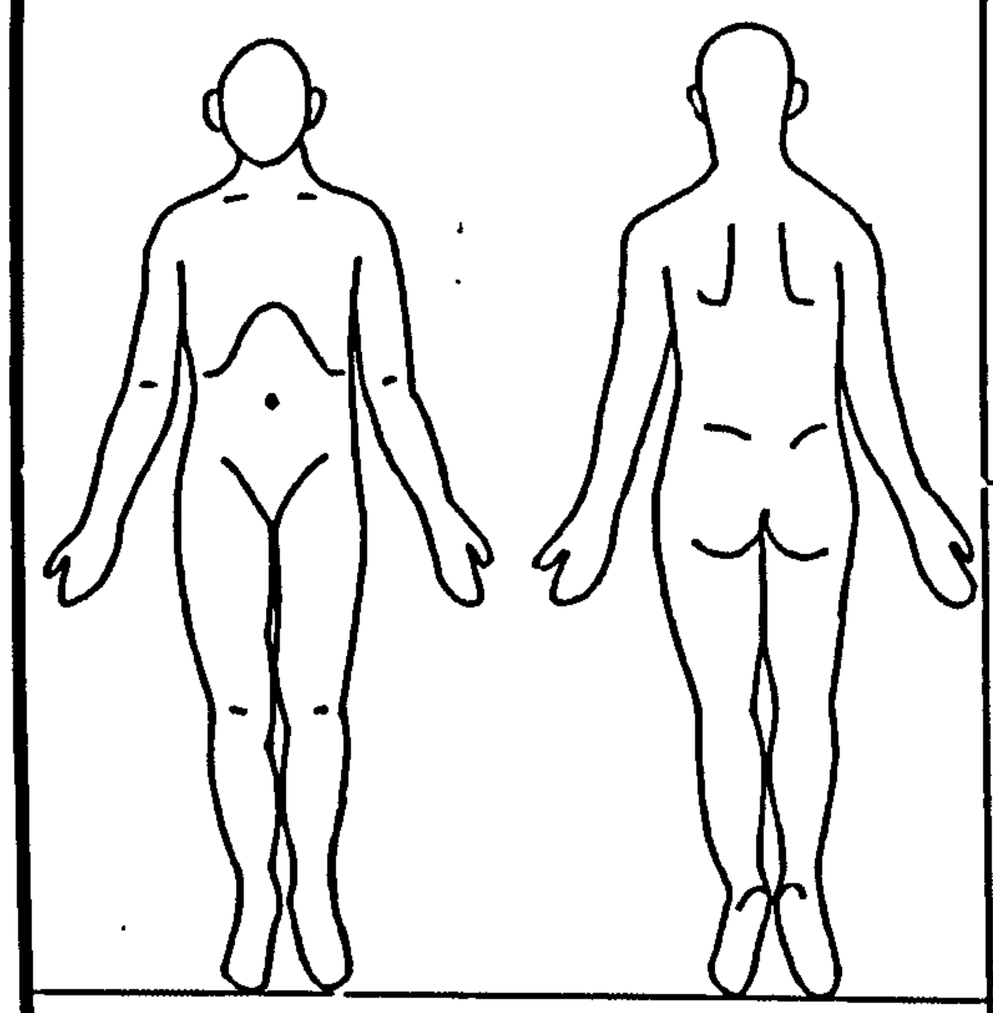
REFERRING DOCTOR NAME | NUMBER

SIGNATURE:

DATE	SWAB TAKEN	SEEN BY DOCTOR	RECORDED IN KARDEX	NURSE SIGN.

FORM 7

DRESSING PROTOCOL

DATE	SITE	ASSESSMENT OF WOUND	PROTOCOL	FREQUENCY
				

APPENDIX C

Nursing data base form in RMH including the Norton Scale for PU risk assessment

NURSING DATA BASE

NAME

DEPARTMENT—WARD **CODE**

DATE

PATIENT NUMBER

CONSULTANT NAME

NUMBER

IDENTITY BAND ISSUED ( ) YES ( ) NO

TYPE OF ADMISSION:

NEXT OF KIN NAME:

TEL. NO.

MEDICATION BROUGHT TO HOSPITAL
( ) NONE ( ) YES ( ) SENT HOME

VALUABLES BROUGHT TO HOSPITAL

( ) NONE DECLARED ( ) YES ( ) DISCLAIMER

( ) HOME ( ) L BOX ( ) SECURITY

DIAGNOSIS:

DATE & TYPE OF OPERATION:

PREVIOUS OPERATION:

MEDICAL HISTORY

REASON FOR ADMISSION

PATIENTS KNOWLEDGE OF CONDITION
E.G. DIABETES, HYPERTENSION

KNOWN ALLERGIES (INCLUDING DRUGS)

ACTIVITIES OF DAILY LIVING

NUTRITION (APPETITE & KNOWN DIETARY PROBLEMS)

DIET

ELIMINATION (KNOWN PROBLEMS) BLADDER: **BOWEL:**

SLEEP (KNOWN PROBLEMS)

MOBILITY (KNOWN PROBLEMS)

EYESIGHT: ( ) NO DIFFICULTY, EXPLAIN LIMITATION:

( ) SPECTACLES ( ) CONTACT LENS ( ) PROSTHESIS

HEARING: ( ) NO DIFFICULTY, EXPLAIN LIMITATION: ( ) HEARING AID

SPEECH: ( ) IMPEDIMENT ( ) DYSPHASIA

OBSERVATIONS:

( ) COUGH **( ) ALERT**

( ) CYANOSIS **( ) CONFUSED**

( ) DYSPNOEA **( ) UNRESPONSIVE**

EMOTIONAL STATE: ( ) ANXIOUS ( ) UNCOMMUNICATIVE

( ) EXCITED ( ) APATHETIC

CONDITION OF MOUTH: ( ) CLEAN/MOIST ( ) DRY/CRUSTED ( ) CARIES ( ) DENTURES

TEMPERATURE PULSE RESP BP WT. HEIGHT

PAIN (DURATION/LOCATION/CHARACTER)

DISCHARGES:

BLEEDING:

PRESSURE SORES RISK INDICATOR

POINTS	4	3	2	1	SCORE
GENERAL CONDITION:	Well nourished	Underweight	Obese	Emaciated Dehydrated Oedematous	
MENTAL STATE:	Alert	Apathetic	Confused	Stuporous	
MOBILITY:	Ambulant	Walks with help	Chairfast	Bedfast	
INCONTINENCE:	Not	Occasionally	Urinary	Double	
SKIN CONDITION:	Intact, Health	Discoloured, Red/Pale	Temp. Cold/Hot	Blistered Broken Necrotic	

(KEY: 1-14 = HIGH RISK, 15-16=MOD. RISK, 17-18=MILD RISK, 19-20=MNI. RISK) TOTAL =

PRESSURE (SORE(S) PRESENT ON ADMISSION: LOCATION: DIMENSIONS:

ABNORMALITIES OR TRAUMA:

CONTUSION (LOCATION) RASH (LOCATION)

ECZEMA (LOCATION) SCAR (LOCATION)

LACERATION (LOCATION) ULCER (LOCATION)

BURN (LOCATION)

SOCIAL HISTORY

PRIMARY LANGUAGE: ( ) READ ENGLISH SPOKEN: ( ) NIL ( ) BROKEN ( ) FLUENT

RESIDES WITH:

TYPE OF HOME: ( ) STAIRS ( ) GROUND LEVEL

FAMILY HEALTH: eg ( ) DIABETES ( ) ALLERGIES

ORIENTATION OF PATIENT: ( ) TO ROOM ( ) CALL BELL ( ) BATHROOM

( ) DAY ROOM ( ) WARD ROUTINE

ADMITTED BY: Signature

INFORMATION OBTAINED WITH ASSISTANCE OF PATIENT, RELATIVE, DR, DR. NOTES, INTERPRETER

SUMMARY

DATE	PROGRESS/EVALUATION	NURSE'S SIGNATURE

APPENDIX D

Mandatory Wound Care Management study day (Syllabus)

RIYADH AL-KHARJ HOSPITAL

Nursing Academic Affairs

INTRODUCTION TO WOUND CARE MANAGEMENT

PREPARED BY: MOAHAMMAD Y. N. SALEH

RN BSc, MSN , Post graduate PhD. student
Wound Care Coordinator/RKH/Saudi Arabia

COURSE DESCRIPION:

This course intended to provide the nurses with knowledge and skills about guidelines for consistent and evident based wound management practice. In the fact that this course will be adherent to variant aspects of wound management starting to explain normal wound healing process, then explaining the factors affecting negatively and delay normal healing, also this course describing the different strategies of wound management stress on the importance of wound assessment in deciding modern dressing would be cost effectively used and indicate the concepts of preparing wound environment, cleansing and irrigation and the intrusion of high technology to this field of practice.

COURSE OBJECTIVES:

Upon completion of this course the participants will be able to:

1. **Describe anatomy and physiology of the skin.**
2. **Analyze the normal healing process.**
3. **Define the factors delay normal healing process.**
4. **Assess the wound according to wound assessment process.**
5. **Describe complications adherent to wound healing process.**
6. **Access appropriate modern wound dressings.**
7. **Indicate appropriate use of wound cleansing solutions.**
8. **Describe proper environment to allow effective wound healing .**
9. **Provide effective wound care according to general principles of wound management**
10. **Manage effectively acute and chronic wounds according to wound care guidelines.**

TEACHING METHODS AND LEARNING STRATEGIES:

1. **Lecture discussion**
2. **Group work**
3. **Computer assisted instruction.**

LEARNING MATERIAL:

1. **White board**
2. **Overhead projector**
3. **Desktop presentation**
4. **Laptop/computer assisted device**
5. **Sample modern dressings**
6. **Handout and pre learning material**
7. **Postures and brochures**

EVALUATION METHODS:

1. Written exam (passing mark is 70% in post test).
2. Course evaluation questionnaire.

COURSE TIME TABLE :

TOPIC	TIME
Introduction	9.00am – 9.15am
Anatomy and Physiology of the skin	9.15am – 9.30am
Physiology of normal wound healing	9.30am – 10.00am
Factors affecting normal healing process	10.00am – 10.15am
Wound assessment process	10.15am – 11.00am
General principles of wound care	11.00am – 11.30amam
BREAK	11.30am – 11.50am
Effective wound environment	11.50am – 12.05pm
Wound cleansing & Irrigation	12.05pm – 12.20pm
Guidelines for acute& chronic wound management	12.20pm – 12.45pm
Evaluation & Feed back	12.45pm – 13.00pm

COURSE OUT LINE

APPENDIX E

Pressure Ulcer Prevention and Management Training Programme (Syllabus)

RIYADH MILITARY HOSPITAL

Nursing Academic Affairs

PRESSURE ULCERS

PREVENTION & MANAGEMENT

PREPARED BY: MOAHAMMAD Y. N. SALEH *RN BSc, MSN*

Wound Care Coordinator

RMH/Saudi Arabia

COURSE DESCRIPION:

This course intended to provide the nurses with knowledge and skills about Pressure Ulcers utilizing consistent and evident based wound care management practice. This course will be adherent to variant aspects of Pressure Ulcers prevention and management through active definition of Pressure Ulcers , describing physiological and epidemiological perspectives of Pressure Ulcers , analyzing chronic wound healing in Pressure Ulcers and factors delayed it , enabling nurses to develop appropriate assessment process in which they will be able to develop prevention and management action plans utilizing wound care management principles and guidelines.

COURSE OBJECTIVES:

Upon completion of this course the participants will be able to:

11. **Describe anatomy and physiology of the skin.**
12. **Define Pressure Ulcers.**
13. **Describe Physiology of Pressure Ulcers development.**
14. **Describe epidemiological perspective of Pressure Ulcers.**
15. **Analyze chronic wound healing process in Pressure Ulcers.**
16. **Define the factors delay healing in Pressure Ulcers.**
17. **Assess Pressure Ulcers according to wound assessment process.**
18. **Develop Pressure Ulcers prevention Plan utilizing risk assessment tools.**
19. **Manage Pressure Ulcer wounds effectively according to wound care guidelines.**

TEACHING METHODS AND LEARNING STRATEGIES:

4. **Lecture discussion**
5. **Group work**
6. **Computer assisted instruction.**

LEARNING MATERIAL:

8. **White board**
9. **Overhead projector**
10. **Desktop presentation**
11. **Laptop/computer assisted device**
12. **Sample modern dressings**
13. **Handout and pre learning material**
14. **Postures and brochures**

EVALUATION METHODS:

3. **Written exam (passing mark is 70% in post test).**
4. **Course evaluation questionnaire.**

COURSE TIME TABLE :

TOPIC	TIME
Anatomy and Physiology of the skin	0800-0900
Epidemiological perspective of Pressure Ulcers	0900-1000
Coffee Break	1000-1030
Chronic Wound Healing in Pressure Ulcers	1030-1130
Lunch	1130-1230
Pressure Ulcers Assessment Process	1230-1330
Pressure Ulcers Prevention Guidelines	1330-1430
Coffee Break	1430-1445
Pressure Ulcer Wounds Management Guidelines	1445-1545
Evaluation & Feed back	1545-1630

COURSE OUTLINE

APPENDIX F

Beds Allocation in RMH

BUILDING 111	
Ward	Beds
I.C.U	6 ICU (closed)
1R	1 King's Suite
2R	3 Royal Suites
2N	17 Short Stay (all specialties) 9 (closed)
3N	15 Oncology 10 Short Stay all speciallies
Burns unit	10 Burns (Plastic Surgery)
4N	28 Surgery (all speciallies)
5N	2 Gastroenterology 3 Oncology 6 Medical 5 Neurology 12 Surgery (all speciallies)
6N	23 All Specialties
7N	23 All Specialties
8N	10 V.V.I.P.s (all speciallies)
TOTAL	183

BUILDING 70	
Ward	Beds
2nd floor	14 Isolation
TOTAL	14

BUILDING 100	
Ward	Beds
2A	18 Psychiatry
3A	29 Antenatal (Obstetric)
4A	20 Postnatal (Obstetric)
4B	26 N.I.C.U.
4C	27 N.C.I.U.
5A	32 Postnatal (Obstetric)
5B	26 Gynaecology
6A	32 Nephrology
6B	26 Rehabilitation
7A	5 Obstetrics & Gynaecology 5 All Specialties
7B	7 Obstetrics & Gynaecology
TOTAL	263

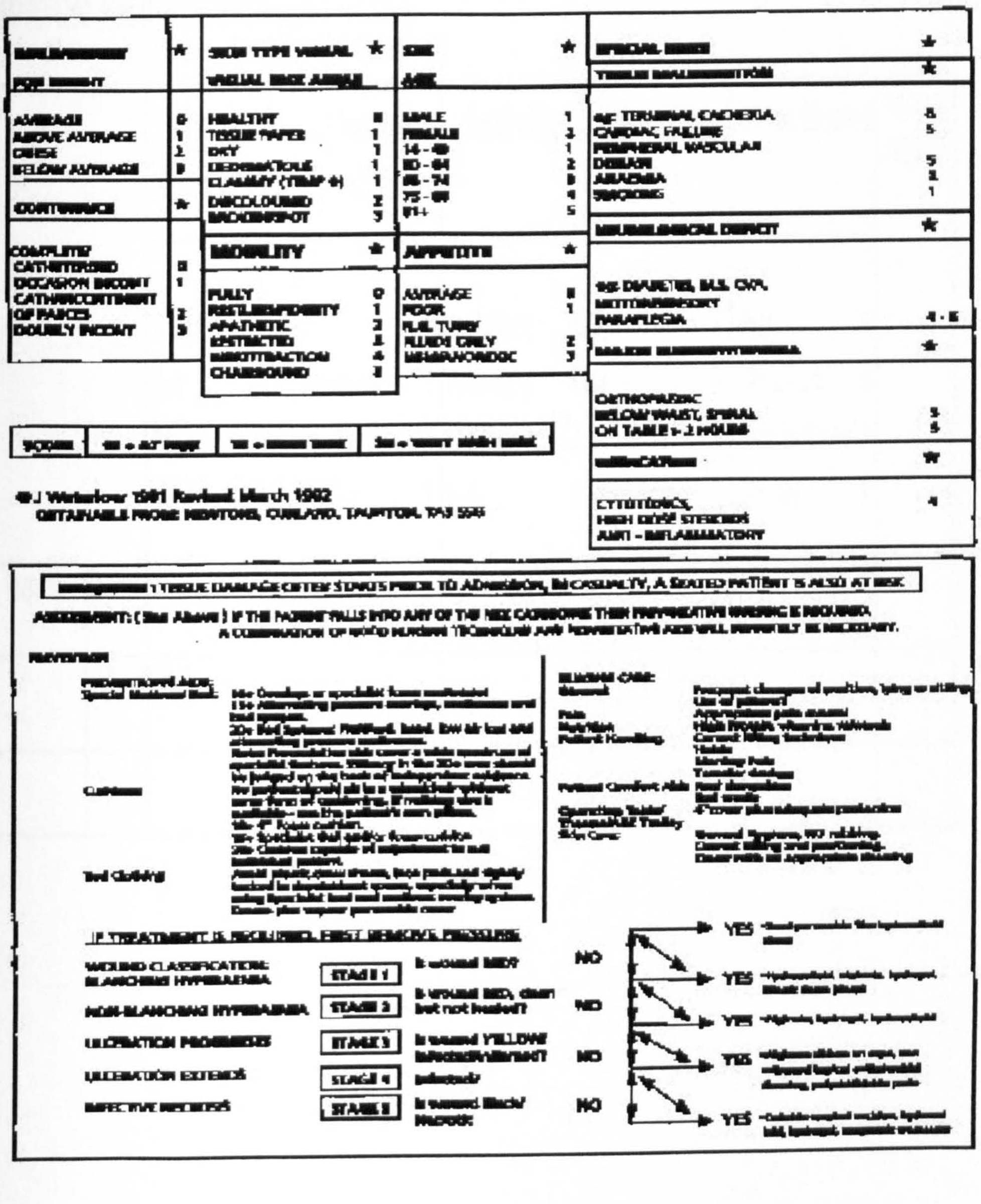
BEDS NOT INCLUDED IN THE ABOVE

Nursery	70 Cots
3B	6 Delivery Suites
	3 H.D.U. for Obstetrics

BUILDING 100	
Ward	Beds
1-1	10 Ophthalmology 5 Neurology 15 Neurosurgery
1-2	14 General Surgery 3 Vascular Surgery 2 Plastic Surgery 1 Dental 4 V.I.P.
1-3	13 E.N.T. 5 General Surgery 4 Single
1-4	14 General Surgery 7 E.N.T. 1 Vascular Surgery 8 Orthopaedics
1-5	16 Haematology
2-1	32 Orthopaedic
2-2	29 Urology 1 Dental 2 Nephrology 2 V.I.P.
2-3	1 Oncology 1 Endocrine (Radioactive Iodine) 9 Neurology
2-4	23 Medical 7 Gastroenterology
3-1	8 (Closed) 8 High Dependency 2 Isolation in I.C.U. 8 I.C.U.
3-2	22 Medical 2 Dental 2 V.I.P. 5 Gastroenterology 1 Plastic Surgery
3-3	16 Paediatrics
3-4	30 (Closed)
4-1	15 Paediatric I.C.U. 4 Paediatric Chronic 3 Paediatric Oncology 4 Paediatric Isolation
4-2	31 Paediatrics 1 Burns 5 Day Cases
4-3	4 Single 6 Chronic Diseases 1 Security 6 Liver Transplant 6 Liver Transplant
TOTAL	416

APPENDIX G

Waterlow and Norton Scales for PU Risk Assessment



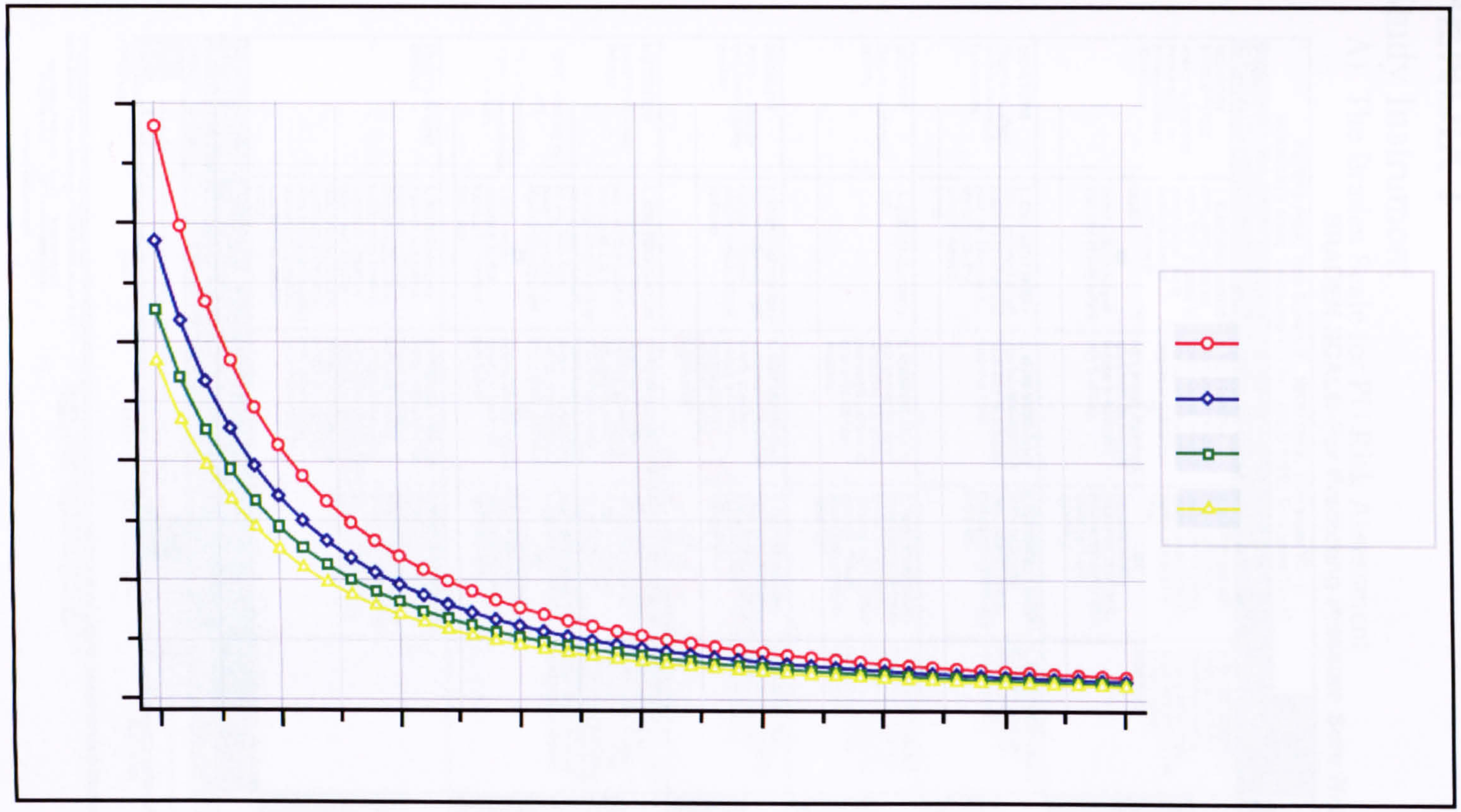
NORTON SCALE

NORTON RISK ASSESSMENT SCALE

	Physical Condition	Mental Condition	Activity	Mobility	Incontinent	TOTAL SCORE
	Good 4	Alert 4	Ambulant 4	Full 4	Not 4	
	Fair 3	Apathetic 3	Walk/help 3	Sl. limited 3	Occasional 3	
	Poor 2	Confused 2	Chairbound 2	V. limited 2	Usually/Urine 2	
	Very Bad 1	Stupor 1	Bed 1	Immobile 1	Doubly 1	
Name Date						

APPENDIX H

G Power Analysis (Sample Estimation)



APPENDIX I

The Study Instrument

A) The Braden Scale for PU Risk Assessment

BRADEN SCALE–For Predicting Pressure Sore Risk

SEVERE RISK: Total Score ≤ 9 **HIGH RISK**: Total score 10 - 12
MODERATE RISK: Total score 13 - 14 **MILD RISK**: Total score 15 - 18

RISK FACTOR	SCORE/DESCRIPTION				DATE OF ASSESS ➡ 1	2	3	4
SENSORY PERCEPTION Ability to respond meaningfully to pressure-related discomfort	**1. COMPLETELY LIMITED–** Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation, **OR** limited ability to feel pain over most of body surface.	**2. VERY LIMITED–** Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness, **OR** has a sensory impairment which limits the ability to feel pain or discomfort over ½ of body.	**3. SLIGHTLY LIMITED–** Responds to verbal commands but cannot always communicate discomfort or need to be turned, **OR** has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**4. NO IMPAIRMENT–** Responds to verbal commands. Has no sensory deficit which would limit ability to feel or voice pain or discomfort.				
MOISTURE Degree to which skin is exposed to moisture	**1. CONSTANTLY MOIST–** Skin is kept moist almost constantly by perspiration, urine, etc. Dampness is detected every time patient is moved or turned.	**2. OFTEN MOIST–**Skin is often but not always moist. Linen must be changed at least once a shift.	**3. OCCASIONALLY MOIST–** Skin is occasionally moist, requiring an extra linen change approximately once a day.	**4. RARELY MOIST–**Skin is usually dry; linen only requires changing at routine intervals.				
ACTIVITY Degree of physical activity	**1. BEDFAST–**Confined to bed.	**2. CHAIRFAST–**Ability to walk severely limited or nonexistent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	**3. WALKS OCCASIONALLY–** Walks occasionally during day but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	**4. WALKS FREQUENTLY–** Walks outside the room at least twice a day and inside room at least once every 2 hours during waking hours.				
MOBILITY Ability to change and control body position	**1. COMPLETELY IMMOBILE–** Does not make even slight changes in body or extremity position without assistance.	**2. VERY LIMITED–**Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	**3. SLIGHTLY LIMITED–** Makes frequent though slight changes in body or extremity position independently.	**4. NO LIMITATIONS–** Makes major and frequent changes in position without assistance.				
NUTRITION Usual food intake pattern [1] NPO: Nothing by mouth. [2] IV: Intravenously. [3] TPN: Total parenteral nutrition.	**1. VERY POOR–**Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement, **OR** is NPO [1] and/or maintained on clear liquids or IV [2] for more than 5 days.	**2. PROBABLY INADEQUATE–** Rarely eats a complete meal and generally eats only about ½ of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement, **OR** receives less than optimum amount of liquid diet or tube feeding.	**3. ADEQUATE–**Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement if offered, **OR** is on a tube feeding or TPN [3] regimen, which probably meets most of nutritional needs.	**4. EXCELLENT–**Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of meat and dairy products. Occasionally eats between meals. Does not require supplementation.				
FRICTION AND SHEAR	**1. PROBLEM–**Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	**2. POTENTIAL PROBLEM–** Moves feebly or requires minimum assistance. During a move, skin probably slides to some extent against sheets, chair, restraints, or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	**3. NO APPARENT PROBLEM–** Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair at all times.					
TOTAL SCORE	**Total score of 12 or less represents HIGH RISK**							

ASSESS.	DATE	EVALUATOR SIGNATURE/TITLE	ASSESS.	DATE	EVALUATOR SIGNATURE/TITLE
1	/ /		3	/ /	
2	/ /		4	/ /	

NAME–Last	First	Middle	Attending Physician	Record No.	Room/Bed

Source: Barbara Braden and Nancy Bergstrom

BRADEN SCALE

B) PU Wound Assessment and Wound Management Checklist

1) Pressure Ulcer Wound Assessment

General characteristics of the patients

1. Hospital File Number.....
2. Ward.....Room Number.....
3. Date of admission .....
4. Gender: A. Male B. Female
5. Age:
   A. ≤ 20 Years B. 21-30 Years C. 31-40 Years D.41-50 Years
   E. 51-60 Years F.61-70 Years G.71-80 Years H. 80+ Years
6. Diagnosis:
   A. Medical B. Surgical C. Oncology D. Renal
   E. Neuro-surgery F. Rehabilitation G. Vascular
   H. Others/ specify.....
7. Norton scoring:
   A. 5-14 B. 15-16 C. 17-18 D. 19-20
   E. Not recorded

n	Assessment	Date				
ages	PU stages guide according to AHCPR (1992)					
ound location						
nd size	Length × Width /cm.					
nd rmining	Present /Specify in cm.....					
	Not present					
nd rosis	Not visible					
	Non adherent yellow slough					
	Loosely adherent yellow slough					
	Adherent soft black eschar					
	Firmly adherent hard black eschar					
nd cates	None					
	Small					
	Moderate					
	Heavy					

nd ulation	Beefy Bright red colored					
	Pink, dull, dusky, pale, easily to bleed					
	Over granulation					
	No granulation					
nd helializtion	Pinky whitish					
	Pale & dull					
	Macerated, fragile and dry					
	No Epithelializtion					
nd Scar	Completely healed wound with scar					
	Scab formation					
	Hypertrophic scar formation					
	No scar					
nd Odor	Slight					
	Moderate					
	Offensive					
	No odor					
nd Pain	At dressing					
	Persistent/continuous					
	Intermittent					
	No pain					
nd ction	Swab culture (result.....)					
	Fever					
	Cellulites/inflammation at the wound site					
	Wound induration and reddened edges					
	Other manifestations of wound infection					

2) PU wound management

nagement Item	Management category	Date				
und dressing	a. Alginates b. Hydrofiber c. Hydrocolloid d. Foam e. Hydrogel f. Medicated dressings g. VAC h. Others (specify)					
rgical rvention	a. No surgical intervention b. Surgical debridement c. Flapping d. Grafting e. Others (specify)					
tective asures	1. Protective mattresses a. Standard bed mattress					
	b. Alternating system					
	c. Therakair					
	d. Genadyne					
	e. Atmosair system					
	f. Gel overlay					
	g. Clinitron bed					
	h. Water mattress					
	i. Others (specify)					
	2. Patient turning					
	o Every 2 hours					
	o Every 3-4 hours					
	o Every 6 hours					
	3. Skin barrier creams					
	4. Vitamins and special nutritional formulas					

3) Other observations:

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C) C. Nurses' Clinical Judgement Rating Scale

Nurses' Clinical judgment of patients at risk of Pressure Ulcer Development

Dear colleague,

This rating is part of a PhD research study. It is intended to investigate the effects of using Risk Assessment Scales of Pressure Ulcer on patient outcomes in terms of pressure ulcer incidence rate among hospitalised patients at RMH-Saudi Arabia.

You are kindly pleased to rate your assigned patient carefully according to your experience with patients at risk of pressure ulcer development. Your rating shall include one of the categories below. Once you completed the rating, please hand it to wound care coordinator or one of the wound care practitioners.

Completion of this rating is voluntary and given information will be kept confidential for research purposes. Your name is not requested and your participation will not affect your current professional status.
If you have any further queries, please feel free to contact wound care coordinator on Bleep 0140 or Tel. extension 1599.

Many Thanks for your unlimited cooperation

Mohammad YN Saleh
Wound Care Coordinator/RMH
PhD Candidate

- *According to your experience with patients at risk of pressure ulcer development, please rate your assigned patient at one of the risk categories mentioned below* ***(Please tick as appropriate)***

No risk	Minimal risk	Moderate risk	High risk	Severe risk

APPENDIX J

The Braden Scale for PU Risk Assessment

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TOTAL SCORE	**Total score of 12 or less represents HIGH RISK**							

ASSESS.	DATE	EVALUATOR SIGNATURE/TITLE	ASSESS.	DATE	EVALUATOR SIGNATURE/TITLE
1	/ /		3	/ /	
2	/ /		4	/ /	

NAME–Last	First	Middle	Attending Physician	Record No.	Room/Bed

Source: Barbara Braden and Nancy Bergstrom

BRADEN SCALE

APPENDIX K

Letter from Authors of The Braden Scale for PU Risk Assessment

Prevention Plus

Home of the Braden Scale

Date: November 23, 2004

To: Mohammed Saleh, Wound Care Coordinator

From: Barbara Braden, PhD, RN, FAAN & Nancy Bergstrom, PhD, RN, FAAN

RE: Permission to use the Braden Scale*

As holders of the official copyright for the Braden Scale for Predicting Pressure Sore Risk, and the interventions, we hereby grant permission for the use of the scale in the Riyadh Military Hospital in Riyadh-Saudi Arabia and in your research as a risk assessment tool of pressure ulcers to assist in clinical decision making.

*It is understood that the name of the instrument and the indication that the copyright belongs to Braden and Bergstrom remain on any copies and that you do not make any changes to the wording or the scoring of this tool.

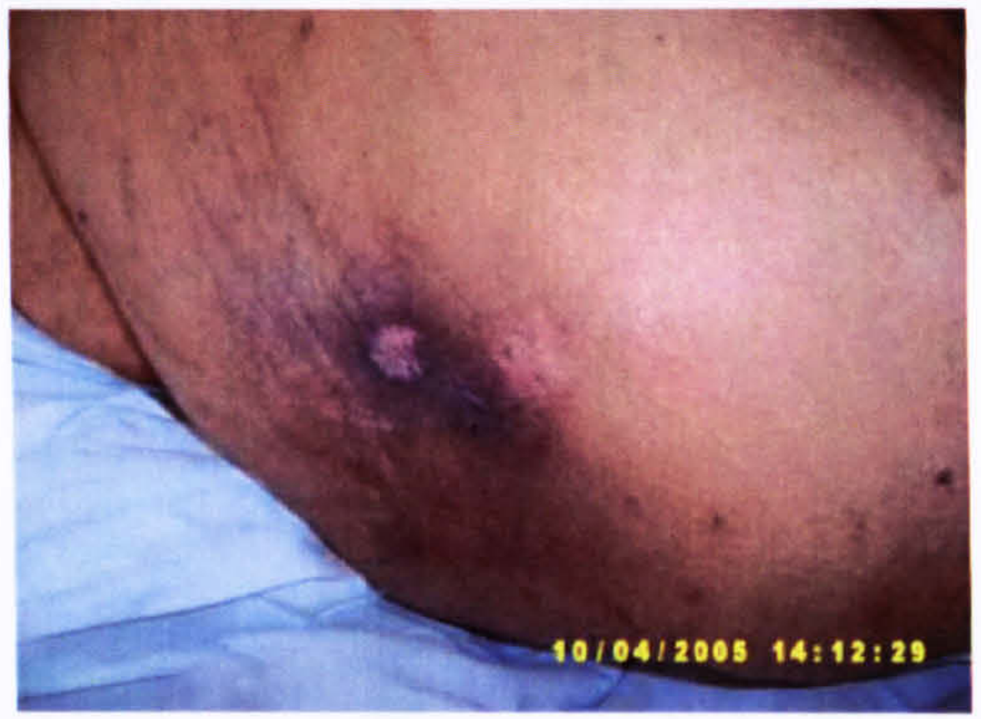
Barbara Braden Nancy Bergstrom

5102 Lafayette Ave. • Omaha, Ne 68132 • Phone & Fax 402.551.8636 • e-mail: JBall79686@aol.com • www.bradenscale.com

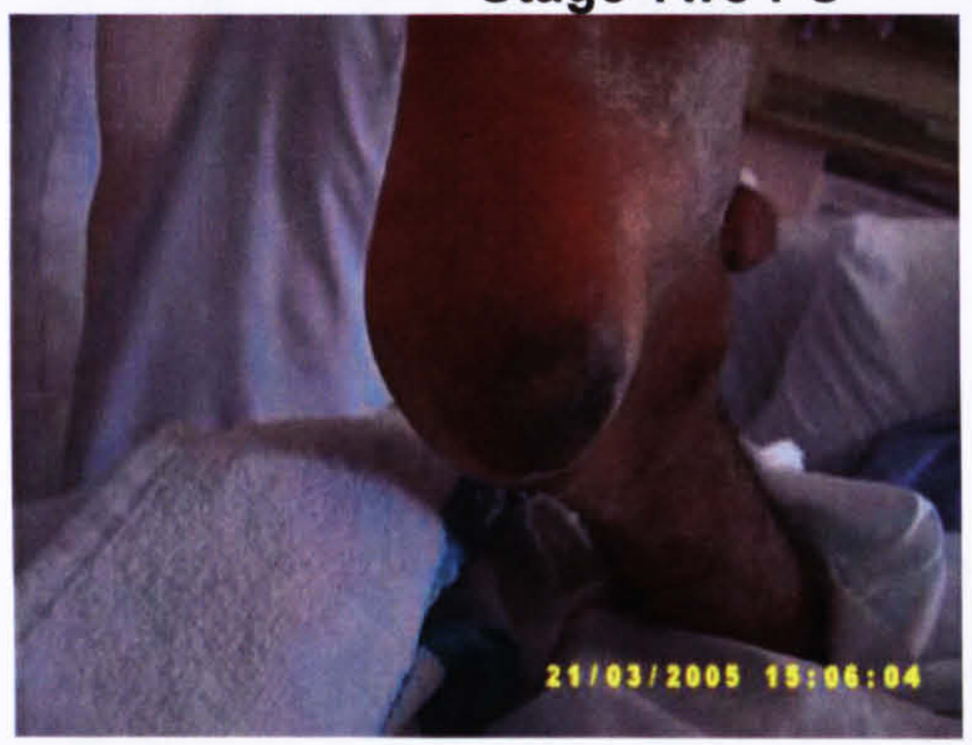
APPENDIX L

Digital Pictures from RMH Patients for PU Stages according to AHCPR (1992) classification system

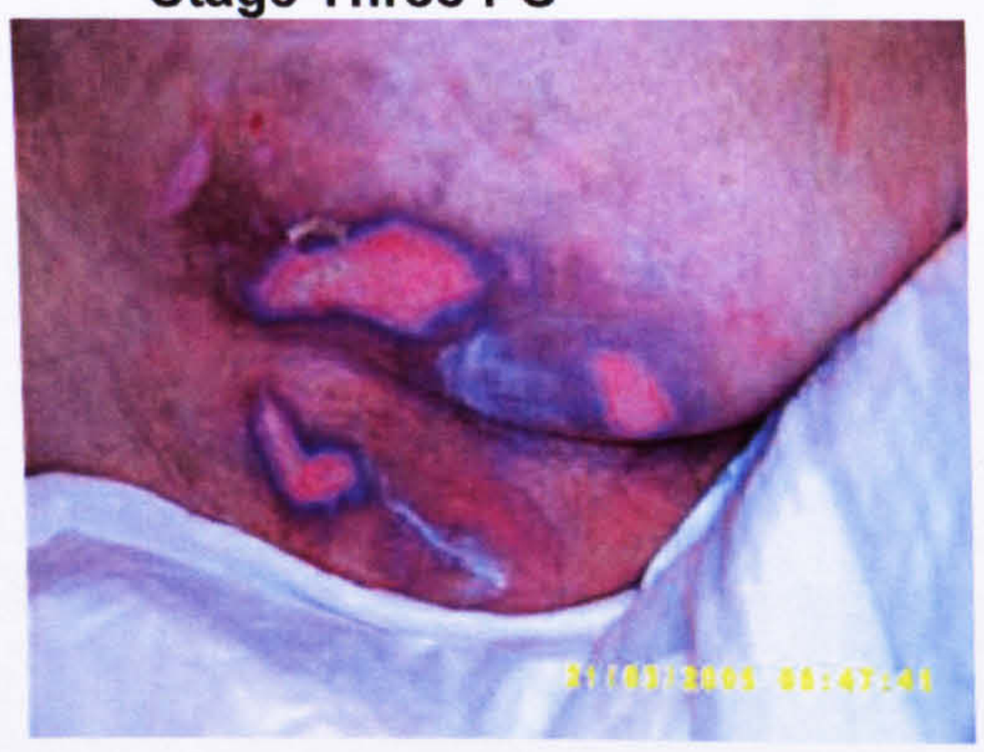
Stage One PU



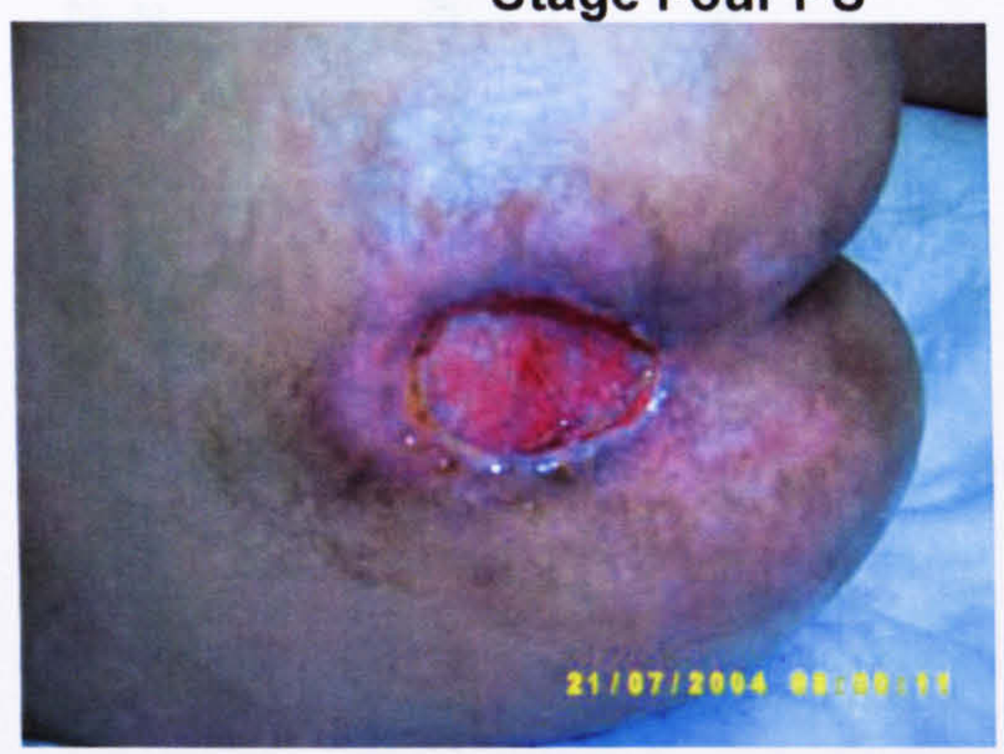
Stage Two PU



Stage Three PU



Stage Four PU



APPENDIX M

Research Training Course for Research Team

RKH
Research Team Training

Terminology

Research:
The systematic, logical and empirical inquiry into the possible relationship among particular phenomena to produce verifiable knowledge.

Nursing Research:
1. Provides the basis for expanding body of scientific knowledge.
2. Emphasizes clinical issues, problems and outcomes.

Qualitative Research:
The investigation of phenomena typically in an in-depth and holistic fashion, through the collection of rich narrative materials using a flexible research design.

Quantitative Research:
The investigation of phenomena that lend themselves to precise measurement and quantification, often involving a rigorous and controlled design.

Variables:
A defined concept e.g. Length of stay
Could be (***independent***) : variables that has the presumed effect on the dependent variable (cause).
Or (dependent): = the effect .
Example: the effect of cigarette smoking on incidence of lung cancer

Incidence:
The number of new cases occurring within a predetermined time span

Prevalence:
The number of cases at a given point of time.

Continuum of Quantitative Research Design

NON – EXPERIMENTAL ------

QUAZI- EXPERIMENTAL -----

EXPERIMENTAL

1. ***Non- experimental studies*** :
   Used in studies in which the researcher wishes to :
   a. construct a picture of a phenomena
   b. explore events ,people or situations as they naturally occur.

2. ***Experimental studies : (true experimental studies)***
   a. **manipulation**: provision of some experimental treatment in one ,or varying degrees ,to some of the subjects in the study
   b. **randomization** : a selection process which each element of the population has an equal and independent chance of being included in the sample.
   c. Control

3. ***Quazi- experimental*** :
   A study design in which **random assignment is not used** but the independent variables are manipulated and certain mechanisms of control are used .

SURVEY STUDIES

Definition:

Is a type of non – experimental studies which aims to collect detailed descriptions of existing variables and use the data to justify and assess current conditions and practices or to make more plans for improving health care practices.

Classification:

1. ***Descriptive :***
   To describe certain phenomena ,characteristics of particular subjects ,frequency of occurrence .
2. ***Exploratory*** :
   To explore issue ,perceptions regarding clinical practices.
3. ***Comparative :***
   To determine differences between variables.

> ***IN SURVEY*** ,investigators attempt only to relate one variable to another ,or assess differences between variables , but they ***DO NOT*** attempt to determine causation.

Survey studies advantages :

1. Great deal of information can be obtained from a large population in a fairly economical manner.
2. Survey research information can be surprisingly accurate

3. A relatively small number of subjects can provide an accurate picture of the population.

Disadvantages :

1. Obtained data tends to be superficial.
2. The breadth rather than the depth of the information is emphasized
3. The survey investigator must know sampling technique ,questionnaire construction interviewing ,and data analysis to produce reliable and valid study.
4. Large –scale survey can be time consuming and costly.

HINT:

RESEARCH CONSUMERS SHOULD RECOGNIZE THAT A WELL-CONSTRUCTED SURVEY CAN PROVIDE A WEALTH OF DATA ABOUT PARTICULAR PHENOMENA OF INTEREST, EVEN THOUGH CAUSATION IS NOT BEING EXAMINED.

Sampling Design:

1. Probability sampling:
   Simple random, stratified random, cluster, systematic
2. Non – probability :
   Convenient, quota, purposive

Purposive sampling design:

A non probability sampling strategy in which the researcher selects subjects who are
considered to be typical of the population.

- ***Disadvantages*** :
  low generalisability and bias

Tool Construction:

A SELF – REPORT INSTRUMENT (STRUCTURED SELF –

ADMINISTERED QUESTIONNAIRE) ***INCLUDE*** :

Open &Closed ended questions

- ***Advantages :***
  - cost effective in comparison to interview
  - anonymity
- ***Disadvantages***:
  - response rate
  - audience

- clarity
- missing information
- response set bias

- ***CAN BE EASLY OVERCOME BY EFFECTIVE RESEARCH COMMUNICATION SESSIONS.***

- ***TRY TO AVOID BIAS:***
  - **judgmental errors**
  - **conscious bias**
  - **extreme bias**

References :

1. Wood G. and Haber J. Nursing Research: methods, critical appraisal, and utilisation. 2002.5th.edition.Mosby
2. Polite D. and Hungler B. Nursing Research: principles and methods.1999.6th. Edition . Lippincott.

APPENDIX N

Ethical Approval from RMH Research and Ethics Committee

بسم الله الرحمن الرحيم

MINISTRY OF DEFENCE AND AVIATION
MEDICAL SERVICES DEPARTMENT

وزارة الدفاع والطيران
الخدمات الطبية للقوات المسلحة

برنامج مستشفى الرياض والخرج
RIYADH AL KHARJ HOSPITAL PROGRAMME

RIYADH ARMED FORCES HOSPITAL
P.O. Box 7897
Riyadh 11159
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R. K. H.

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RESEARCH & ETHICAL COMMITTEE

09 November 2004

Mr. Mohammad Yousef Nassar Saleh
Coordinator
Nursing Wound Care Service

Re: The impact of nurse's wound assessment performance on wound management practices among intensive care units patients

Dear Mr. Saleh

As acting chairman of the Research & Ethical Committee, I am pleased to inform you that I approved this research proposal with the some proviso (see attached).

Your research protocol has now been documented under:

Project No. 292
Series of 2004

Kindly quote the project number indicated herein in all transactions and communications. You are advised to submit a report in relation to this research scheme to update the committee of its progress.

I trust your research scheme proves fruitful and beneficial to the RKH Program.

Yours sincerely

EMERITUS PROFESSOR DAVID A. PRICE EVANS, MD DSc PhD FRCP
Acting Chairman Research and Ethical Committee
First Floor, Building 136

Cc: Mr. David Purvis, A/Director of Nursing
File

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APPENDIX O

Ethical Approval from Faculty of Health and Life Sciences Research Ethics Committee in De Montfort University

Mr Mohammad Saleh
Wound CareCoordinator
Nursing Wound Care Service
Riydah Military Hospital

17 Feburary 2005

Dear Mr Saleh

Re: The Impact of Nurses Wound Assessment Performance On Wound Management Practices.

I am pleased to inform you, that following consideration by the Faculty of Health and Life Sciences Research Ethics Committee, both the above project have been granted ethical approval.

Yours sincerely,

Professor Paul Whiting
Chair of the Faculty of Health and Life Sciences Research Ethics Committee

APPENDIX P

Letter from Head Nurse of Medical Surgical Ward for Piloting the study

بسم الله الرحمن الرحيم

بـــرنـامـج مستشفى الـريـــاض والخـرج

RKH

مذكره داخلية

RIYADH AL KHARJ HOSPITAL PROGRAMME

INTERNAL MEMORANDUM

Date 16th December 2006 — التاريخ -

To Mr. Mohd YN Salleh, Wound Care Coordinator — من -

From Moon Phang.Head Nurse 4N. 5N. CDU. — إلى -

RE: RESEARCH STUDY

Further to the verbal discussion about piloting your research instrument on the Braden Scale for Pressure Ulcers Risk Assessment and its role in the prevention and treatment, one patient from 4N Surgery will be identified for this study. This matter has been discussed with the staff and they are interested to assist you in the application of the tool. Please liaise with the Charge Nurse for any necessary arrangements.

Best Regards.

Moon Phang
B-1404, Ext. 1443

APPENDIX Q Tables of Summary Study Findings

Table 1 Frequencies and percentages of the main general characteristics of the patients involved in the study

Characteristics		Frequency	Percentage
Group	A	225	31.3
	B	228	31.7
	C	266	37.0
Type	Pretest	265	36.9
	Posttest	256	35.6
	Excluded	198	27.5
Gender	Male	464	64.5
	Female	255	35.5
Age group	Less than 30 years	119	17.0
	31-40	36	5.0
	41-60	139	19.0
	61-70	149	20.7
	71-80	163	22.7
	80+	59	8.2
Diagnosis	Medical	289	40.2
	Surgical	155	21.6
	Oncology	72	10.0
	Renal	38	5.3
	Neuro-surgical	29	4.0
	Rehabilitation	52	7.2
	Vascular	2	0.3

Table 2 Frequencies and percentages of the main general characteristics of the patients involved in the study by groups

Characteristics		Frequency			Percentage		
		GA	GB	GC	GA	GB	GC
Type	Pretest	79	91	95	29.8	34.3	35.8
	Posttest	74	76	106	28.9	29.7	41.4
	Excluded	72	61	65	36.4	30.8	32.0
Gender	Male	208	166	90	92.4	72.8	33.8
	Female	17	62	176	7.6	27.2	66.2
Age group	Less than 20	17	16	4	7.6	7	1.5
	21-30	16	59	7	7.1	25.9	2.6
	31-40	6	19	11	2.7	8.3	4.1
	41-50	9	26	36	4	11.4	13.5
	51-60	20	19	29	8.4	8.3	10.9
	61-70	44	42	63	19.6	18.4	23.7
	71-80	64	26	73	28.4	11.4	27.4
	80+	22	9	28	9.8	3.9	10.5
Diagnosis	Medical	103	41	145	45.8	18	54.5
	Surgical	67	67	21	29.8	29.4	7.9
	Oncology	7	14	51	3.1	6.1	19.2
	Renal	2	33	3	0.9	14.5	1.1
	Neuro-surgical	6	14	9	2.7	6.1	3.4
	Rehabilitation	3	49	0	1.3	21.5	0.0
	Vascular	0	0	2	0	0	0.8

Table 3 Frequencies and percentages of selected patients' characteristics by the patients' type

Characteristics		Frequencies			Percentages		
		Pretest	Posttest	Excluded	Pretest	Posttest	excluded
Gender	Male	177	165	122	38.1	35.5	26.2
	Female	88	91	76	34.5	35.6	29.8
Age group	Less than 30	42	52	25	35.2	43.6	21.0
	30-50	39	45	23	36.4	42	21.4
	51-60	28	24	16	41	35.2	23.5
	60+	128	122	121	34.5	32.8	32.6
Diagnosis	Medical	113	98	78	34.1	33.9	26.9
	Surgical	58	62	35	37.4	40	22.5
	Oncology	30	19	23	41.6	26.3	31.9
	Renal	12	7	19	31.5	18.4	50.0
	Neuro-surgical	16	10	3	55.1	34.9	10.3
	Rehabilitation	19	15	18	36.5	28.8	34.6
	Vascular	1	0	1	50	0	50.0

Table 4 Frequencies and percentages of selected attributes in relation to PU incidence (NCPU)

Attribute		Frequency of NCPU	Percentage of NCPU
Group	A	55	24.4
	B	54	23.4
	C	56	21.1
Type	Pretest	83	31.0
	Posttest	49	19.0
	Excluded	33	17.0
PU Location	Sacral	83	50.3
	Trochanter	20	12.1
	Heels	21	12.7
	Ischium	8	4.8
	Buttocks	13	7.9
	Occipital	1	0.6
	Ankle joint	4	2.4
	Toes	8	4.8
	Ears	5	3
	Metatarsum	1	0.6
	Knees	1	0.6
PU stage	Stage one	78	47.2
	Stage two	60	36.3
	Stage three	16	9.6

	Stage four	11	6.6
Age group	Less than 30	18	10.9
	30-50 years	17	10.3
	51-60 years	25	15.1
	61-70	27	16.3
	71-80	57	34.5
	80+	13	7.8
Gender	Male	111	67.2
	Female	54	32.7
Diagnosis	Medical	82	49.6
	Surgical	32	19.3
	Neuro-surgical	13	6.0
		7	4.2
	Oncology	10	6.0
	Renal	5	3.0
Braden scores	Sever risk	10	6.0
	High risk	73	44.2
	Moderate risk	41	24.8
	Mild risk	41	24.8
CJ scores	Severe risk	4	2.4
	High risk	50	30.3
	Moderate risk	61	36.9
	Minimal risk	37	22.4
	At no risk	2	1.2

Table 5 Frequencies and percentages of selected attributes in relation to PU prevalence

Attributes		PU Frequency	PU Percentage
Groups	A	84	37.7
	B	64	26.4
	C	94	38.8
Type	Pretest	97	40.0
	Posttest	81	33.4
	Excluded	64	26.4
PU stage	Stage one	30	12.3
	Stage two	67	27.6
	Stage three	39	16.1
	Stage four	106	43.8
PU location	Sacrum	116	47.9
	Trochanter	48	19.8
	Heels	38	15.7
	Ischium	18	7.4
	Buttocks	7	2.8
	Occiput	7	2.8
	Ankle	3	1.2
	Toes	3	1.2
	Ears	1	0.4
	Metatarsum	1	0.4

Table 6 Frequencies and percentages of using certain attributes related to protective measures

Attributes		Frequency of use	Percentage of use
Protective mattresses	Standard mattresses	400	55.6
	Alternating system	106	14.7
	Therakair	130	18.0
	Genadyne	26	3.6
	Atmosair	49	6.8
	Gel overlays	8	1.1
skin barrier creams		302	42.0
Vitamins & nutritional supplements		275	38.2
Patients' turning schedule	Every 2 hours	125	17.3
	Every 3-4 hours	541	75.2
	Every 6 hours	30	0.4

Table 7 Frequencies and percentages of using certain attributes related to protective measures by group and type

utes		G A	G B	GC	Pretest	Posttest	Excluded
ctive esses	Standard mattresses	29.7(119)	33.2(133)	37.0(148)	38.7(155)	25.5(102)	35.7(143)
	Alternating system	16.9(18)	34.0(36)	49.0(52	51.8(55)	33.9(36)	14.0(15)
	Therakair	52.3(68)	24.6(32)	23.0(30)	28.4(37)	53.0(69)	18.4(24)
	Genadyne	57.0(15)	3.8(1)	38.4(10)	26.9(7)	57.6(15)	15.3(4)
	Atmosair	4.0(2)	44.9(22)	51.0(25)	10.2(5)	67.3(33)	22.4(11)
	Gel overlay	37.5(3)	50.0(4)	12.5(1)	75.0(6)	12.5(1)	12.5(1)
arrier creams		31.0(94)	33.0(100)	35.8(108)	44.3(134)	36.4(110)	19.2(58)
ins & nutritional ements		24.3(67)	36.7(101)	39.0(107)	42.5(117)	33.0(91)	24.3(67)
nts' g ule	Every 2hours	32.8(41)	33.6(42)	33.6(42)	48.0(60)	13.6(17)	38.0(48)
	Every 3-4 hours	31(167)	31(169)	37.8(205)	33.4(181)	42.8(232)	23.6(128)
	Every 6 hours	20(6)	50(15)	30.0(9)	50.0(15)	6.6(2)	43.3(13)

Table 8 Frequencies and percentages of certain attributes related to protective measures by NCPU

Attribute		Frequency of use with NCPU (n=165)	Percentage of use with NCPU	Frequency of use without NCPU (n=554)	Percentage of use without NCPU
Protective mattresses	Standard mattresses	100	60.6	300	54.1
	Alternating system	28	16.9	78	14.0
	Therakair	29	17.5	101	18.2
	Genadyne	6	3.6	20	3.6
	Atmosair	0	0.0	49	8.8
	Gel overlay	2	1.2	6	1.0
Patient turning schedule	Every 2 hours	28	17.0	97	17.5
	Every 3-4 hours	128	77.5	413	74.5
	Every 6 hours	5	3.0	25	4.5
Skin barrier creams		86	52.1	216	39.0
Vitamins & nutritional supplements		70	42.4	205	37.0

Table 9 Frequencies and percentages of the Braden scores and CJ scores among groups, type and protective mattresses

Attributes		Group			Type			*Protective mattresses					
		A	B	C	Pretest	Posttest	Excluded	1	2	3	4	5	6
The Braden scores	Severe (n=22)	59(13)	18(4)	23(5)	68(15)	0	32(7)	36(8)	45(10)	9(2)	9(2)	0	0
	High (n=248)	34(84)	22(56)	44(108)	42(104)	37(91)	21(53)	44(110)	16.9(42)	29(71)	7(18)	2(5)	0.8(2)
	Moderate (n=172)	30(51)	28(48)	42(73)	32(55)	42(72)	26(45)	50(84)	17(30)	24(41)	1(2)	8(13)	1(2)
	Mild (n=266)	26(68)	44(118)	30(80)	32(84)	35(93)	33(89)	70(188)	9(23)	6(16)	2(4)	11(31)	2(4)
The CJ scores	Severe (n=6)	50(30)	0	50(3)	67(4)	33(2)	0	17(1)	50(3)	33(2)	0	0	0
	High (n=165)	35(58)	21(34)	44(73)	38(63)	40(66)	22(36)	42(70)	21(34)	27(45)	5(9)	2(3)	3(4)
	Moderate (n=232)	34(79)	25(57)	41(96)	37(85)	43(100)	20(47)	45(105)	15(35)	25(58)	6(13)	8(19)	0.8(2)
	Minimal (n=221)	28(61)	41(91)	31(69)	33(74)	35(78)	31(69)	64(142)	14(31)	9(20)	0.9(2)	11(25)	0.4(1)

*

1= Standard Mattress 2= Alternating System 3= Therakair Mattress 4= Genadyne Mattress 5= Atmosair Mattress

6= Gel Overlays

APPENDIX R

Poster Presented in the 9th EPUAP Meeting, Berlin-Germany 2006

Pressure Ulcer Prevalence & Incidence among Hospitalized Patients at Riyadh Military Hospital – Saudi Arabia

Mohammad Y.N. Saleh RN. MsN, Post Graduate PhD Student (DeMontfort University, Leicester UK), Wound Care Coordinator RMH-SA.
Dr S Parboteeah, DeMontfort University, Leicester, UK
Prof Denis Anthony, DeMontfort University, Leicester, UK

INTRODUCTION

Pressure ulcers remain a significant problem known for ages in both hospital and community settings not only because of financial burden but also in terms of human suffering, pain, disfigurement, loss of productive time, emotional discomfort and changes in body image. As a result of increased awareness of the problem in the last three decades, nurses have become more proactive in promoting prevention plans to overcome such a problem. The need for improving the figures of pressure ulcer prevalence and incidence has been well documented but with little evidence suggesting improvement (Pancorbo--Hidalgo, 2006 ; Flanagan,1995).

Numerous estimates of incidence and prevalence of pressure ulcers from different countries: UK, USA, Canada and Europe were reviewed and the literature revealed variations in the study populations, different data collection methodologies, lack of national and international consensus on pressure ulcers grading systems, risk assessment scales and inadequate documentation of prevalence and incidence which lacked comparability between data sets collected.

AIM

This poster will discuss the initial findings of pressure ulcer prevalence and incidence survey from (2003 to 2006) at Riyadh Military Hospital(RMH) – Saudi Arabia compared to data from other countries.

METHODS

A wound care management system was implemented in 2003. The action plan included the development of a pressure ulcer management policy utilizing the Agency for Health Care Policy and Research Guidelines(AHCPR ,1992) for pressure ulcer prevention and treatment, a mandatory educational program and a pressure ulcer prevalence and incidence survey.

One week period prevalence and cumulative incidence of 8 weeks patient observation and skin assessment were utilized to collect the data from 10 medical-surgical wards. A well known risk assessment tool (The Braden Scale) was used to consider patients at risk with a cut off score of ≤18. AHCPR (1992) pressure ulcer classification system was considered and patients with grade I pressure ulcers were included. Data was collected by one tissue viability specialist and 2 staff nurses .

RESULTS

This survey undertaken from 2003 to 2006 showed that the prevalence ranged from 19.9% to 23.8% and the incidence ranged from 31.8% to 36.4% among hospitalized patients (Figure 1.).

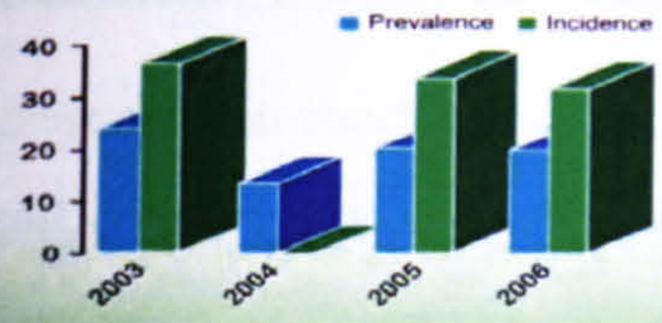


Figure 1. Prevalence and Incidence of Pressure Ulcers at RMH

CONCLUSION

In conclusion wound care system is an active, challenging and conflicting area of practice. Such studies may contribute the body of evidence with regard to clinical outcomes, efficiency and effectiveness. Further study is underway to disentangle the effects of clinical judgement, education, training and the use of the Braden Scale in reducing pressure ulcers in hospitalised patients.

DISCUSSION

Figures shown are particularly useful in providing broad view about pressure ulcer prevalence and incidence at RMH and in establishing baseline data for future improvement in such situation lacking national studies and documentation of pressure ulcers prevalence and incidence.

The prevalence and incidence figures at RMH showed higher rates compared to developed countries in general. It demonstrates mild decrease in incidence and moderate decrease in prevalence from 2003 to 2006 which address the need for more exploration in the future to show the effectiveness of prevention programs implemented .

Literature reviews showed UK prevalence ranged from 5.1 to 32.1% and incidence was 2.2 to 29 % per annum (1980-1997). The prevalence reported for hospitals in the USA and Canada ranged from 4.7 to 29.7% and incidence was 8.5 to 14.8% (1980 -1999). Prevalence reports from some Europe countries ranged from 7% in Germany to 15% in Netherlands(1995) and 12% in Germany to 22% in Netherlands (2004) (Lahman,2005;Whittington,2000;Amlung,1999;Tannen, 2004;Kaltenthaler,2001; O'Dea,1995).

Action plan of wound care system revealed its worth to RMH as a health care facility. However, more significant work should be directed toward prevention strategies of pressure ulcers, included educational programs and further reliable and valid studies with consistent standardized methods of data collection to interpret pressure ulcers incidence and prevalence data properly.

APPENDIX S

Descriptive statistical analysis

1. General characteristics of the patients involved in the study

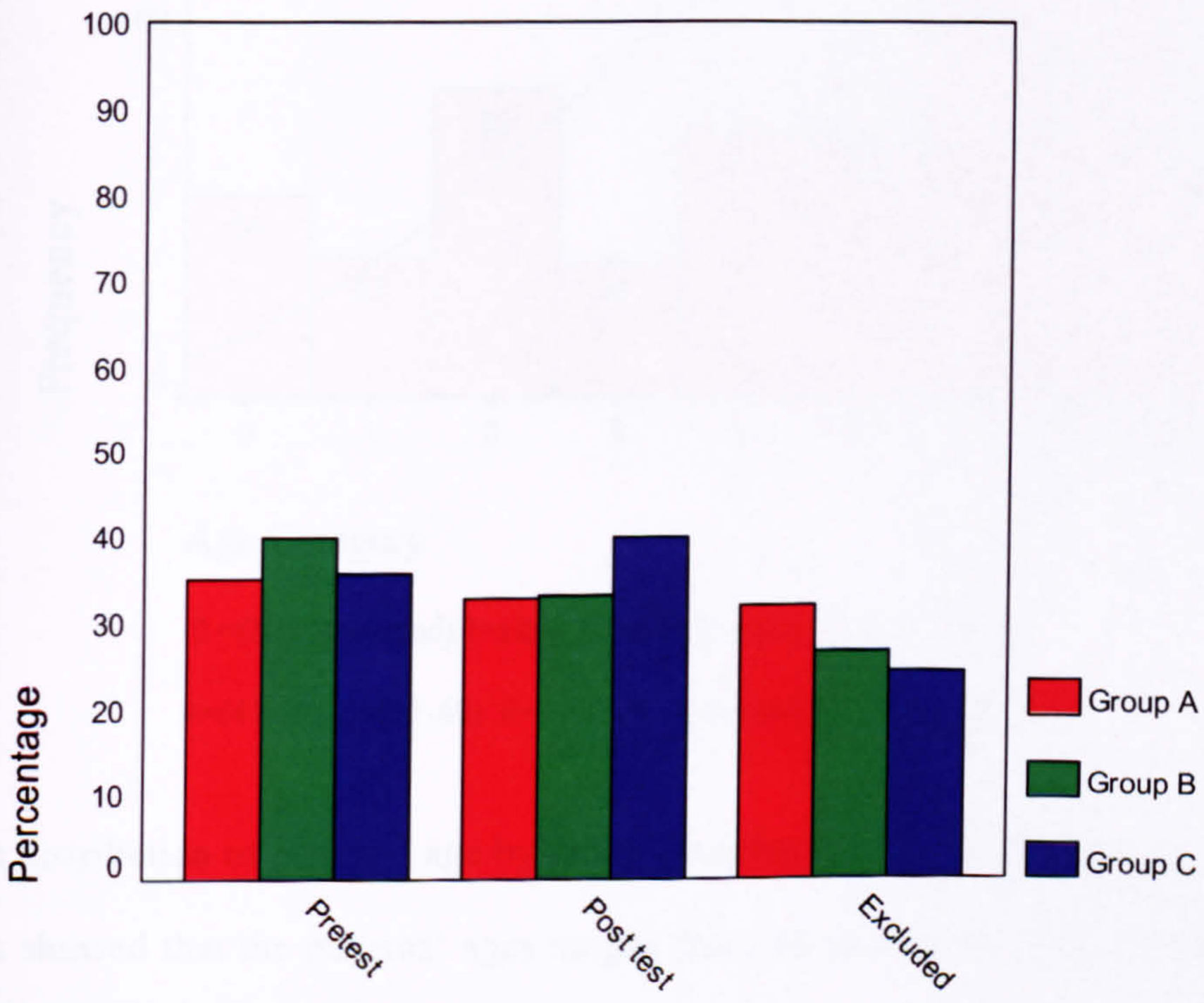
In total, 719 patients were included in the study. All conformed to the inclusion criteria. During the study, data was collected from newly admitted and/or inpatients from nine medical and surgical wards, including 237 beds and 264 nursing staff. The nine medical and surgical wards were divided into three groups: Group A (GA), which included patients from the Male Medical, Isolation and Male Orthopaedic and Spinal Surgery wards; Group B (GB), which included patients from the Rehabilitation, Renal and Neuro-Surgery wards; and Group C (GC), which included patients from the Female Medical, Oncology and VIP Medical-Surgical wards.

Of the sample, 72.4 per cent (n=521) of the patients completed the eight week observation period and 27.6 per cent (n=198) did not complete this period because of discharge, transfer or death. Of the patients who did complete the period, 265 were observed in the pre-test and 256 in the post-test stages. The findings indicate that 31.3 per cent (n=225) of the patients were from Group A, 31.7 per cent (n=228) from Group B and 37 per cent (n=266) from Group C.

The distribution of patients by the group and type (pre-test or post-test) as shown in Figure 4.1 indicated that the patients included from groups A, B and C (n=265) before intervention (pre-test) accounted for 29.9 per cent (79 of 265 patients), 34.3 per cent (91

of 265) and 35.8 per cent (95 of 265) respectively while those patients included after intervention (post-test) (n=256) accounted for 28.9 per cent (74 of 256), 29.7 per cent (76 of 256 patients) and 41.4 per cent (106 of 256 patients) of those groups respectively. Of the sample, 198 patients did not complete the eight week observation period. They accounted for 36.4 per cent (72 of 198 patients), 30.8 per cent (61 of 198 patients) and 32.8 per cent (65 of 198 patients) from the groups A, B and C respectively.

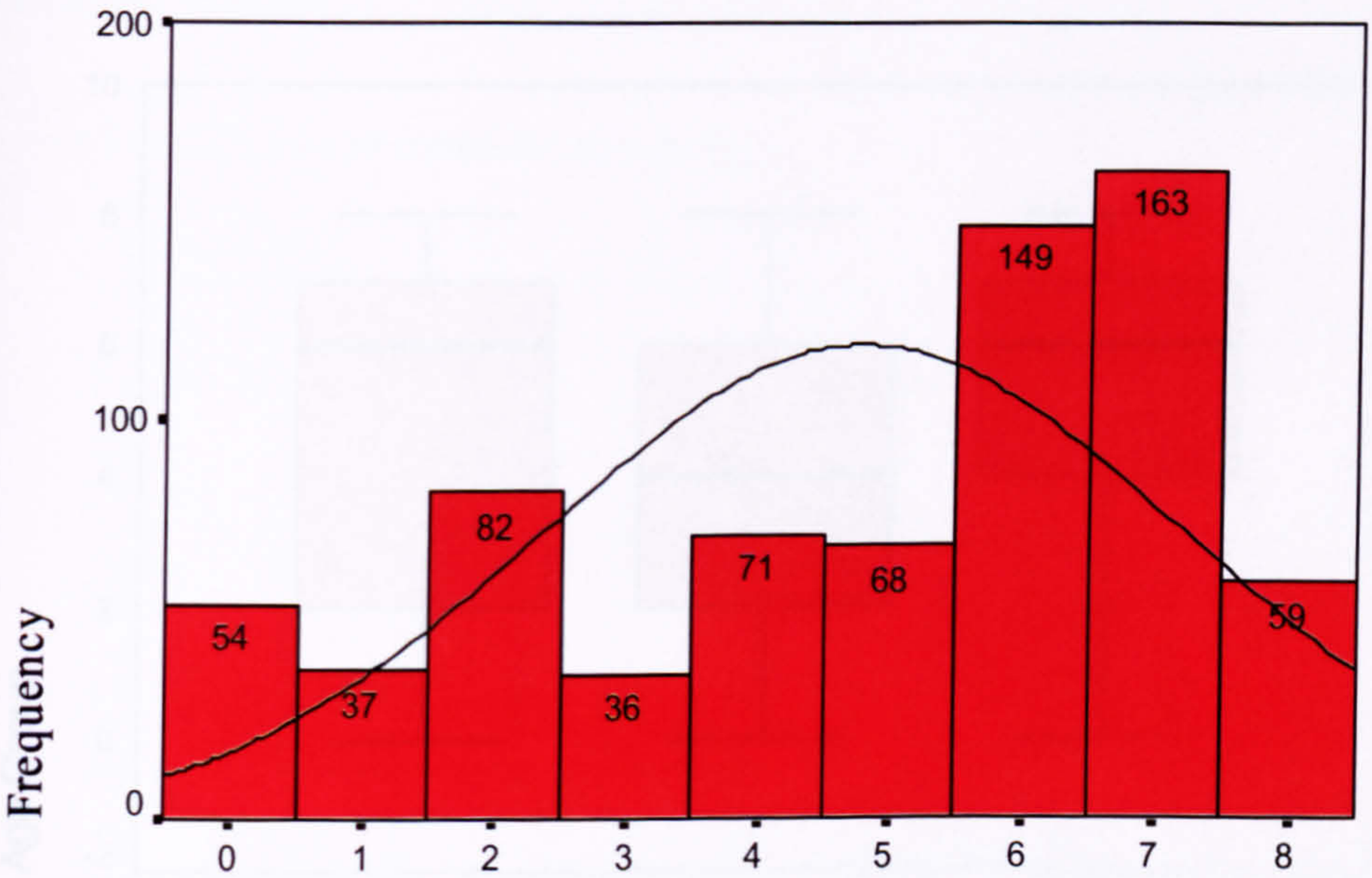
Figure 1 Distribution of patients by groups and types



The patients' age as shown in a histogram in Figure (2) revealed that nearly half, 51.6 per cent (n=371) of the patients were aged 60 years and over. Of the sample, 17 per cent (n=119) were less than 30 years old, 5 per cent (n=36) were 30 to 40 years old, 19 per cent (n=139) were 40 to 60 years old, 21 per cent (n=149) were 60 to 70 years old, 23 per cent (n=163) were 70 to 80 years old, and 8 per cent (n=59) were over 80.

Furthermore, the distribution of age indicated a negative skewness (-0.6) towards older patients.

Figure 2 Distribution of patients by age



Age Category

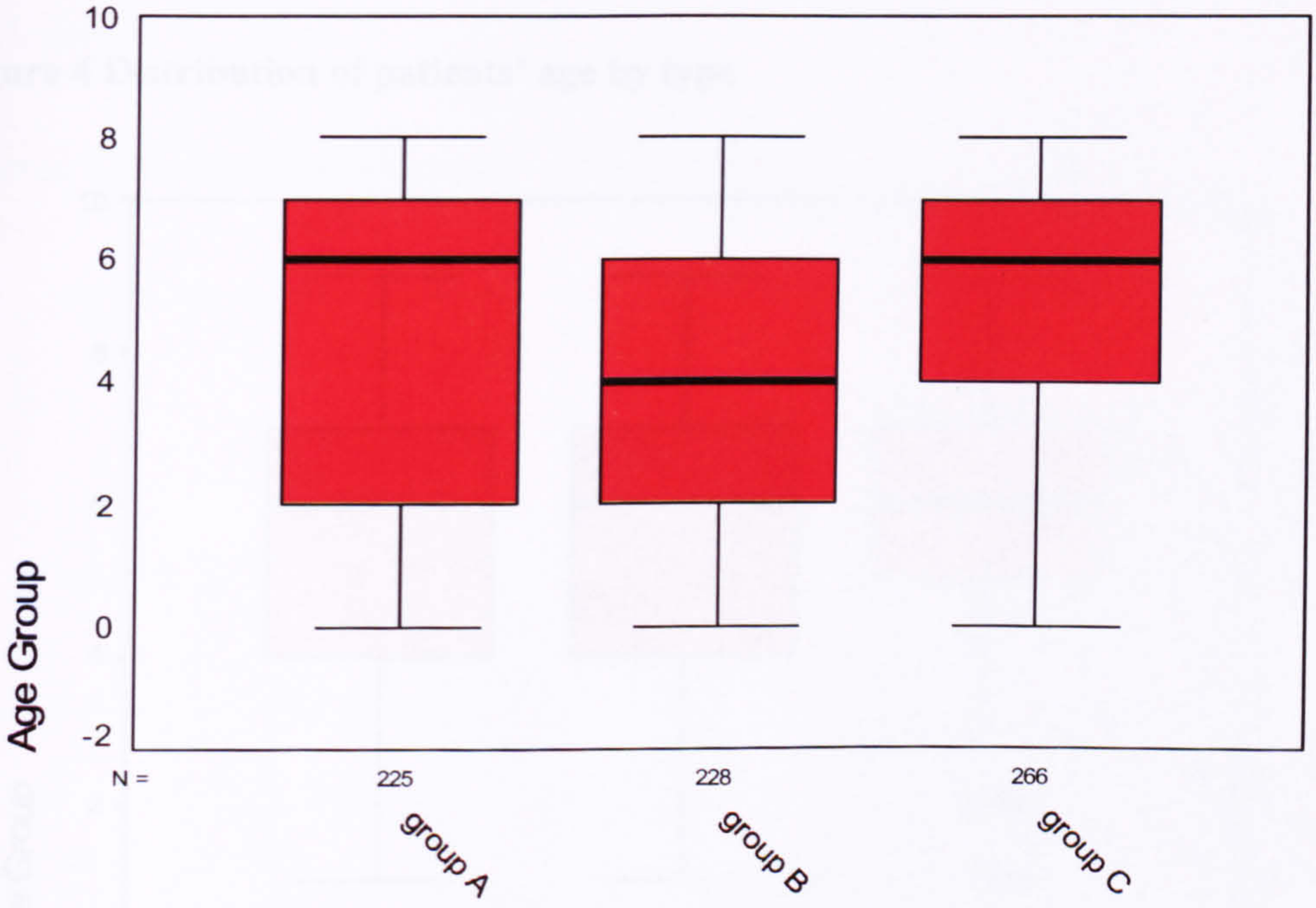
0 =(Not Recorded) 1=(less than 20) 2=(21-30) 3 =(31-40)

4=(41-50) 5=(51-60) 6=(61-70) 7=(71-80) 8=(more than 80)

The distribution of patients' age by group described in Figure (3) and presented by box plot showed that the patients' ages ranged from 18 to over 80. The findings indicated that GB patients were younger. The number of patients between 20 and 30 accounted for 25.9 per cent (59 of 228 patients) in GB and 7.1 per cent (16 of 225 patients) in GA and 2.6 per cent (7 of 266 patients) in GC. The findings showed that 57.8 per cent (130 of 225) patients aged 60 years over belonged to GA and a relatively similar percentage of 61.6 (164 of 266 patients) to GC, while 33.7 per cent (77 of 228 patients) belonged

to GB. The number of patients in GA and GC aged between 70 and 80 was nearly threefold the number in GB, being 28.4 per cent (64 of 225 patients) in GA, 27.4 per cent (73 of 266 patients) in GC and 11.4 per cent (26 of 228 patients) in GB.

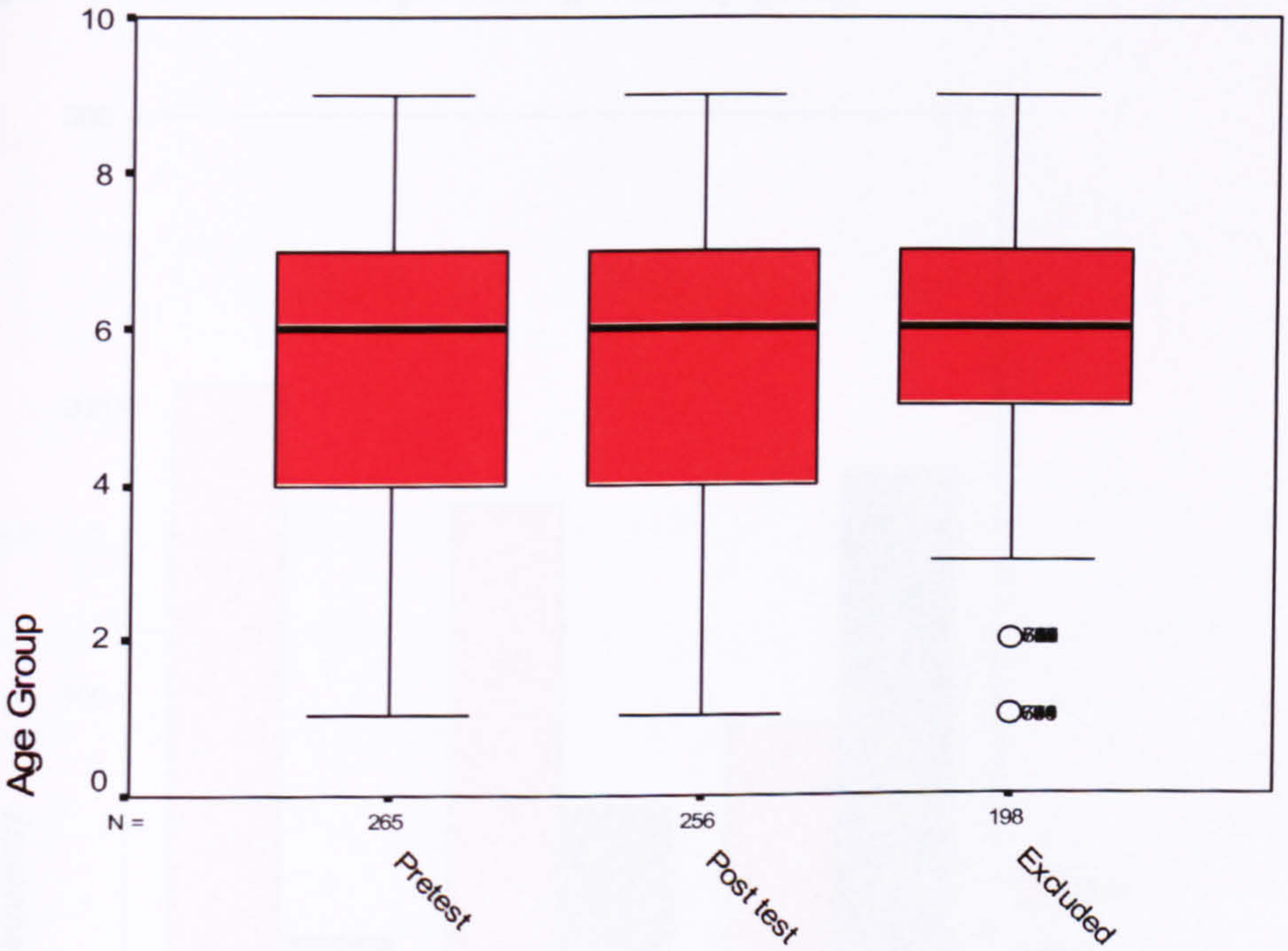
Figure 3 Distribution of patients' age by group



The distribution of age by type of patient showed a relatively minimal variation among different age groups. Among those patients less than 30 years old, 35.3 per cent (42 of 119 patients) were pre-test compared to 43.7 per cent (52 of 119 patients) post-test and 21 per cent (25 of 119 patients) excluded. The results indicate that, of those patients in the middle-aged group (30 to 50 years old), 36.5 per cent (39 of 107 patients) were pre-test compared to 42 per cent (45 of 107 patients) post-test and only 21.5 per cent (23 of 107 patients) excluded. There was minimal variation among those patients who were 50

to 60 years old, 41 per cent (28 of 68 patients) being pre-test compared to 35.2 per cent (24 of 68) post-test and 23.5 per cent (16 of 68) excluded. The variation almost disappeared in the age group over 60, of whom 34.5 per cent (128 of 371) were pre-test compared to 32.8 per cent (122 of 371) in post-test and 32.6 per cent (121 of 371) excluded. See Figure 4.

Figure 4 Distribution of patients' age by type



The findings showed that 64.5 per cent (n=464) of the patients were male and 35.5 per cent (n=255) were female. The distribution of gender varied among groups A, B and C. Although male patients accounted for 92.4 per cent (208 of 225 patients) in GA, they were 33.8 per cent (90 of 266 patients) in GC and 72.8 per cent (166 of 228 patients) in GB. Only 7.6 per cent (17 of 225) were female in GA while they accounted for 66.2 per cent (176 of 266) in GC and 27.2 per cent (62 of 228) in GB, as shown in Figure 5. The

findings showed minimal variation among the distribution of age by type of patient. Of the sample, 38.1 per cent (177 of 464 patients) were male in pre-test compared to 35.5 per cent (165 of 464 patients) in post-test and 26.2 per cent (122 of 464 patients) in excluded, while 34.5 per cent (88 of 255 patients) were female in pre-test compared to 35.7 per cent (91 of 255) in post-test and 29.8 per cent (76 of 255 patients) in excluded. See Figure 6.

Figure 5 Distribution of patients' gender by group

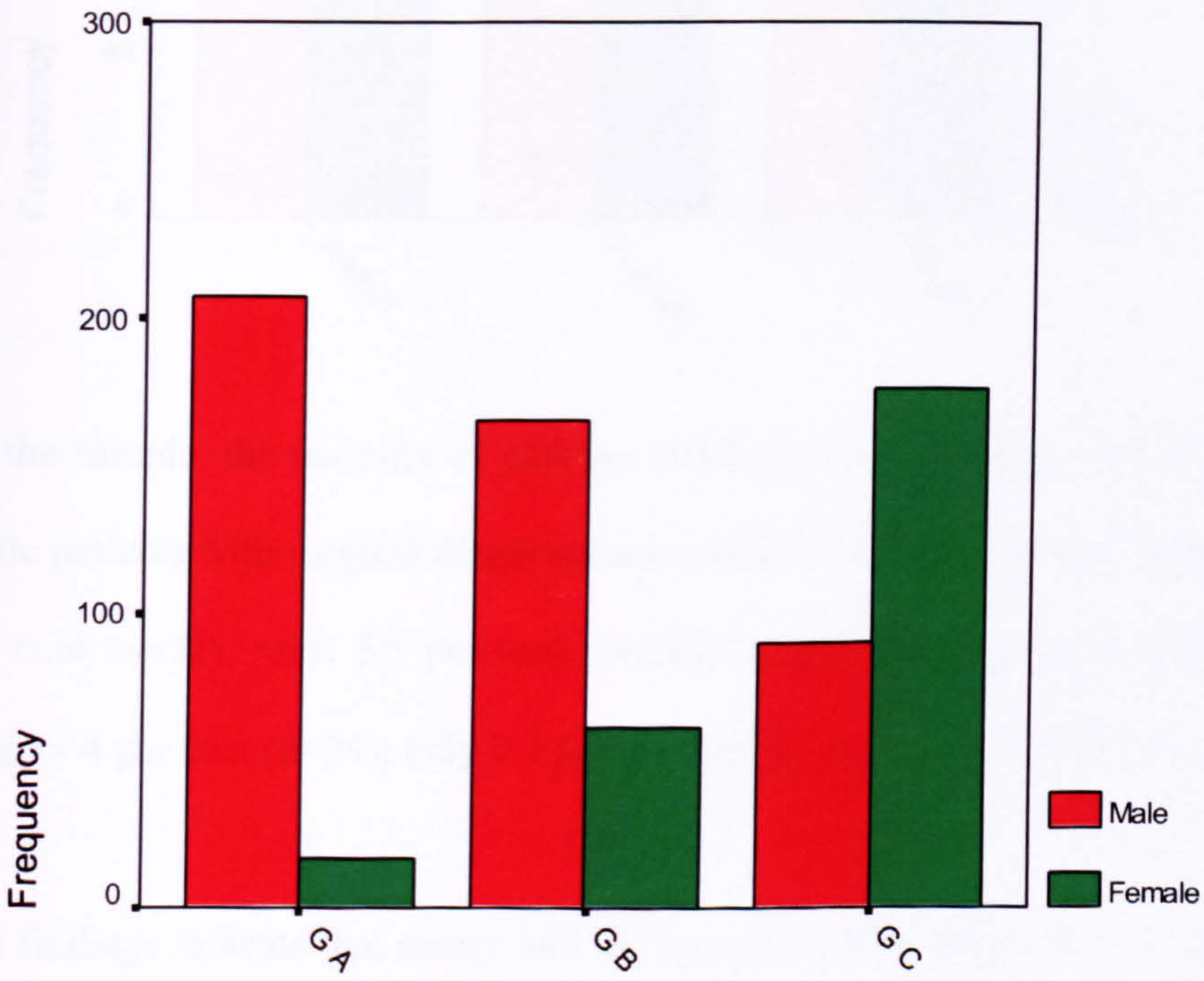
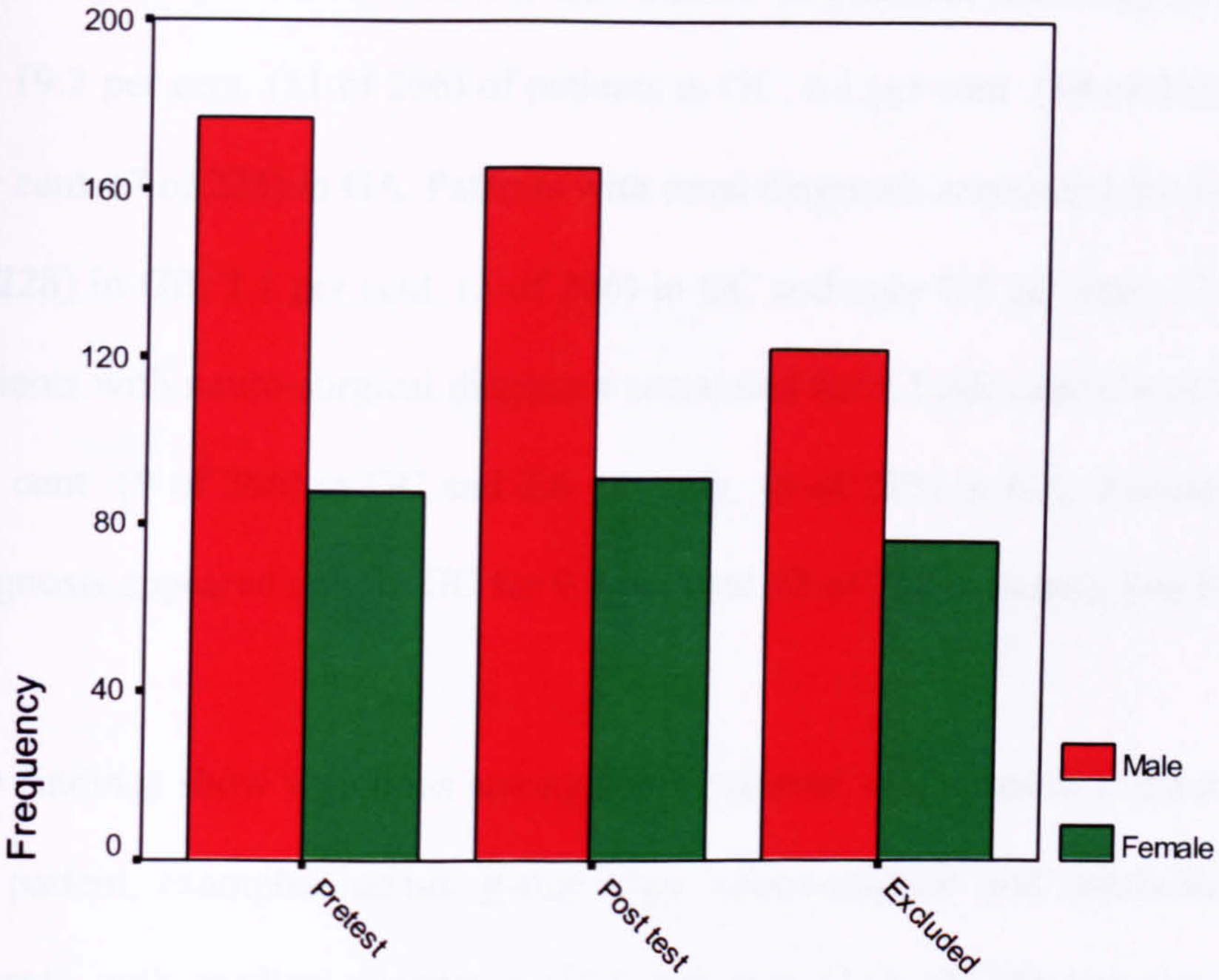


Figure 6 Distribution of patients by gender and type



Of the sample, the majority of patients (40.2 per cent (n=289)) had medical diagnosis while patients with surgical diagnosis accounted for 21.6 per cent (n=155), oncology 10 per cent (n=72), renal 5.3 per cent (n=38), rehabilitation 7.2 per cent (n=52), neuro-surgery 4 per cent (n=29); only 0.3 per cent (n=2) were vascular patients. See Figure 7.

The findings indicate that nearly half the patients in GA, 45.8 per cent (103 of 225) and 54.5 per cent (145 of 266) in GC had medical disorders, while only 18 per cent (41 of 228) were reported in GB.

The findings show that patients with surgical diagnosis in GA were 29.8 per cent (67 of 225 patients), with a similar total in GB (29.4 per cent (67 of 228 patients)), while only 7.9 per cent (21 of 66 patients) had surgery in GC. The findings showed that GB

retained more patients for rehabilitation (21.5 per cent (49 of 228)) compared to GA with only 1.3 per cent (3 of 225); GC retained no patients. Oncology patients accounted for 19.2 per cent (51 of 266) of patients in GC, 6.1 per cent (14 of 228) in GB and 3.1 per cent (7 of 225) in GA. Patients with renal diagnosis accounted for 14.5 per cent (33 of 228) in GB, 1.1 per cent (3 of 266) in GC and only 0.9 per cent (2 of 225) in GA; patients with neuro-surgical diagnosis accounted for 6.1 per cent (14 of 228) in GB, 3.4 per cent (9 of 266) in GC and 2.6 per cent (6 of 225) in GA. Patients with vascular diagnosis appeared only in GC for 0.8 per cent (2 of 266 patients). See Figure 8.

The findings show variations among some patients' diagnoses in relation to the type of the patient, examples including oncology, neuro-surgical and rehabilitation. Of those patients with medical diagnosis, 39.1 per cent (113 of 289 patients) were pre-test compared to 33.9 per cent (98 of 289) post-test and 27 per cent (78 of 289) excluded. Of those patients with surgical diagnosis, 37.4 per cent (58 of 155) were pre-test, 40 per cent (62 of 155) post-test and 22.6 per cent (35 of 155) were excluded. Among oncology patients, 41.8 per cent (30 of 72) were pre-test while only 26.3 per cent (19 of 72) were post-test and 31.9 per cent (23 of 72) were excluded. Among renal patients, 31.5 per cent (12 of 38) were pre-test while only 18.5 per cent (7 of 38) were post-test and 50 per cent (19 of 38 patients) were excluded patients. Of neuro-surgical patients, more than half (55 per cent (16 of 29)) were pre-test compared to 34.8 per cent (10 of 29) post-test and 10.2 per cent (3 of 29) excluded. Rehabilitation patients accounted for 36.5 per cent (19 of 52) of pre-test compared to 28.8 per cent (15 of 52) of post-test and 34.7 per cent (18 of 52) excluded. Of those patients with vascular diagnosis, 50 per cent (1 of 2) were from each of the pre-test and excluded categories. See Figure 9.

Figure 7 Distribution of patients by Diagnosis

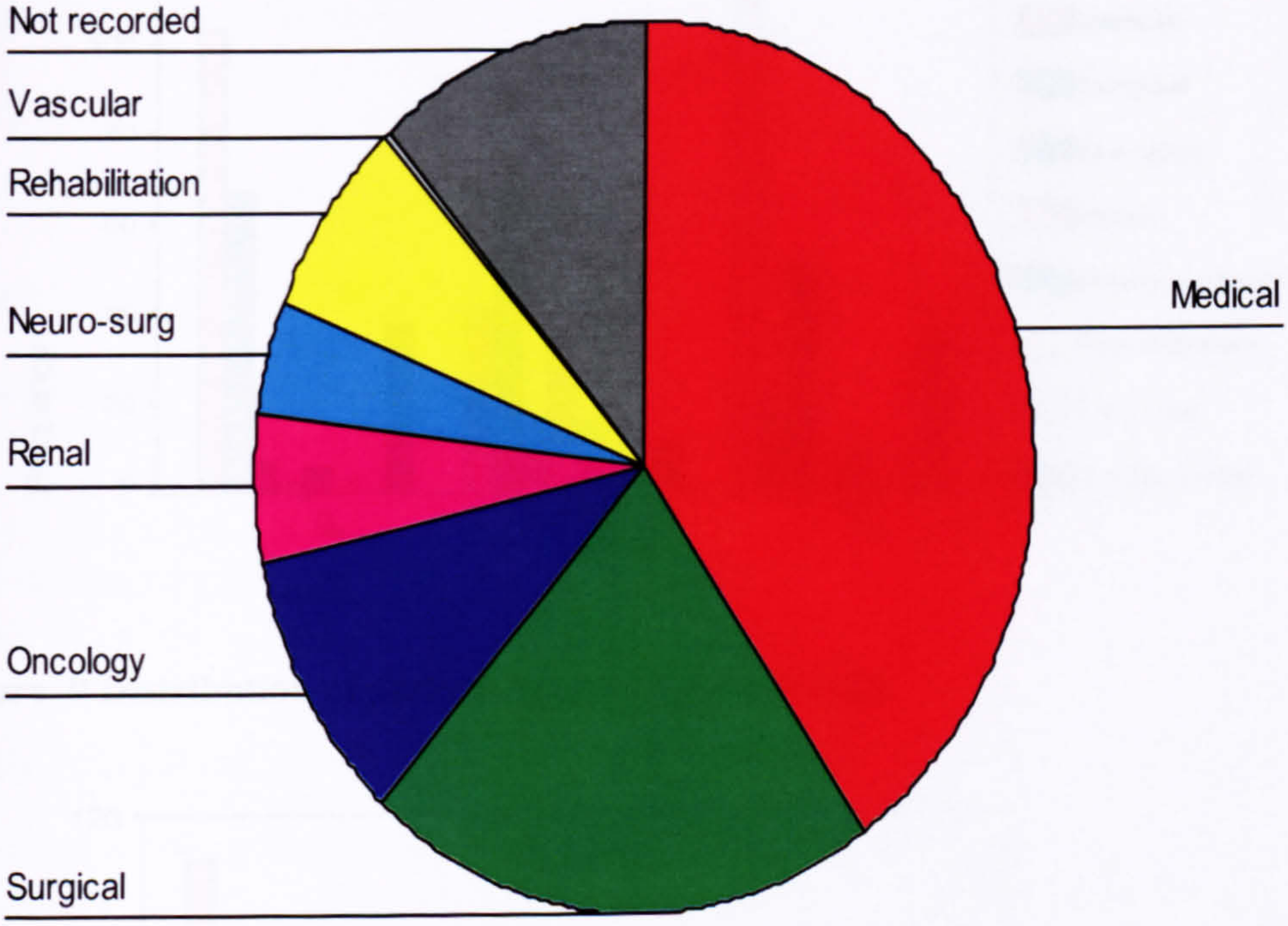


Figure 8 Distribution of patients by diagnosis and group

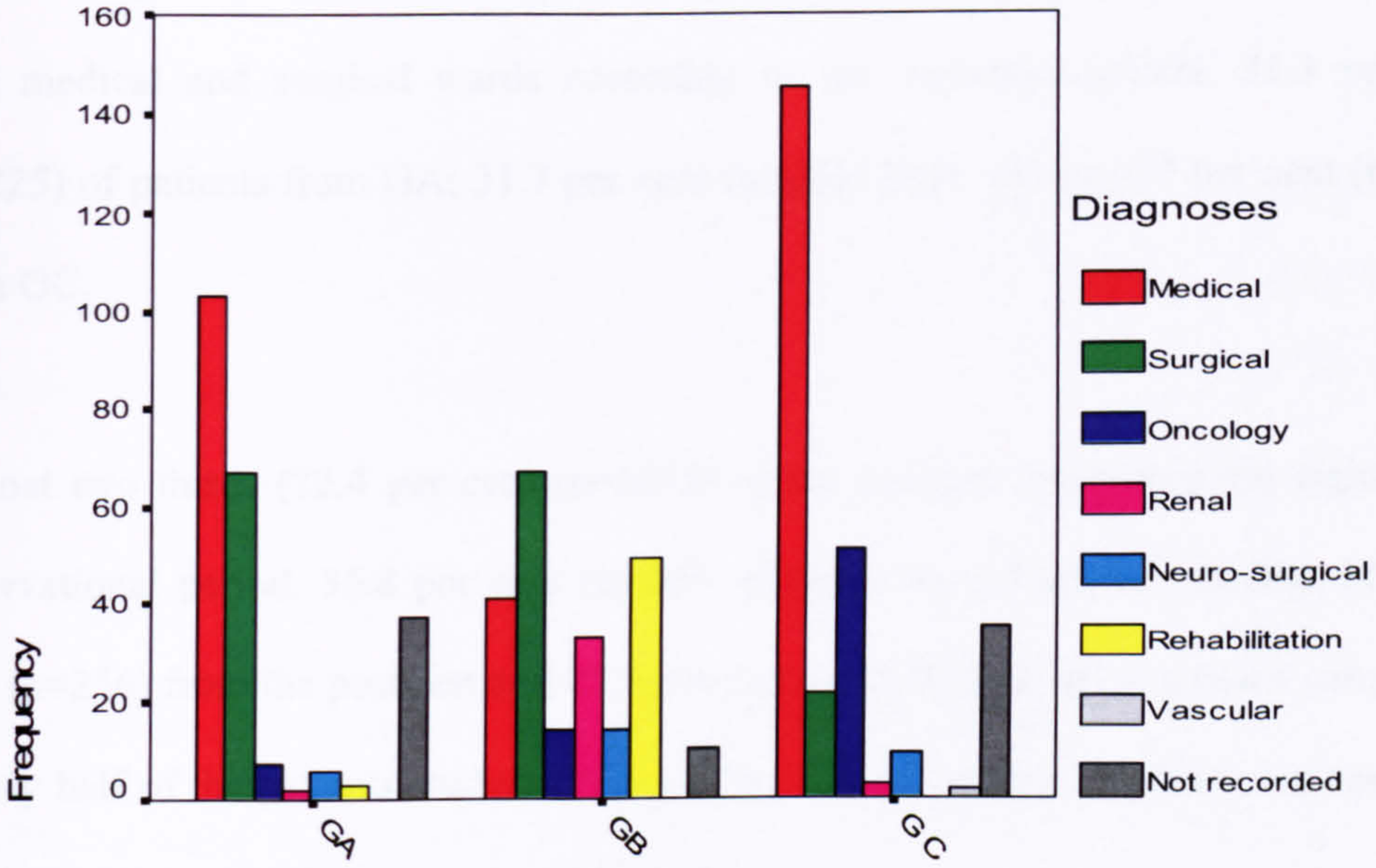
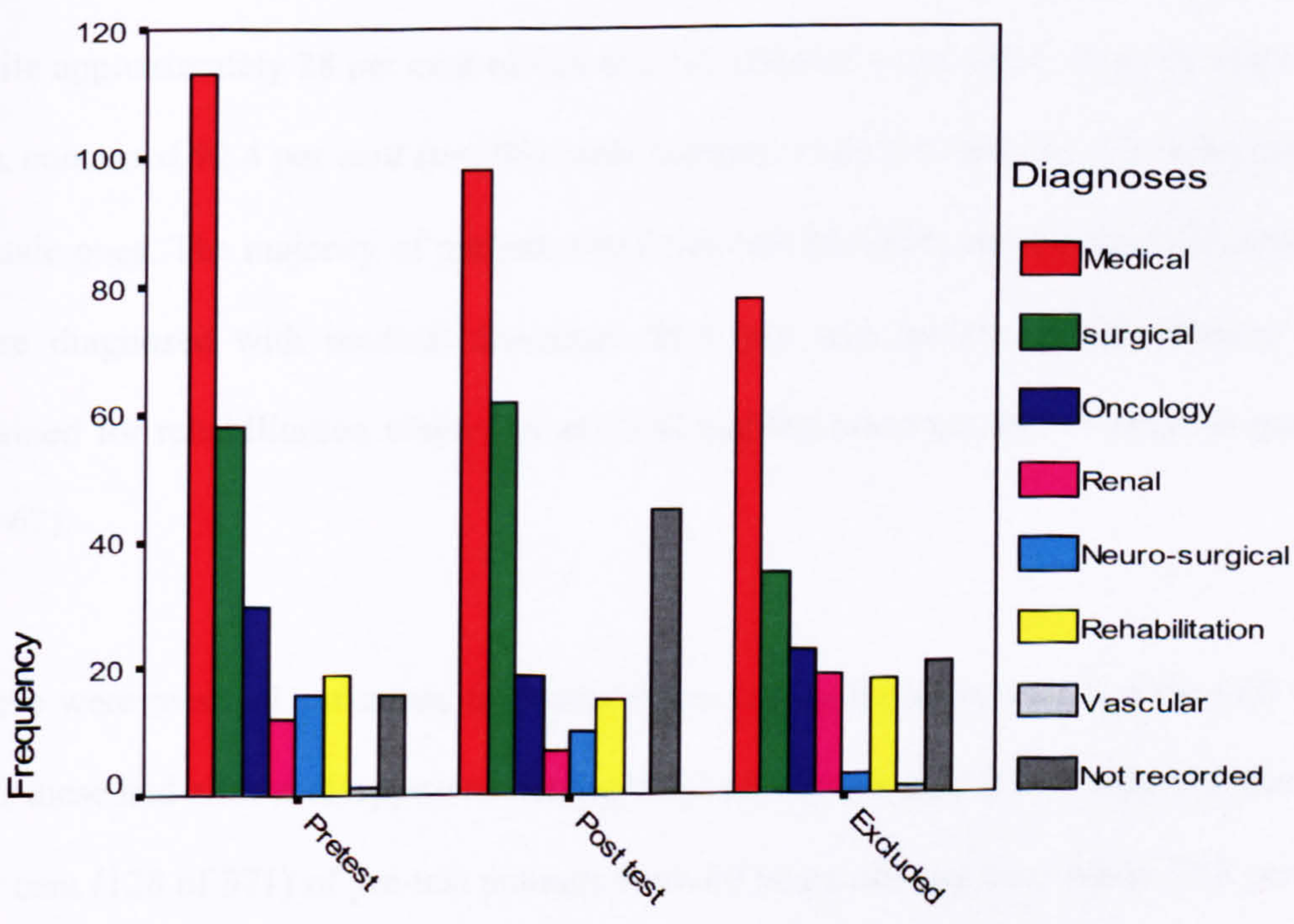


Figure 9 Distribution of patients by diagnosis and type



In order to sum up the findings of this section, tables were constructed as shown in Appendix Q, tables 1 2 and 3. A total of 719 patients were included in the study from nine medical and surgical wards according to the inclusion criteria. 31.3 per cent (n=225) of patients from GA; 31.7 per cent (n=228) from GB and 37 per cent (n=266) from GC.

Almost two thirds (72.4 per cent (n=521)) of the patients completed the eight week observational period. 36.8 per cent (n=265) of them were from the pre-test, 35.6 per cent (n=256) from the post-test and 27.5 per cent (n=198) from the excluded categories. Nearly half of the patients studied (51.6 per cent (n=371)) were 60 years old and over, and the majority (64.5 per cent (n=464)) were male.

Among the patient groups, 25.9 per cent of GB patients were young (20 to30 years old), while approximately 28 per cent of GA and GC patients were older (70 to 80 years old). GA contained 92.4 per cent (n=208) male patients while GC had 66.2 per cent (n=176) female ones. The majority of patients (40.2 per cent (n=289), mostly from GA and GC) were diagnosed with medical disorders. 21.5 per cent (n=49) of GB patients were retained for rehabilitation while GA and GB had the same number of surgical patients (n=67).

There were minimal variations in patient types among those patients less than 60 years old; these had almost disappeared among those above this age. It was reported that 34.5 per cent (128 of 371) of pre-test patients were 60 years old and over while 32.8 per cent

(122 of 371) were in the post-test and 32.6 per cent (121 of 371 patients) in the excluded categories.

A relatively similar gender frequency was reported among the patient type, with very minimal variation among male patients. Furthermore, it was noted that more variations were reported for patient types among oncology, renal, neuro-surgical and rehabilitation patients than among other diagnoses.

2. Pressure ulcer incidence and prevalence among the patients

The PU incidence rate (referred to as Nosocomial PU (NCPU)) is defined in chapter three (section 3.11)

Of the sample, 22.9 per cent (n=165) of the patients developed Stage One to Four PUs. In GA, 24.4 per cent (55 of 225 patients) were reported with NCPU, in GB 23.4 per cent (54 of 228 patients) were reported with NCPU and in GC 21.1 per cent (56 of 266 patients) (Figure 10).

The findings also revealed that 31 per cent (83 of 265) of the NCPU developed in pre-test while only 19 per cent (49 of 256) developed in post-test and 17 per cent (33 of 198 patients) developed in excluded patients (Figure 11).

Of those patients with NCPU, 47.2 per cent (78 of 165 patients) were Stage One, 36.4 per cent (60 of 165 patients) were Stage Two, 9.7 per cent (16 of 165 patients) were Stage Three and 6.7 per cent (11 of 165 patients) were Stage Four (Figure 12). More

than half (50.3 per cent, or 83 of 165 patients) developed NCPU on the sacral area, 12.7 per cent (21 of 165 patients) on the heels, 12.1 per cent (20 of 165 patients) on the trochanter, 7.9 per cent (13 of 165 patients) on the buttocks, 4.8 per cent (8 of 165 patients) on the toes, 4.8 per cent (8 of 165 patients) on the ischial area, 3 per cent (5 of 165 patients) on the ears, 2.4 per cent (4 of 165 patients) on the ankle joints, and 0.6 per cent (1 of 165 patients) developed one PU on their occipital area, knee and metatarsum (Figure 13).

The distribution of NCPU stages by location showed that 53.8 per cent (42 of 78 patients) developed Stage One NCPU on the sacral area, 14.1 per cent (11 of 78 patients) on the trochanter and 11.5 per cent (9 of 78 patients) on the heels. The results showed that 53.3 per cent (32 of 60 patients) had Stage Two NCPU on the sacral area and 11.7 per cent (7 of 60 patients) on each of the knees and the heels. 37.5 per cent (6 of 16 patients) of Stage Three NCPU developed PUs on the sacral area, 18.8 (3 of 16 patients) on the heels and 12.5 per cent (2 of 16 patients) on each of the heels and the trochanter areas. It was also reported that the most common site for Stage Four NCPU are the heels, the sacrum, the ankle joint and the toes, all of which reported relatively similar values and accounted for 27.3 per cent (3 of 11 patients) in all of the above four sites (Figure 14).

Figure 10 Distribution of NCPU by group

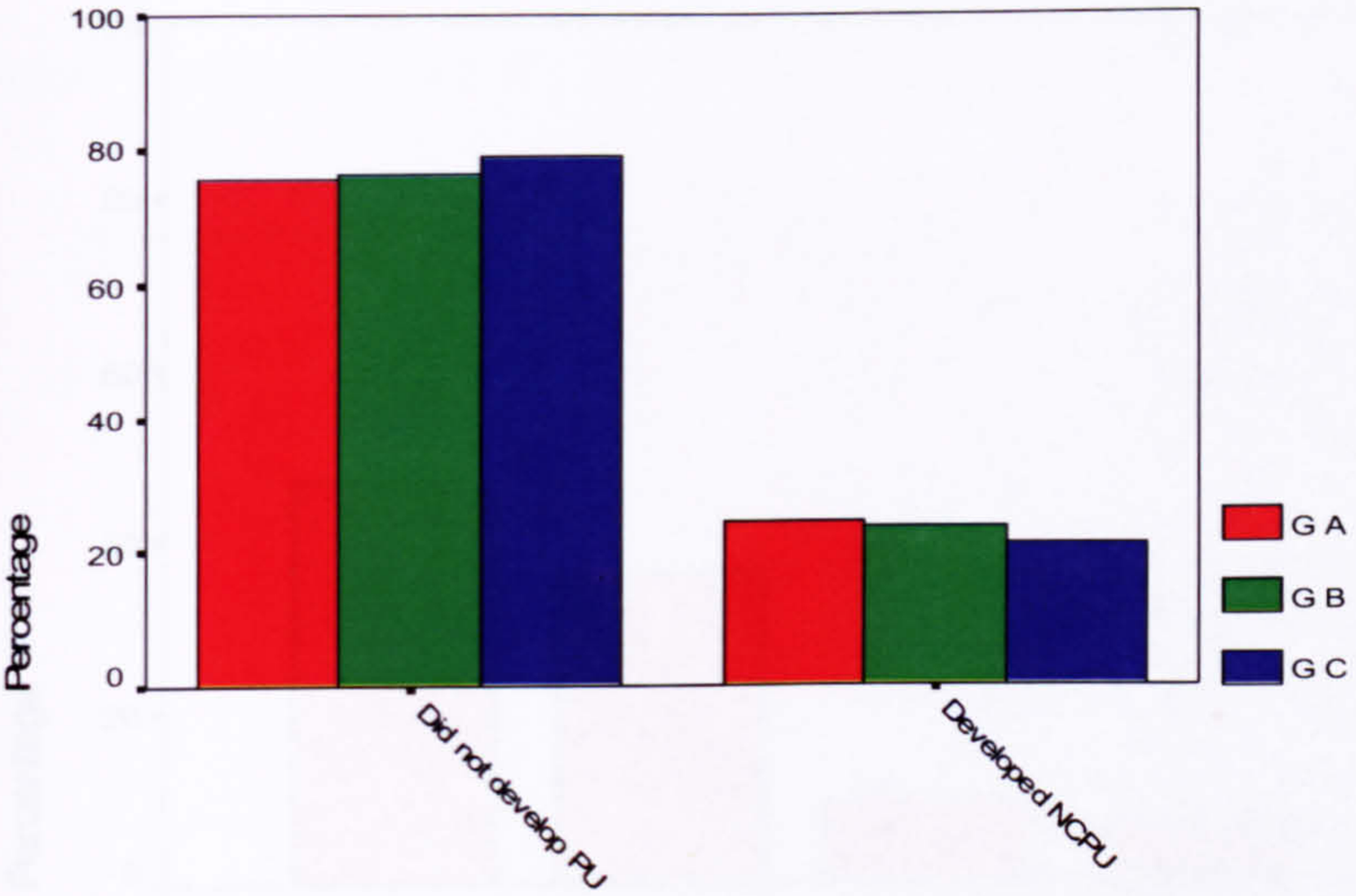


Figure 11 Distribution of NCPU by type

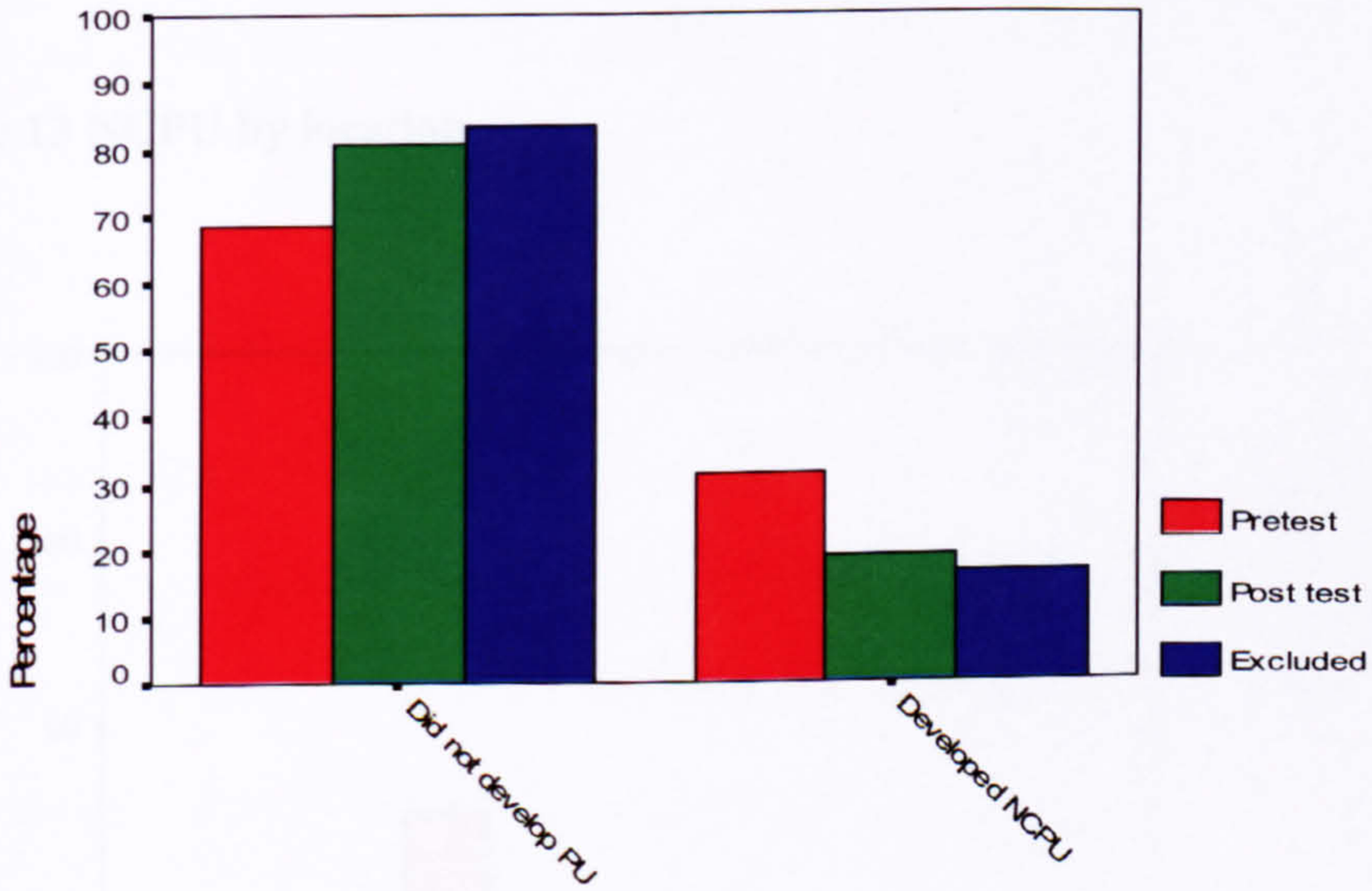


Figure 12 NCPU by stages

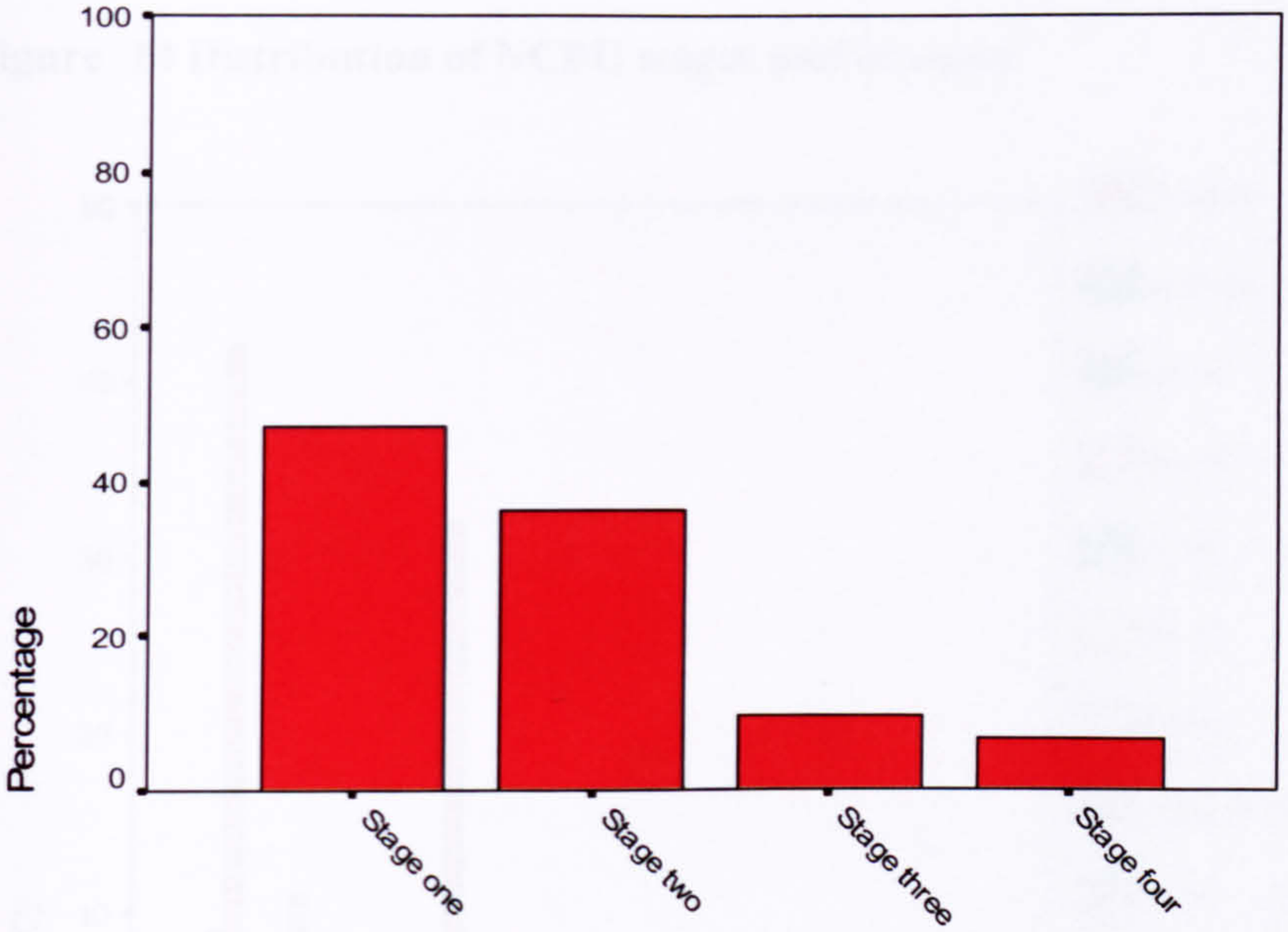


Figure 13 NCPU by location

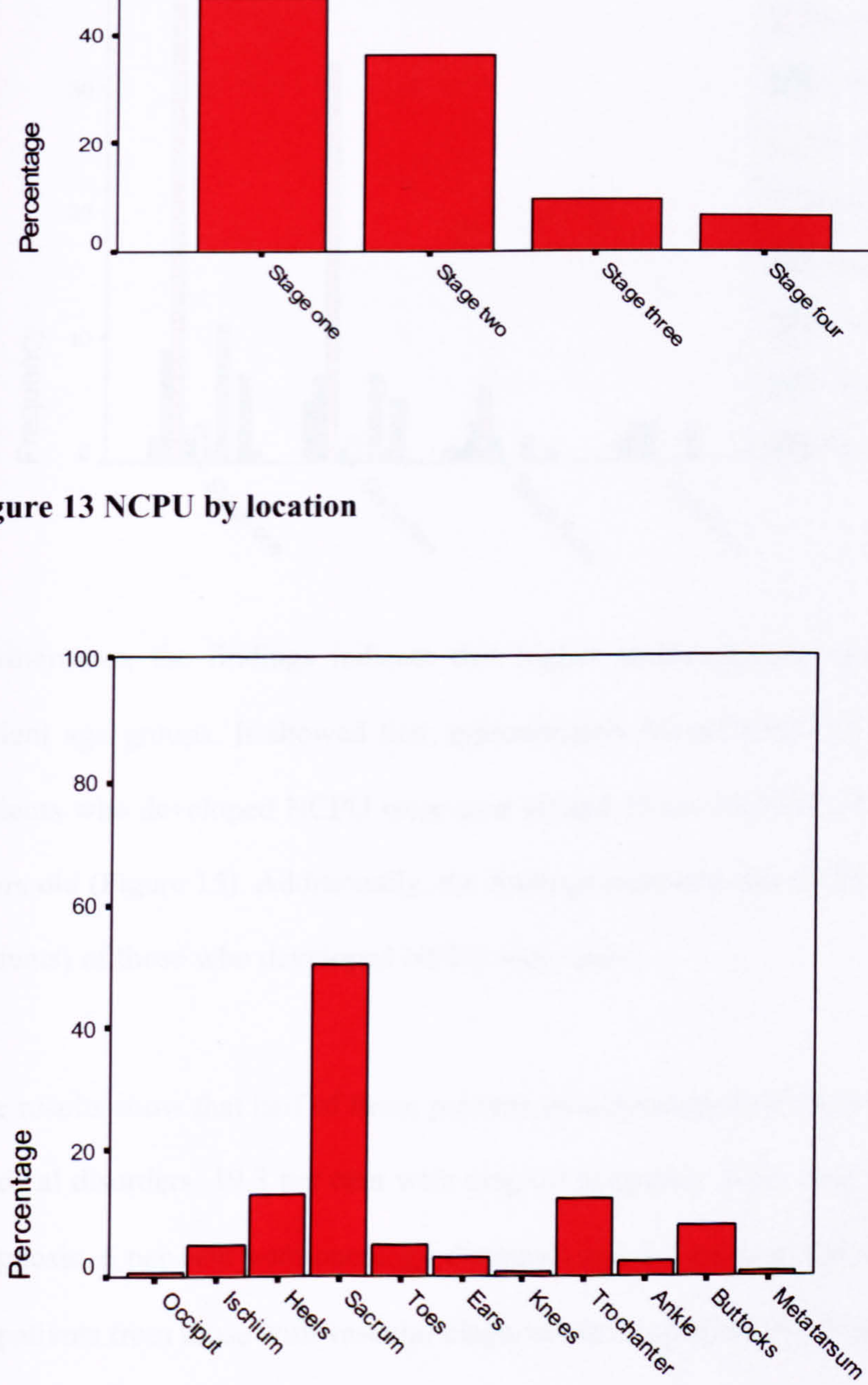
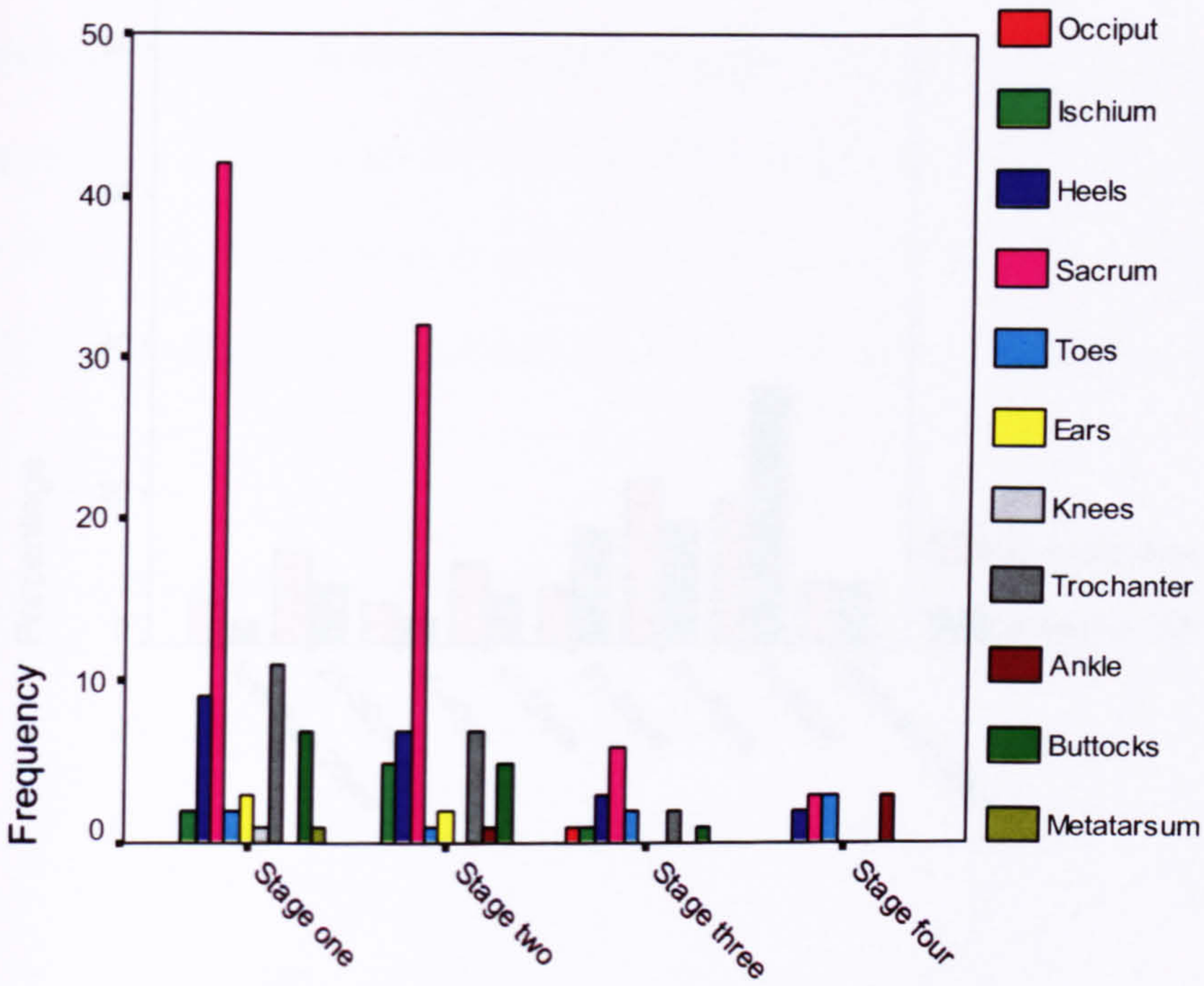


Figure 14 Distribution of NCPU stages and location



Furthermore, the findings indicate that higher incidence rates were noted for older patient age groups. It showed that approximately 60 per cent (97 of 165 patients) of patients who developed NCPU were over 60 and 35 per cent (57 of 165) were 70 to 80 years old (Figure 15). Additionally, the findings indicated that 67.2 per cent (111 of 165 patients) of those who developed NCPU were males.

The results show that half of those patients who developed NCPU were diagnosed with medical disorders, 19.3 per cent with surgical diagnosis, 8 per cent with neuro-surgical diagnosis, 6 per cent with oncology diagnosis and 4.2 per cent for rehabilitation, while no patients from those with vascular diagnosis developed NCPU (Figure 16).

Figure 15 Distribution of NCPU by age group

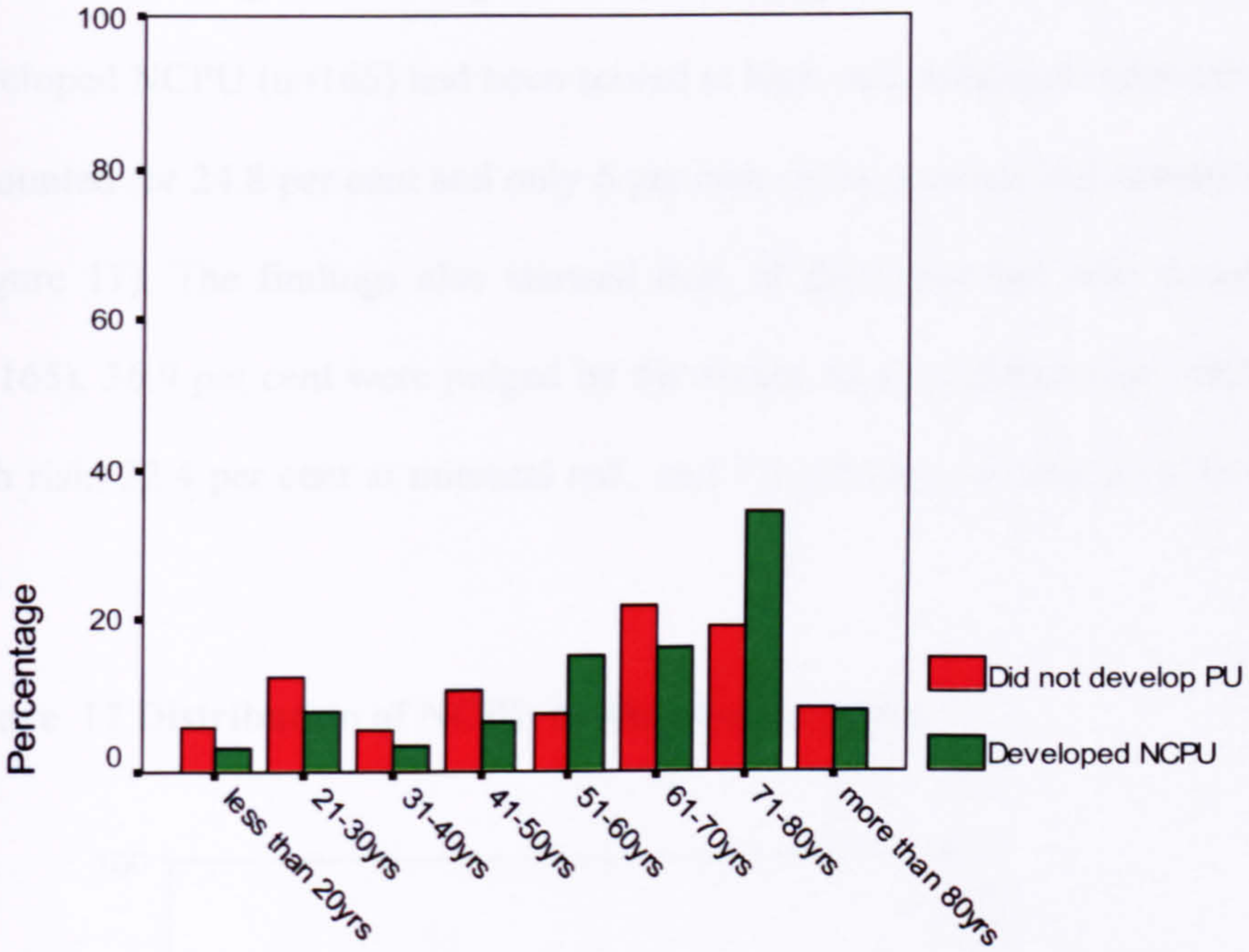
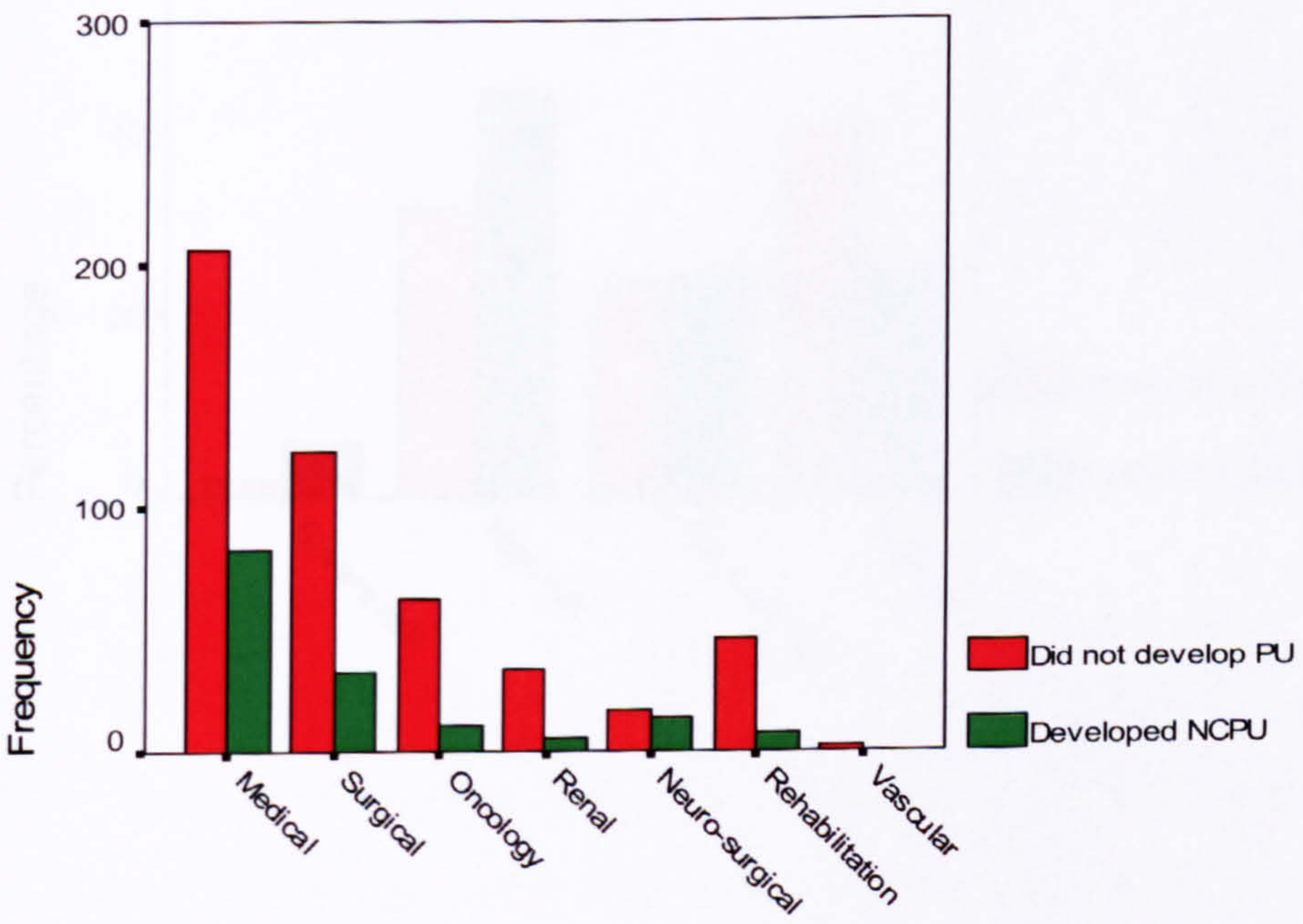


Figure 16 Distribution of NCPU by diagnosis



The findings suggest that a higher percentage of patients developed PU and were identified as being at risk using the Braden scoring. 44.2 per cent of those patients who developed NCPU (n=165) had been scored at high risk, mild and moderate risk patients accounted for 24.8 per cent and only 6 per cent of the patients had scored at severe risk (Figure 17). The findings also showed that, of those patients who developed NCPU (n=165), 36.9 per cent were judged by the nurses as at moderate risk, 30.3 per cent at high risk, 22.4 per cent at minimal risk, and 1.2 per cent at severe or no risk (Figure 18).

Figure 17 Distribution of NCPU by the Braden scores

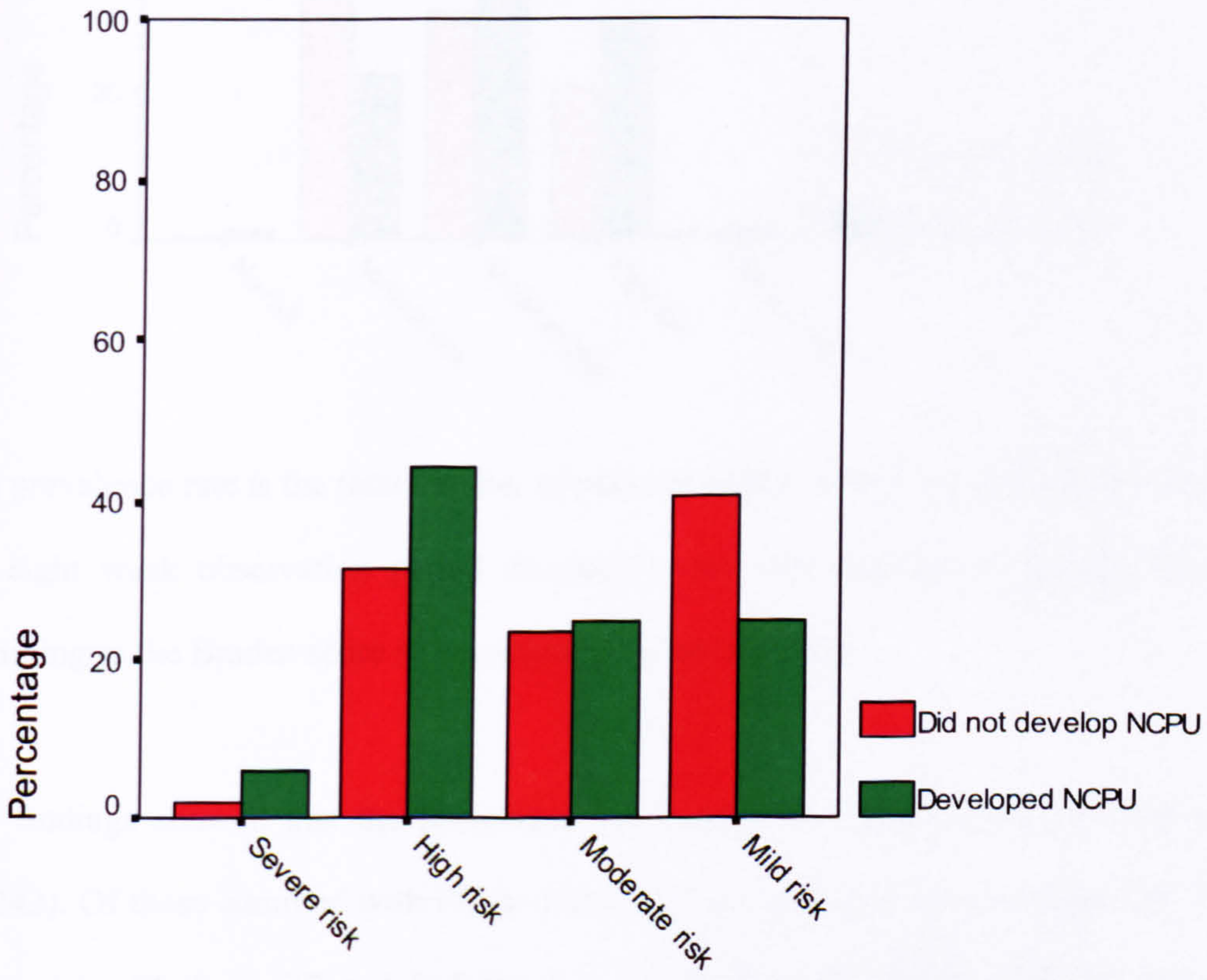
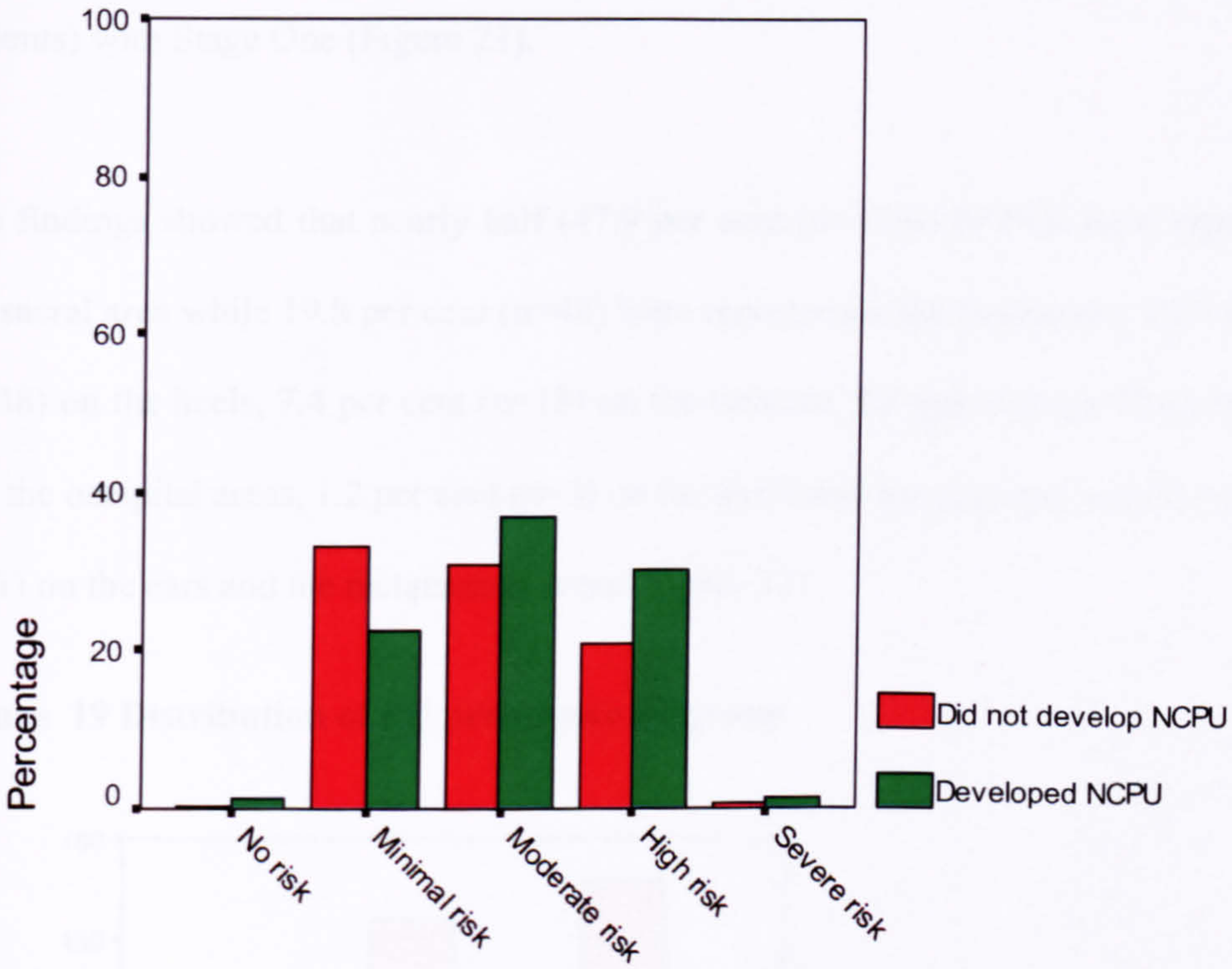


Figure 18 Distribution of NCPU by Clinical Judgement (CJ) scores



The prevalence rate is the total number of patients admitted with PU or had a PU during the eight week observation period divided by the total number of patients at risk according to the Braden score ≤18 multiplied by one hundred.

The findings showed that the prevalence rate among the sample was 33.7 per cent (n=242). Of those admitted with PU (n=242), 37.7 per cent (n=84) were from GA, 26.4 per cent (n=64) from GB and 38.8 per cent (n=94) from GC (Figure 19). 40 per cent (n=97) of those admitted with PU were reported in pre-test while 33.4 per cent (n=81) in post-test and 26.4 per cent (n=64) in the excluded patients' group (Figure 20).

The prevalence findings indicate that 43.8 per cent (106 of 242 patients) of patients were admitted with Stage Four PUs, 27.6 per cent (67 of 242 patients) with Stage Two, 16.1 per cent (39 of 242 patients) with Stage Three and only 12.3 per cent (30 of 242 patients) with Stage One (Figure 21).

The findings showed that nearly half (47.9 per cent (n=116)) of PUs were reported in the sacral area while 19.8 per cent (n=48) were reported on the trochanter, 15.7 per cent (n=38) on the heels, 7.4 per cent (n=18) on the ischium, 2.8 per cent (n=7) on buttocks and the occipital areas, 1.2 per cent (n=3) on the ankle and the toes and only 0.4 per cent (n=1) on the ears and the metatarsum areas (Figure 22)

Figure 19 Distribution of PU prevalence by group

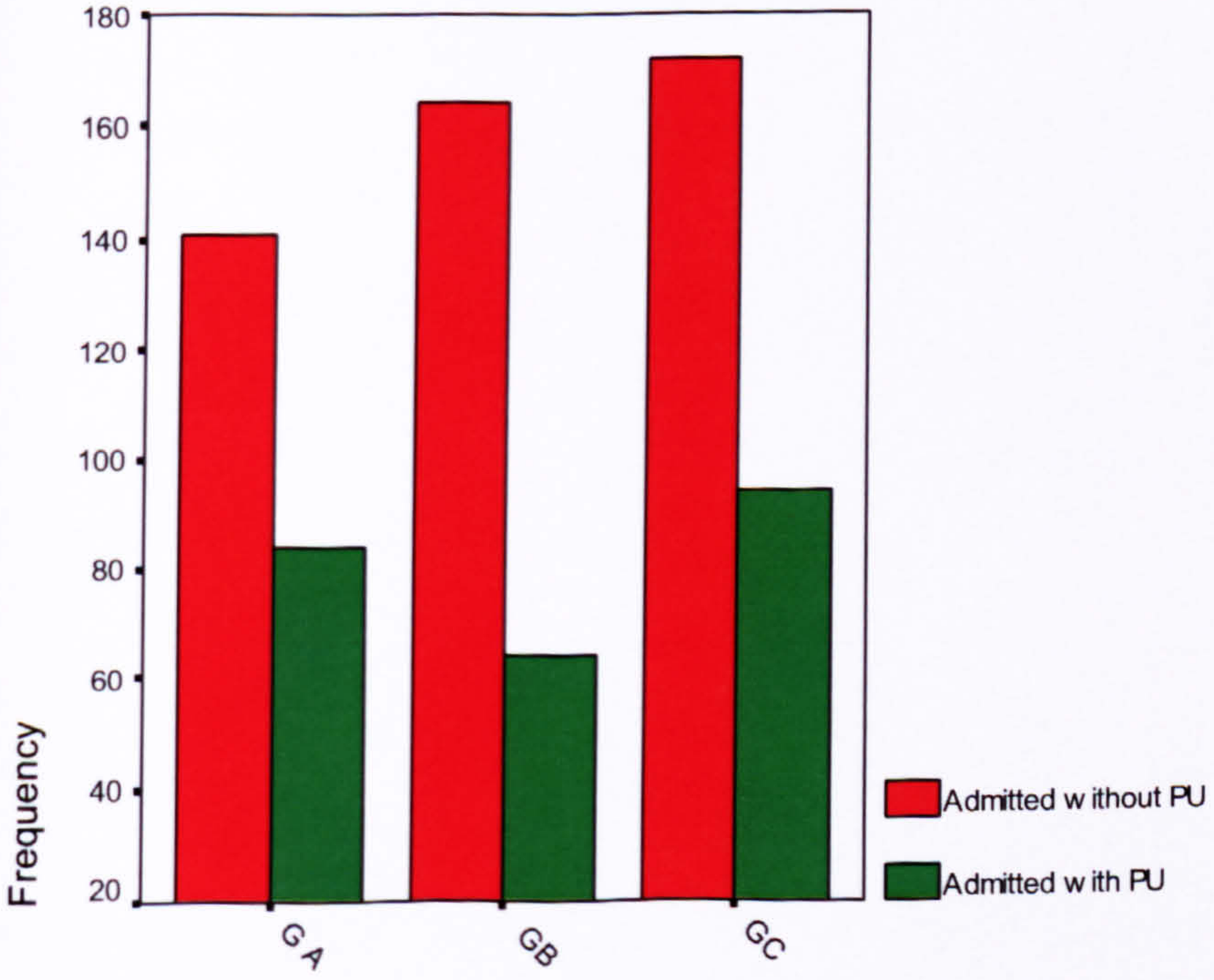


Figure 20 Distribution of PU prevalence by type

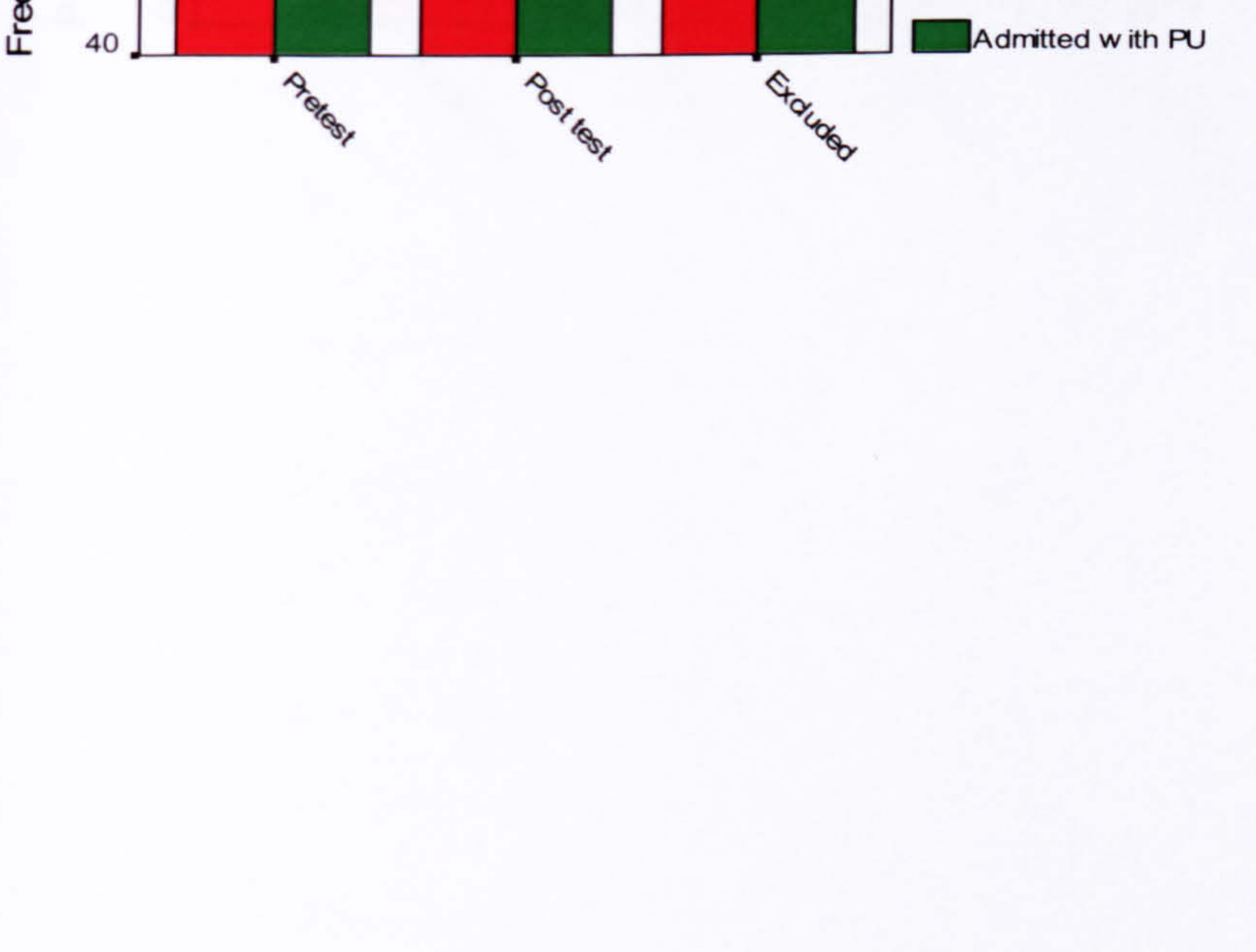


Figure 21 Distribution of PU stages among patients admitted with PU

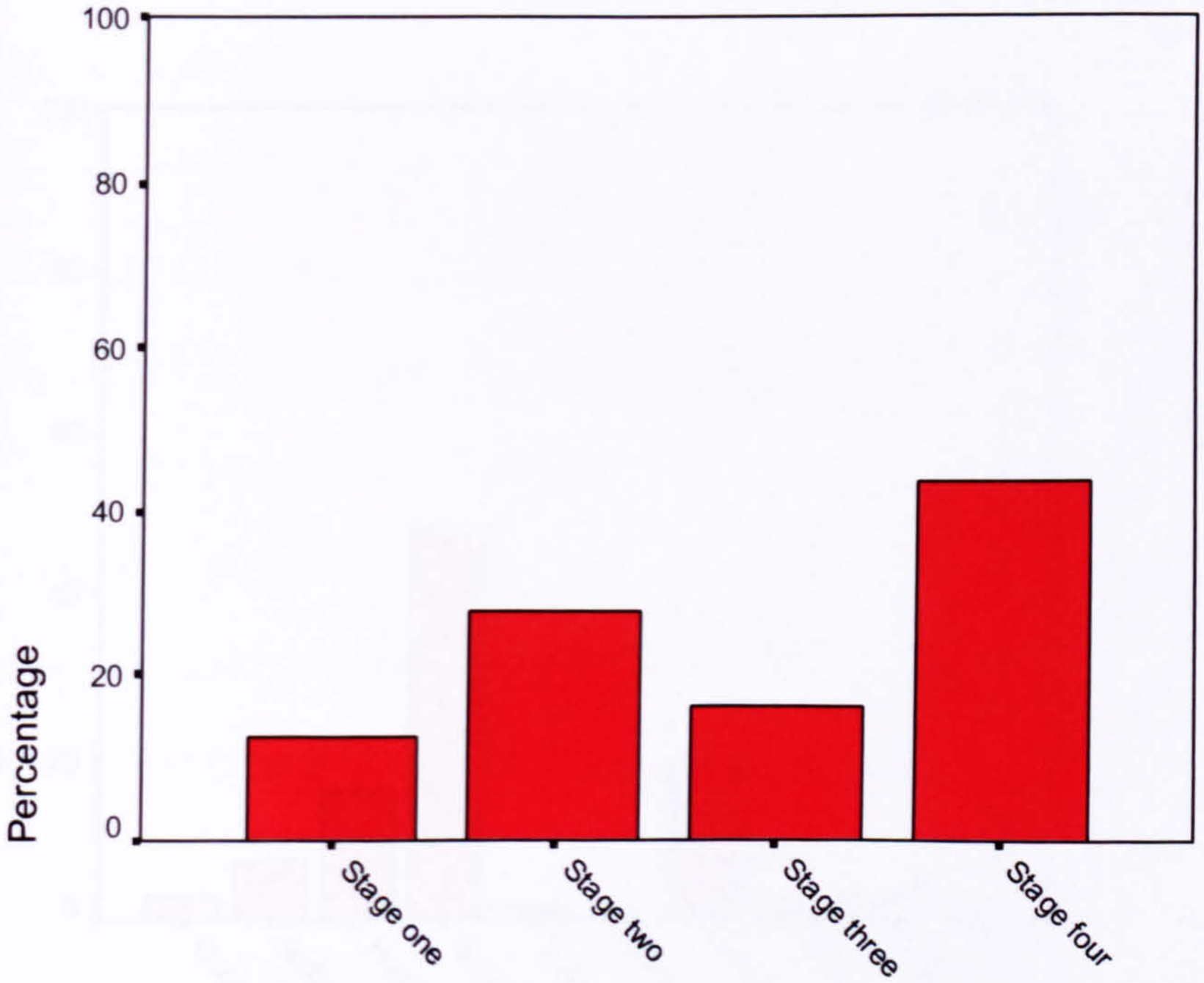
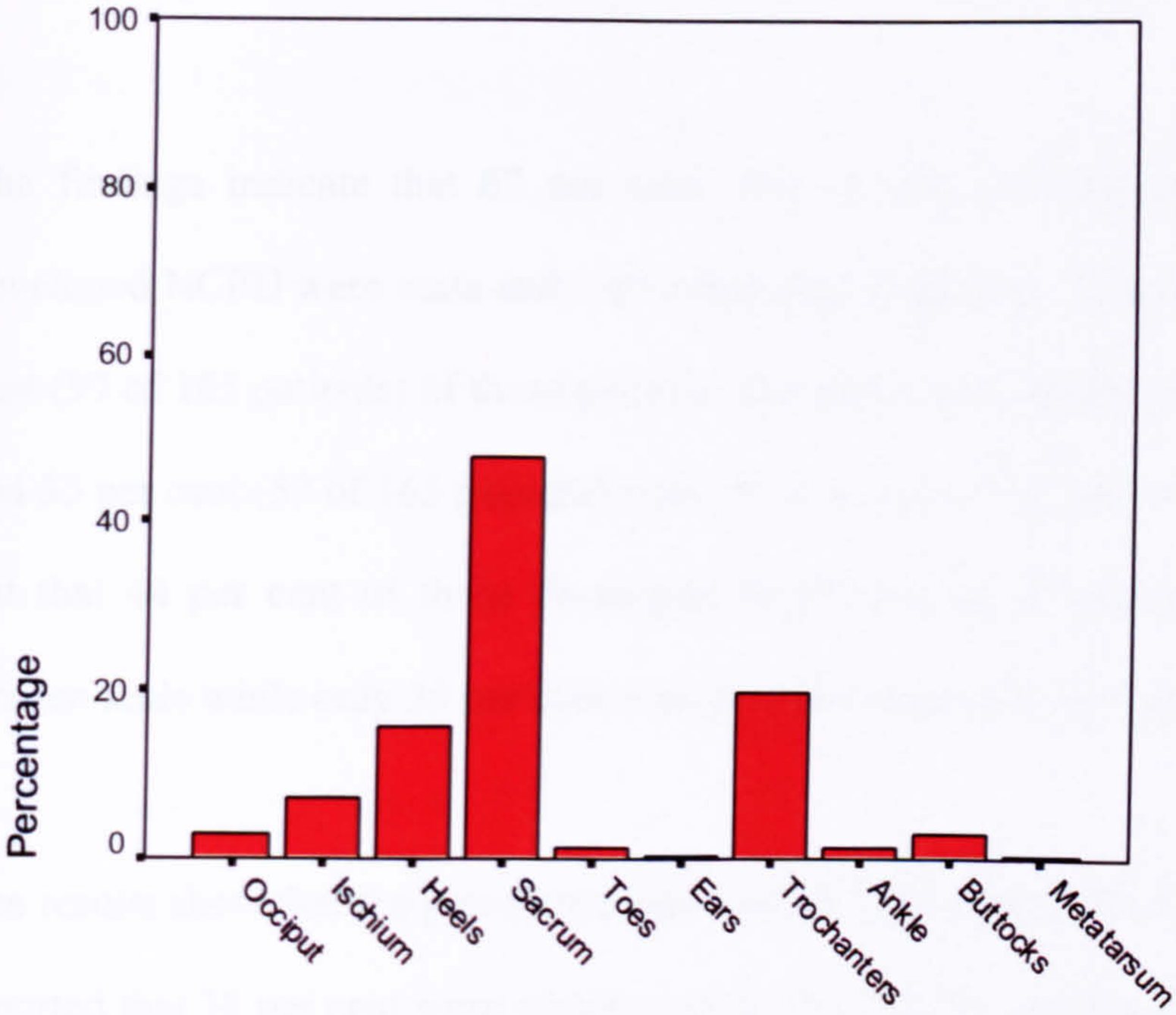


Figure 22 Distribution of PU location among patients admitted with PU



To sum up this section's findings, tables were constructed as shown in Appendix Q, tables 4 and 5. 22.9 per cent (165 of 719 patients) of patients developed NCPU. The NCPU among the groups showed relatively similar distributions ranging from 21 per cent in GC to 24 per cent in GA, while it was variable among patient types, ranging from 19 per cent in post-test to 31 per cent in pre-test patients.

47 per cent (78 of 165 patients) of patients developed Stage One PUs compared to only 6.6 per cent (11 of 165 patients) who developed Stage Four. Half of the NCPU developed on the sacrum.

Of those patients who developed Stage One and Stage Two PUs, more than half developed on the sacrum, while of those patients who developed Stage Four, NCPU were equally distributed on the sacrum, heels, ankle joint and toes.

The findings indicate that 67 per cent (111 of 165 patients) of those patients who developed NCPU were male and were medically diagnosed. They also show that 60 per cent (97 of 165 patients) of those patients who developed NCPU were over 60 years old and 35 per cent (57 of 165 patients) were 70 to 80 years old. Moreover, the results point out that 44 per cent of those developed NCPU scored at high risk according to the Braden scale while only 30 per cent were scored at high risk by using CJ.

The results show that the prevalence rate was 33.7 per cent (242 of 719 patients). It was reported that 38 per cent were admitted with PUs in GA compared to 39 per cent in GC and 26 per cent in GB. It was noted that the distribution of PU prevalence among patient types was variable. It showed that 40 per cent of those admitted with PUs were pre-test patients while 33.4 per cent were post-test and 26.4 per cent were excluded. Nearly half (48 per cent) of prevalent PUs were developed in the sacrum, 44 per cent of which were Stage Four PUs.

3. Pressure ulcer prevention strategies (protective measures)

3.1 The use of protective mattresses

The findings indicate that more than half 55.6% (400 of 719 patients) of the sample were placed on standard hospital mattresses while other protective mattresses were used as follows: The alternating pressure reducing system was used only in 14.5% (n=106) of

the patients, low air loss and pulsating system (referred to as Therakair) in 18.1% (n=130), low air loss system (referred to as Genadyne) in 3.6% (n=26), self adjusting technology system (referred to as Atmosair) in 6.8% (n=49) and Gel overlays were used in 1.1% (n=8) of the patients (Figure 23).

The findings show a slight difference among those patients who used the standard mattresses in relation to the type of the patients. 38.7 per cent (155 of 400) of the standard mattresses used in pre-test phase, 35.8 per cent (143 of 400) in excluded patients and 25.5 per cent (102 of 400) in post-test patients. The findings show that more than half of an alternative system 51.9 per cent (55 of 106) were used in pre-test, 33.9 per cent (36 of 106) in post-test and 14 per cent (15 of 106) in excluded patients. It was reported that 53 per cent (69 of 130) of Therakair system used in post-test patients compared to only 28.4 per cent (37 of 130) in the pre-test and 18.4 per cent (24 of 130) in the excluded patients. Among Genadyne system, a majority of 57.6 per cent (15 of 26) were used in post-test patients compared to 26.9 per cent (7 of 26) in pre-test and 15.3 per cent (4 of 26) in the excluded patients. The use of the Atmosair system was reported in 67.3 per cent (33 of 49) in post-test patients compared to only 22.4 per cent (11 of 49) in excluded patients and 10.2 per cent (5 of 49) in pre-test. Among the use of Gel overlays, it was noted that the majority (75 per cent, or 6 of 8) used in pre-test patients compared to only 12.5 per cent (1 of 8) in each in the post-test and the excluded patient groups (Figure 24).

The findings show that 37 per cent (148 of 400) of those standard mattresses were used from GC patients compared to 29.8 per cent (119 of 400) from GA and 33.2 per cent

(133 of 400) from GB. Of the alternating system, 49 per cent (52 of 106) were used from GC compared to 34 per cent (36 of 106) from GB and only 17 per cent (18 of 106) from GA. The results also showed that 52.2 per cent (68 of 130) of the Therakair system were used from GA compared to 23.9 per cent (30 of 130) in both GB and GC. An increase in use of the Genadyne system was noted in GA, which accounted for 57.7 per cent (15 of 26) compared to 38.4 per cent (10 of 26) in GC and only 3.9 per cent (1 0f 26) in GB. The use of the Atmosair system accounted for 51 per cent (25 of 49) in GC, 45 per cent (22 of 49) in GB and only 4 per cent (3 of 49) in GA. The use of Gel overlays accounted for 50 per cent (4 of 8) in GB, 37.5 per cent (3 of 8 patients) in GA and 12.5 per cent (1 of 8) in GC (Figure 25).

The findings also indicate that of those patients who developed NCPU (165 of 719 patients) only 39.3 per cent (65 of 165 patients) were placed on a protective mattress, while 50.9 per cent (282 of 554 patients) of those who did not develop NCPU used one (Figure 26).

Figure 23 Distribution of protective mattresses

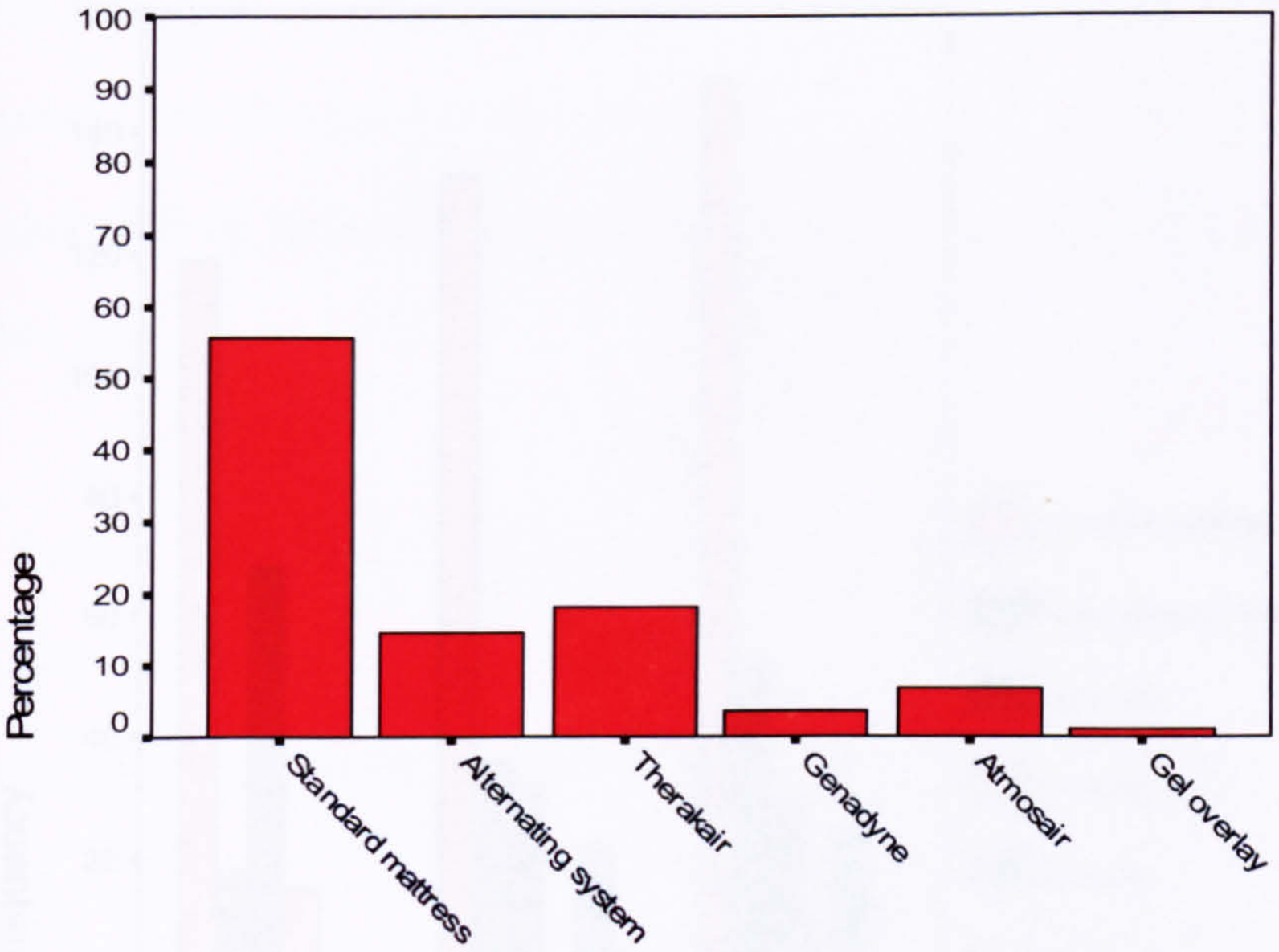


Figure 24 Distribution of protective mattresses by type

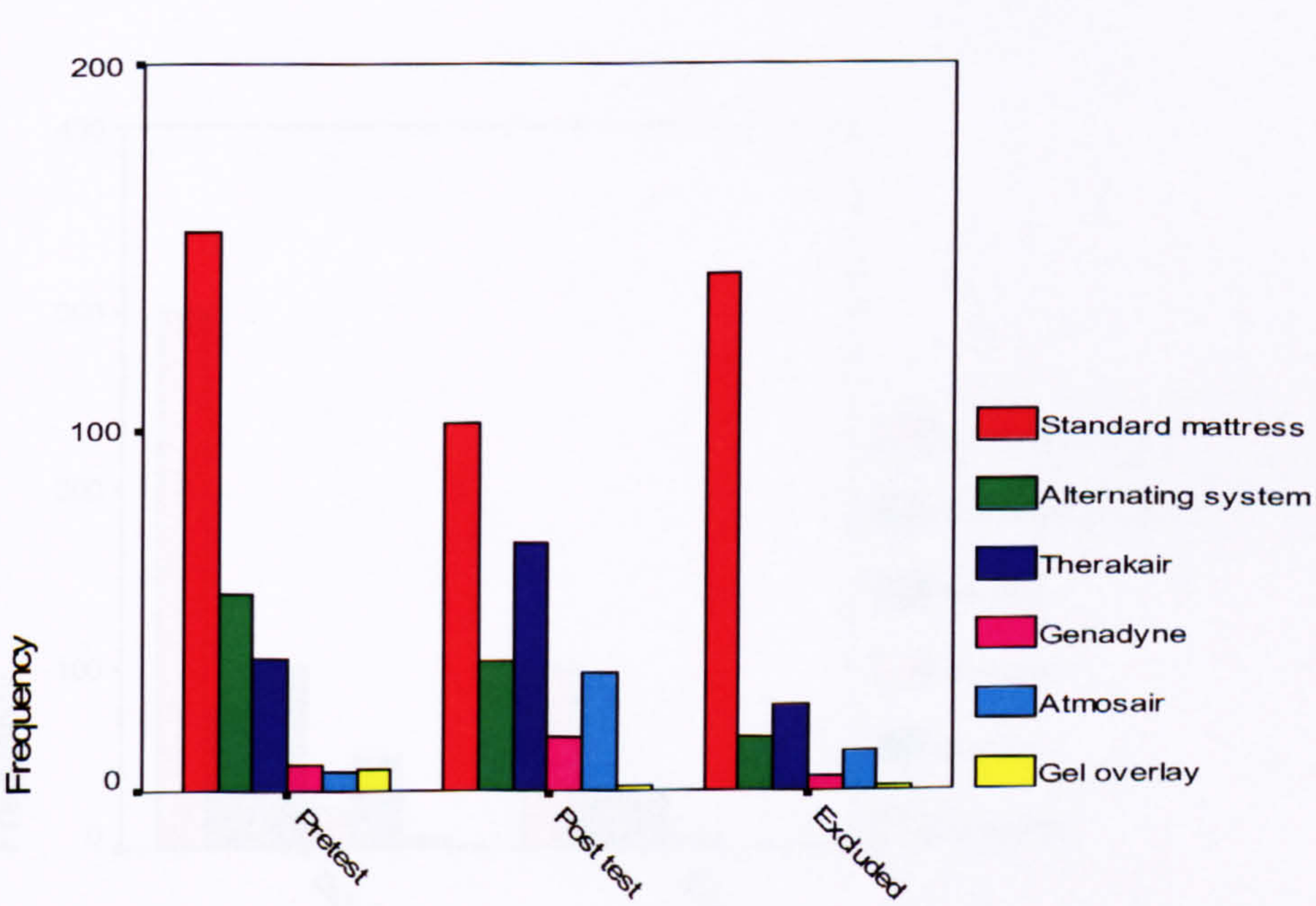


Figure 25 Distribution of protective mattresses by group

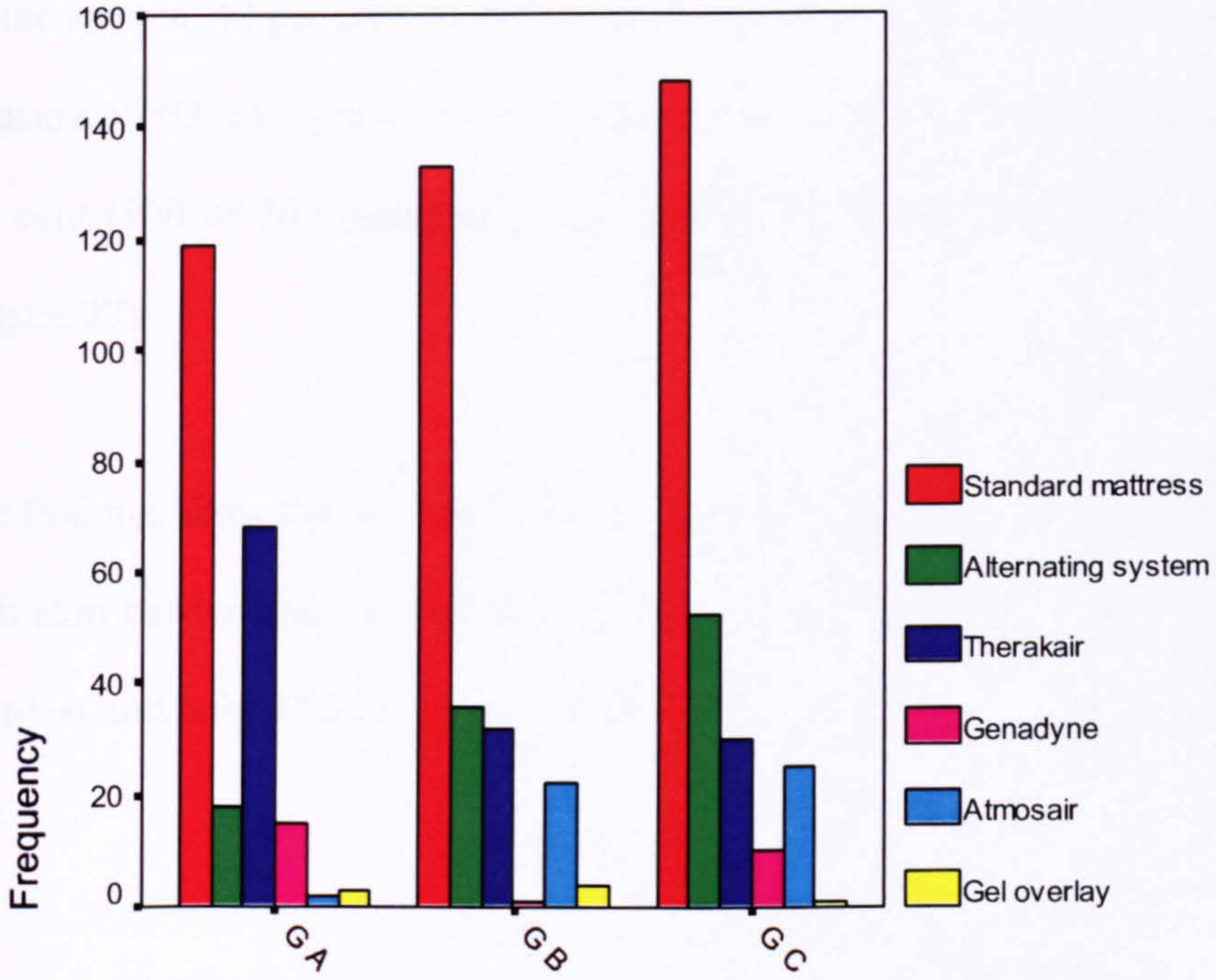
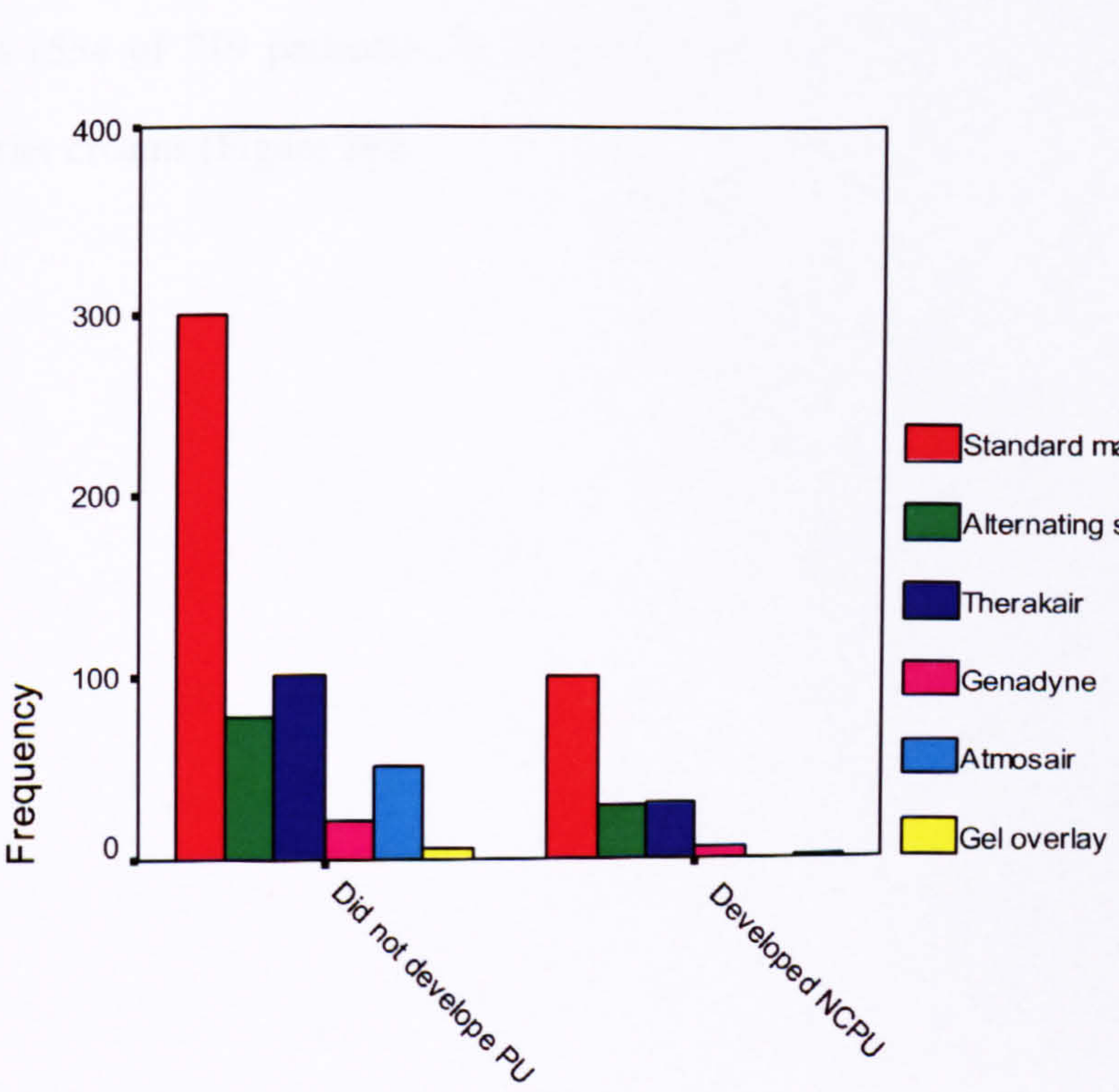


Figure 26 Distribution of protective mattresses and NCPU



3.2 The use of skin barrier creams

Of the sample, 42 per cent (n=302) were treated with skin barrier creams as a protective measure of PU. 31.1 per cent (94 of 302 patients) of those were in GA compared to 33.1 per cent (100 of 302 patients) in GB and 35.8 per cent (108 of 302 patients) in GC (Figure 27).

The findings show that 44.3 per cent (134 of 302 patients) of those patients who treated with skin barrier creams were from pre-test, 36.4 per cent (110 of 302 patients) from post-test and only 19.2 per cent (58 of 302 patients) from the excluded patients (Figure 28).

Of those patients who developed NCPU (165 of 719 patients), 52.1 per cent (86 of 165 patients) were treated with skin barrier creams. Of those patients who did not develop PUs (554 of 719 patients), 39 per cent (216 of 554 patients) were treated with skin barrier creams (Figure 29).

Figure 27 The use of skin barrier creams by group

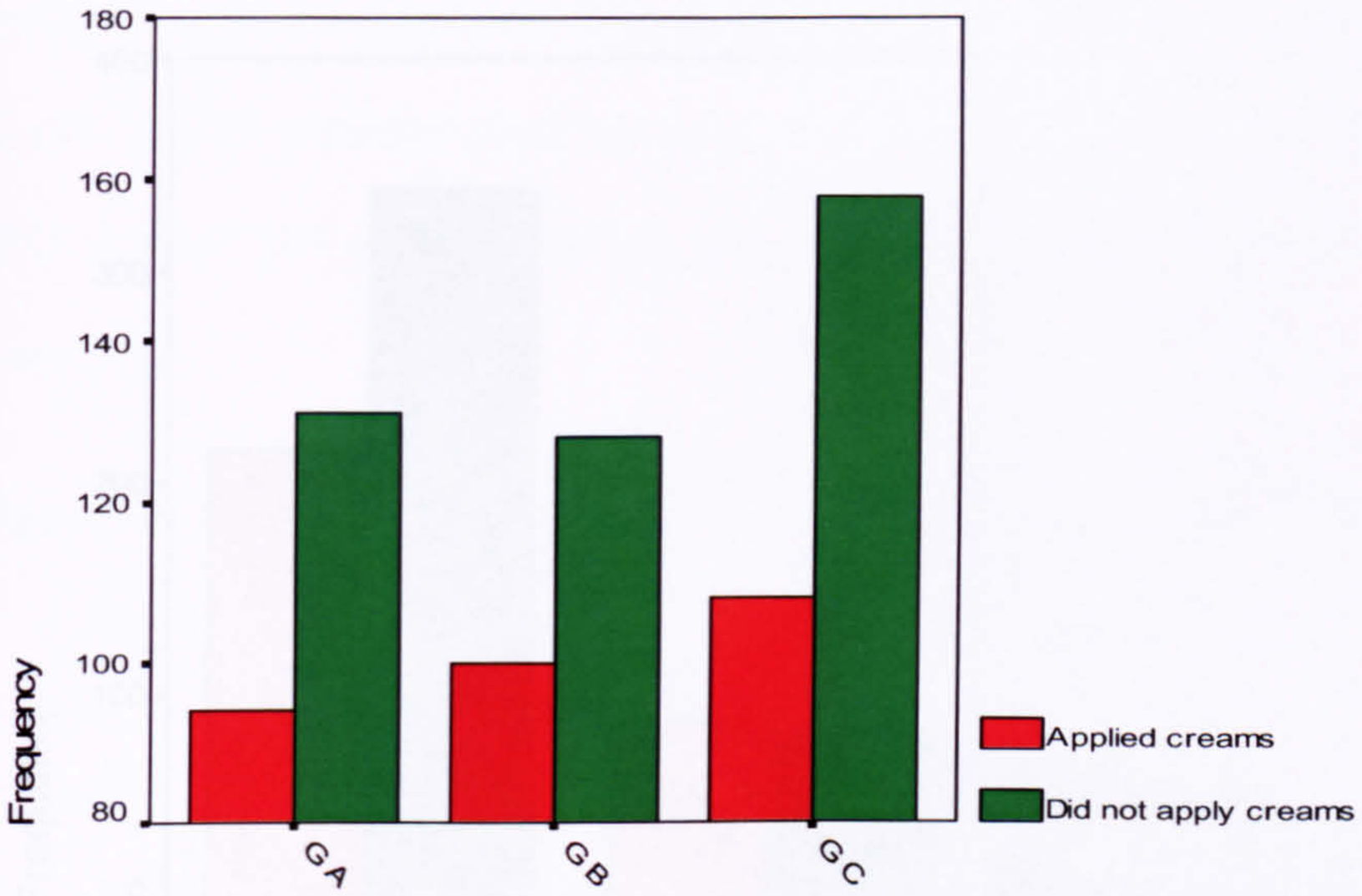


Figure 28 The use of skin barrier creams by type

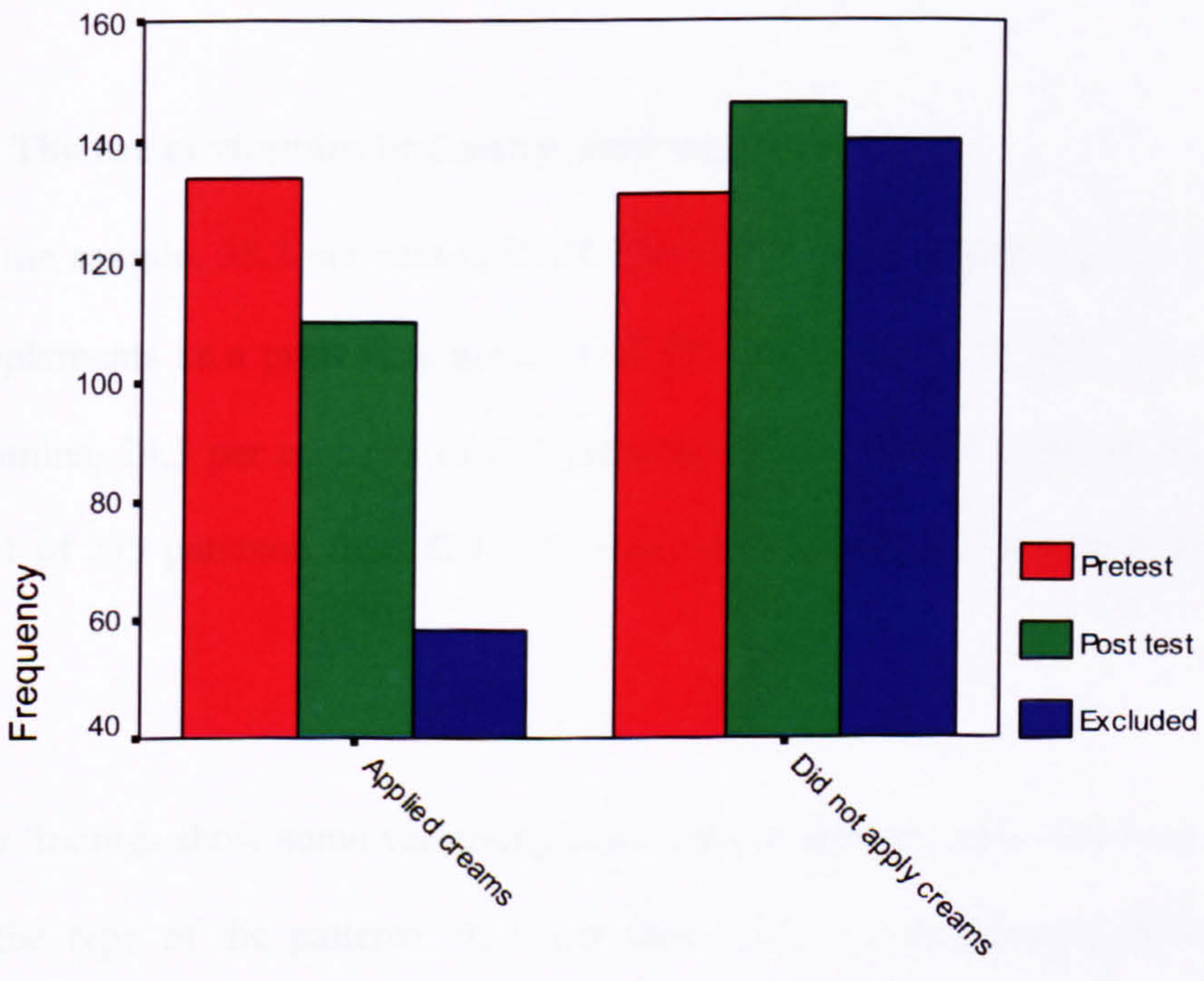
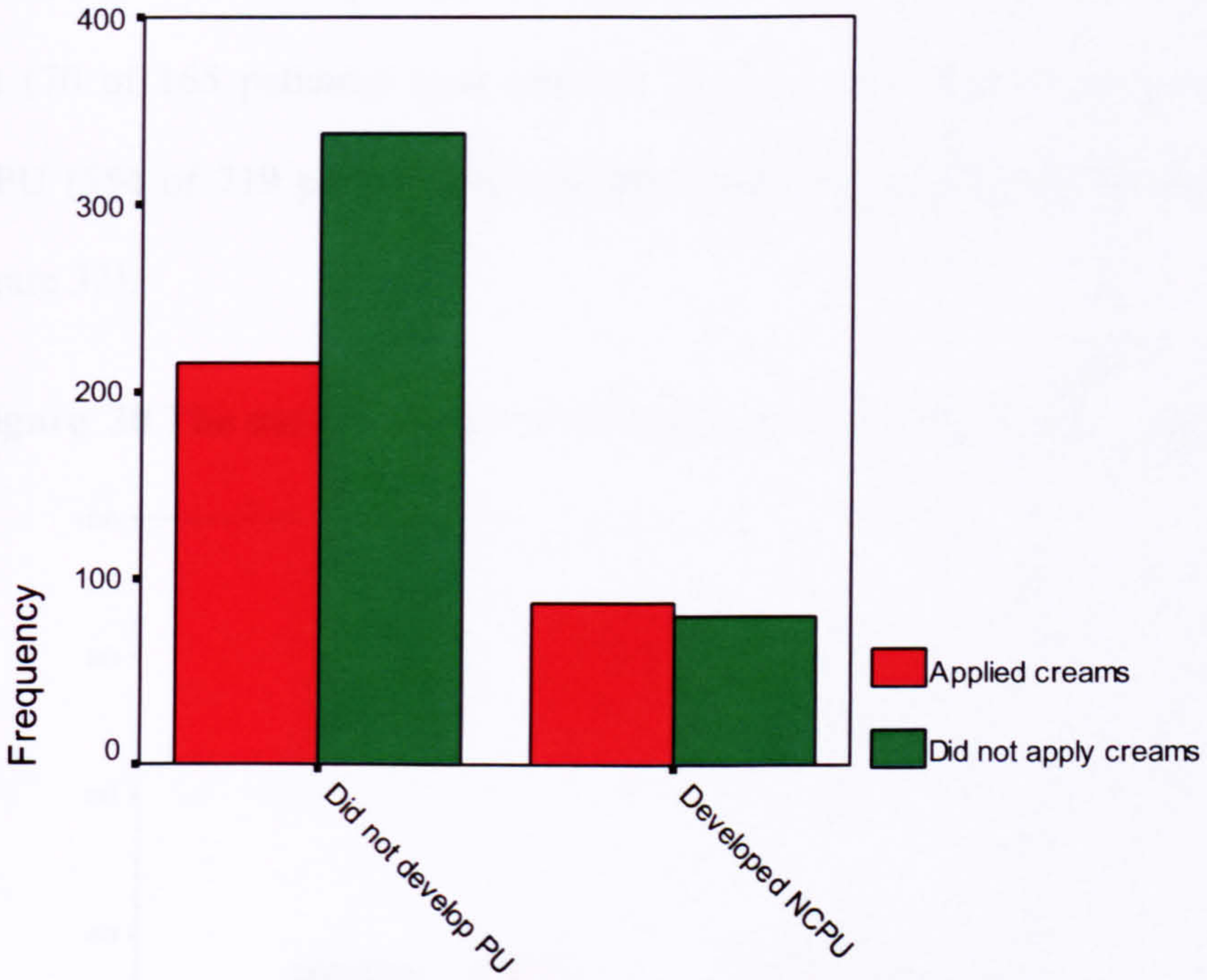


Figure 29 The use of skin barrier creams and NCPU



3.3 The use of vitamins and nutritional supplements

Of the sample, 38.2 per cent (275 of 719) of the patients used vitamins and nutritional supplements as a protective measure of PU development. Of those patients who used vitamins, 24.3 per cent (67 of 275 patients) were from GA compared to 36.7 per cent (101 of 275 patients) from GB and 39 per cent (107 of 275 patients) from GC (Figure 30).

The findings show some variability among those patients who used vitamins in relation to the type of the patients: 42.5 per cent (117 of 275 patients) of those who used vitamins were from the pre-test patients compared to 33 per cent (91 of 275 patients) from post-test patients and only 24.3 per cent (67 of 275 patients) from excluded patients (Figure 31).

Furthermore, of those patients who developed NCPU (165 of 719 patients), 42.4 per cent (70 of 165 patients) used vitamins, and of those patients who did not develop NCPU (554 of 719 patients), 63 per cent (349 of 554 patients) did not use vitamins (Figure 32).

Figure 30 The use of vitamins and nutritional supplements by group

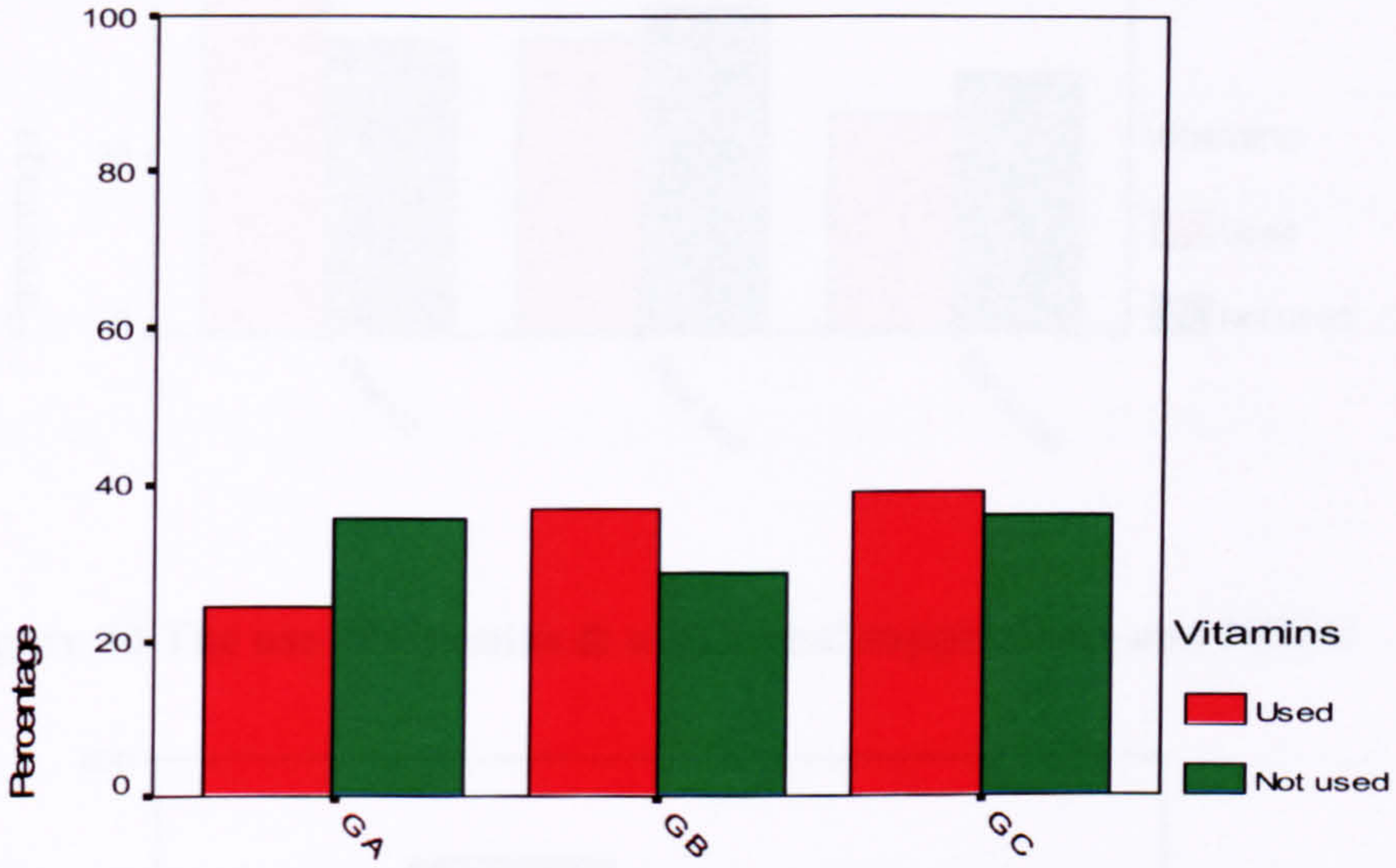


Figure 31 The use of vitamins and nutritional supplements by type

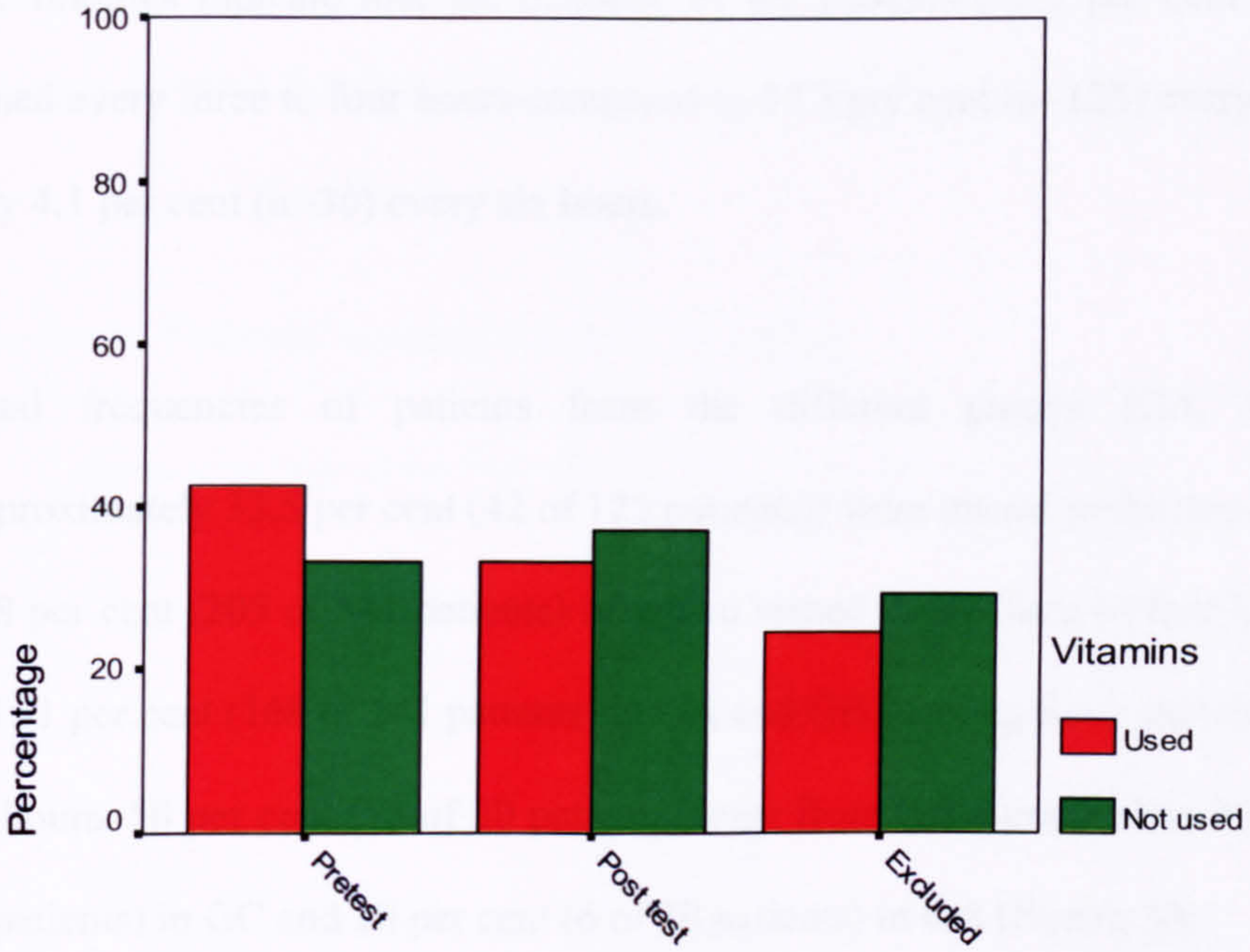
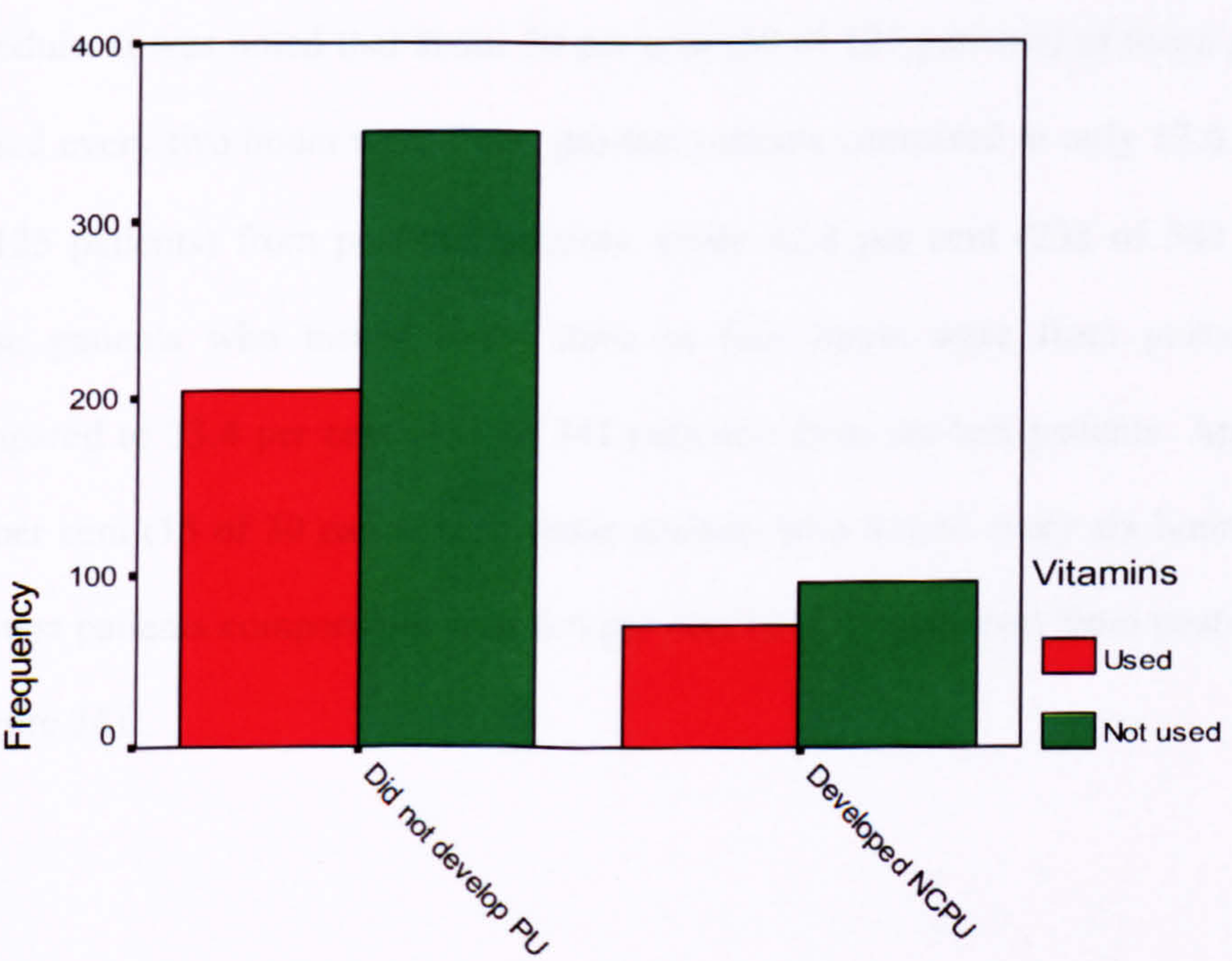


Figure 32 The use of vitamins & nutritional supplements and NCPU



3.4 Distribution of the patients' positioning (patients' turning schedules)

The findings indicate that the majority of the patients (75.2 per cent (n=541)) were turned every three to four hours compared to 17.3 per cent (n=125) every two hours and only 4.1 per cent (n=30) every six hours.

Equal frequencies of patients from the different groups (GA, GB and GC) (approximately 33.5 per cent (42 of 125 patients)) were turned in the two-hour schedule; 37.8 per cent (205 of 541 patients) of whom turned every three to four hours from GC and 31 per cent (168 of 541 patients) in GA and GB. Among those patients turned every six hours, 50 per cent (15 of 30 patients) were from GB compared to 30 per cent (9 of 30 patients) in GC and 20 per cent (6 of 30 patients) in GA (Figure 33).

The results also show variability in the type of patients in relation to the turning schedule. It was noted that about 50 per cent (60 of 125 patients) of those patients who turned every two hours were from pre-test patients compared to only 13.6 per cent (17 of 125 patients) from post-test patients, while 42.8 per cent (232 of 541 patients) of those patients who turned every three to four hours were from post-test patients compared to 33.4 per cent (181 of 541 patients) from pre-test patients. Approximately 50 per cent (15 of 30 patients) of those patients who turned every six hours were from pre-test patients compared to only 6.6 per cent (2 of 30 patients) from post-test patients (Figure 34).

Among those patients who developed NCPU, 77.5 per cent (128 of 165 patients) were turned every three to four hours. A relatively similar figure (74.5 per cent, or 413 of 554) was reported for those who did not develop NCPU (Figure 35).

Figure 33 Patients' turning schedule by group

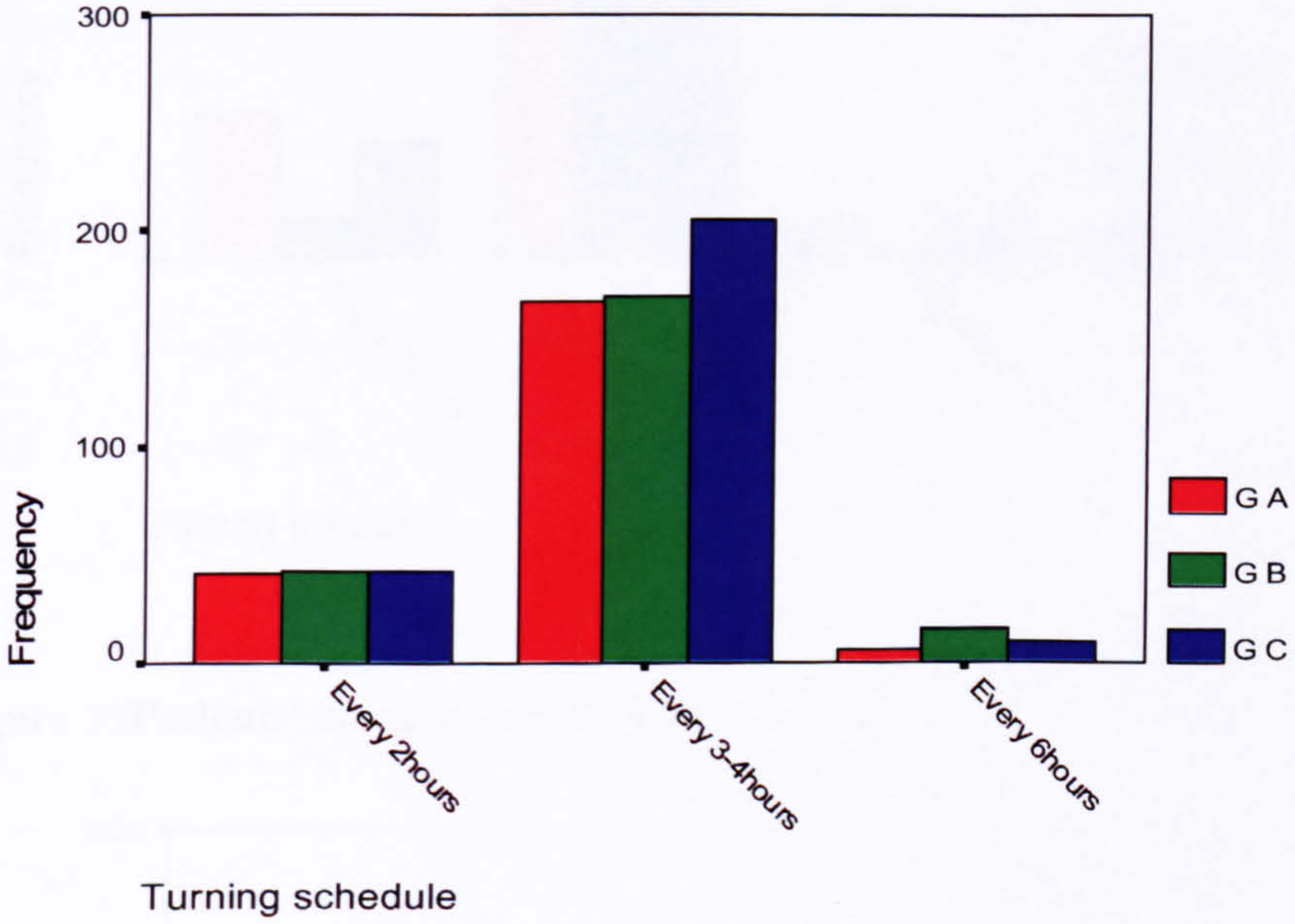


Figure 34 Patients' turning schedule by type

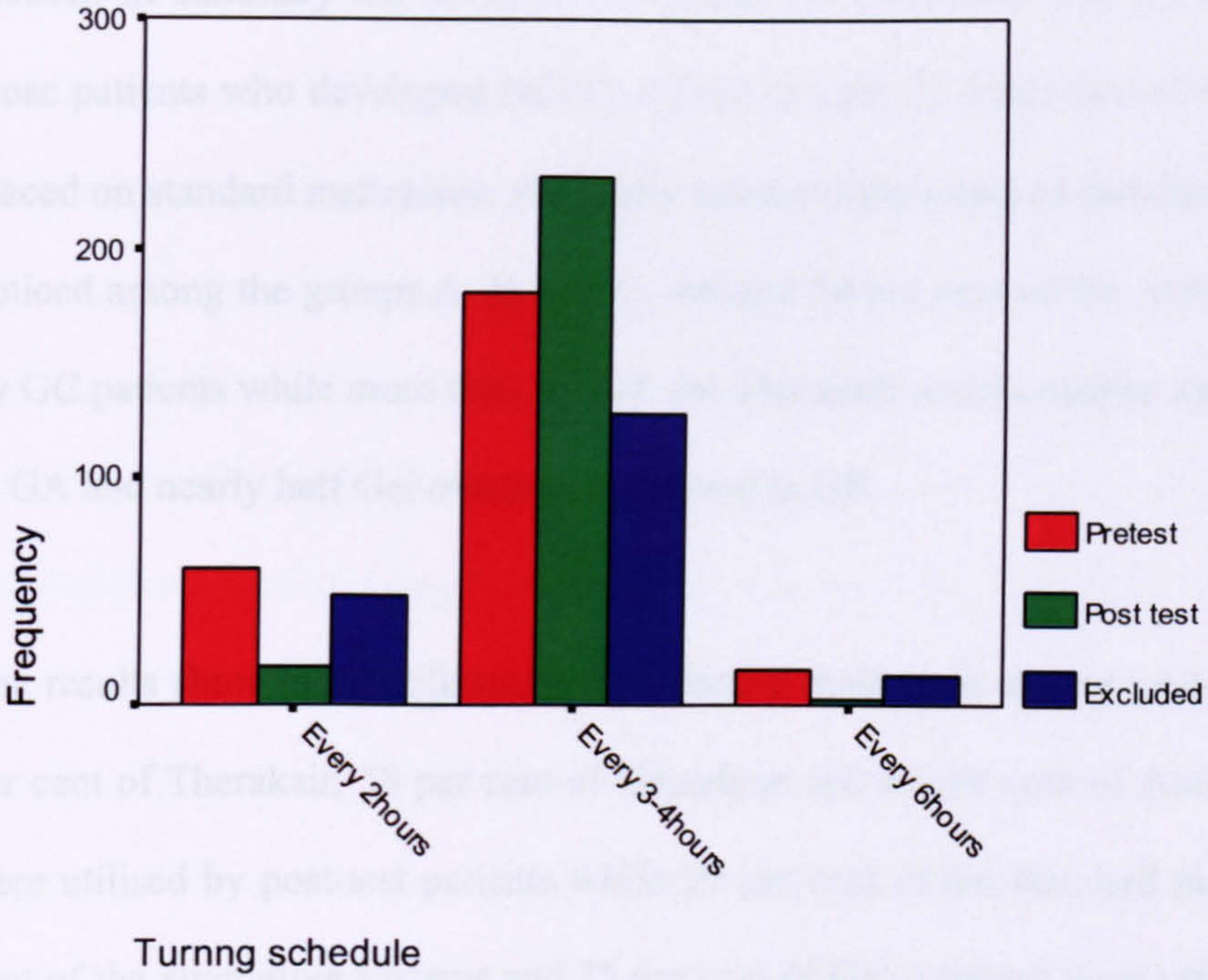
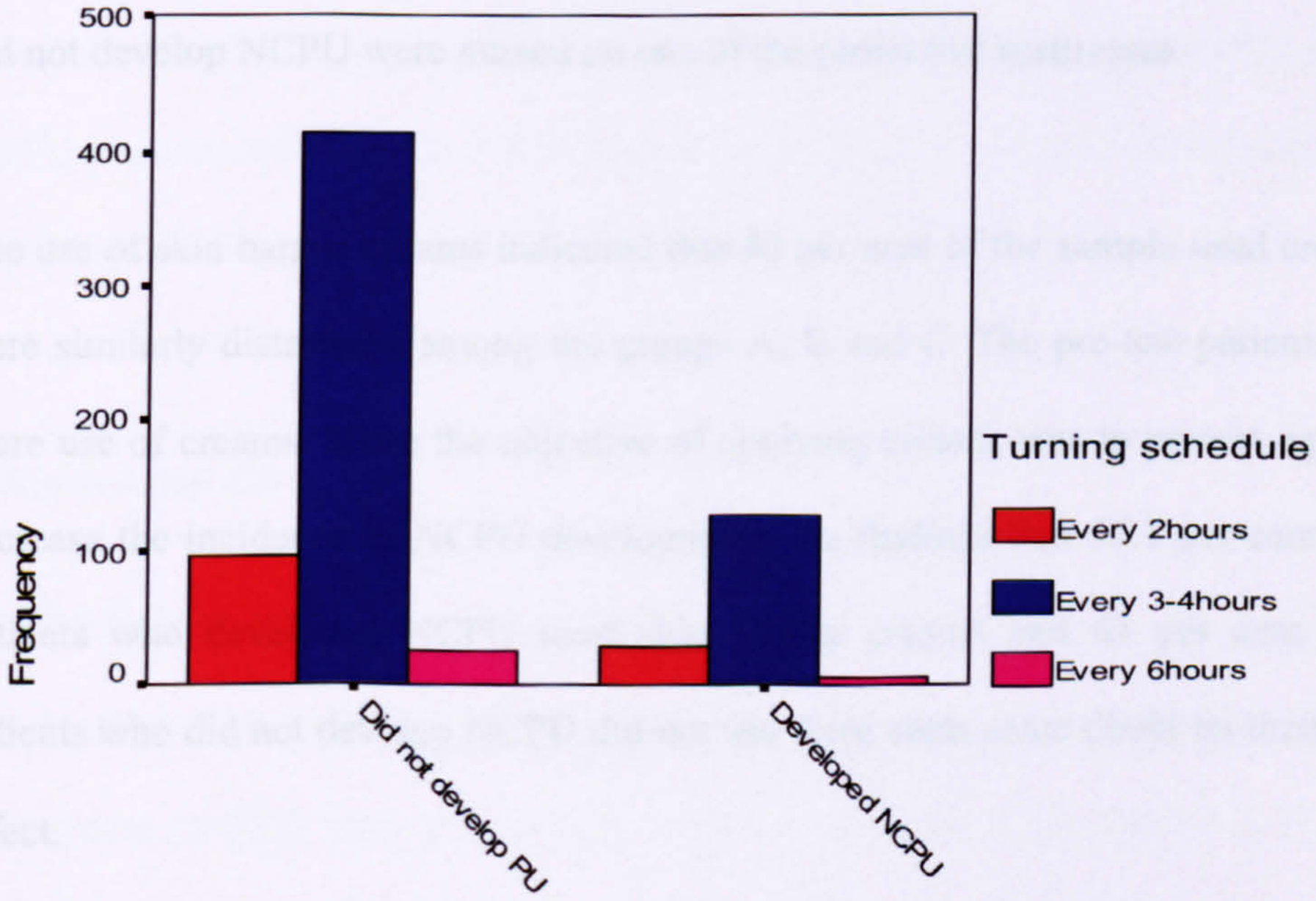


Figure 35Patients' turning schedule and NCPU



Tables were constructed as shown in Appendix Q, table 6, 7, and 8 to sum up this section. In summary the utilisation of protective mattresses was not optimum among those patients who developed NCPU. Of the sample, 55.6 per cent of the patients were placed on standard mattresses. A slightly similar distribution of standard mattresses was noticed among the groups A, B, and C. Around 50 per cent of the Atmosair system use by GC patients while more than half of the Therakair and Genadyne systems were used in GA and nearly half Gel overlays were used in GB.

The results show more utilisation of protective mattresses among post-test patients. 53 per cent of Therakair, 58 per cent of Genadyne and 67 per cent of Atmosair mattresses were utilised by post-test patients while 39 per cent of the standard mattresses, 52 per cent of the alternative systems and 75 per cent of Gel overlays were utilised for pre-test patients. It is important to point out that, of those patients who developed NCPU, only 39 per cent were placed on one of the protective mattresses; 50.9 per cent of those who did not develop NCPU were nursed on one of the protective mattresses.

The use of skin barrier creams indicated that 42 per cent of the sample used creams and were similarly distributed among the groups A, B and C. The pre-test patients showed more use of creams. Since the objective of applying creams was to protect against and decrease the incidence of NCPU development, the findings that 52.1 per cent of those patients who developed NCPU used skin barrier creams and 61 per cent of those patients who did not develop NCPU did not use them casts some doubt on their positive effect.

In relation to the use of vitamins and nutritional supplements as protective measures, the findings show that 38.2 per cent of the patients were supplied with vitamins. Some variability was noticed among the groups in relation to vitamins supply, ranging from 24.3 per cent in GA patients to 37 per cent in GB and 39 per cent in GC. 43 per cent of those supplied with vitamins were from pre-test patients compared to 33 per cent from post-test. Based on these findings, it is doubtful that a conclusive effect of vitamins on reducing NCPU development can be inferred. The results reveal that 42.4 per cent of those patients who developed NCPU were supplied with vitamins and 63 per cent of those were did not develop NCPU were not.

75 per cent of patients were turned every three to four hours; their distribution among the groups was relatively similar. 43 per cent of those who turned every three to four hours from post-test patients and half of those who turned every two hours were from pre-test patients. The effect of patients' turning schedules on NCPU development is still uncertain. The findings showed that almost 78 per cent of those patients who developed NCPU were turned every three to four hours and about 75 per cent of those who did not develop them were turned on the same schedule.

4. Braden and CJ scoring

4.1 The Braden scores

The findings show that the Braden scores among the sample patients were as follows: 37 per cent (n=266) were at mild risk, 34.4 per cent (n=248) at high risk, 24 per cent (n=172) at moderate risk and only 3 per cent (n=22) at severe risk (Figure 36).

Of those patients who were scored at severe risk, 59 per cent (13 of 22 patients) were from GA compared to 18 per cent (4 of 22 patients) from GB and 23 per cent (5 of 22) from GC, while of those at high risk, 43.5 per cent (108 of 248 patients) were from GC compared to 34 per cent (84 of 248 patients) from GA and 22.5 per cent (56 of 248 patients) from GB. Of those patients at moderate risk, 42 per cent (73 of 172 patients) were from GC compared to 30 per cent (51 of 172 patients) from GA and 28 per cent (48 of 172 patients) from GB. Of those at mild risk, 44.3 per cent (118 of 266 patients) were from GB compared to 26 per cent (68 of 266 patients) from GA and 30 per cent (80 of 266 patients) from GC (Figure 37).

The distribution of the Braden scores by type of patient indicated remarkable differences between pre-test and post-test patients. It was noted that 68 per cent (15 of 22 patients) of patients were scored at severe risk; 42 per cent (104 of 248 patients) of those at high risk were pre-test; this compared to no patients at all in post-test stage at severe risk and 36.6 per cent (91of 248 patients) at high risk. On the other hand, 42 per cent (72 of 172 patients) of those at moderate risk and 35 per cent (93 of 266 patients) at mild risk were post-test compared to 32 per cent (55 of 172 patients) at moderate risk and 31.5 per cent (84 of 266 patients) at mild risk in pre-test (Figure 38).

The results show that, of those patients scored as severe risk, 45.5 per cent (10 of 22 patients) were placed on alternative systems and 36.4 per cent (8 of 22 patients) on standard mattresses, only 9 per cent (2 of 22 patients) on Therakair and Genadyne systems, and no patients on Atmosair and Gel overlays. Among those patients at high

risk, 44.3 per cent (110 of 248 patients) were nursed on standard mattresses while 17 per cent (42 0f 248 patients) used alternative systems, 28.6 per cent (71 of 248 patients) used Therakair, 7.3 per cent (18 of 248 patients) used Genadyne and only 0.8 per cent (2 of 248 patients) used Gel overlays. It was noted that nearly half (48.8 per cent, or 84 of 172) of patients scored at moderate risk were placed on standard mattresses while 17.4 per cent (30 of 172 patients) used alternative systems, 24 per cent (41 of 172 patients) used Therakair, 7.5 per cent (13 of 172 patients) used Atmosair and 1.1 per cent (2 of 172 patients) used Genadyne and Gel overlays. Unsurprisingly, among those patients at mild risk, the majority (70.7 per cent, or 188 of 266 patients) used standard mattresses while 8.6 per cent (23 of 266 patients) used alternative systems, 6 per cent (16 of 266 patients) used Therakair, 11.6 per cent (31 of 266 patients) Atmosair and only 1.5 per cent (4 of 266 patients) Genadyne and Gel overlays (Figure 39). These findings suggest that the use of protective mattresses does not solve the problem, and is in fact inappropriate in relation to the Braden scores especially in high and severe risk categories.

Figure 36 Distribution of the Braden Scores

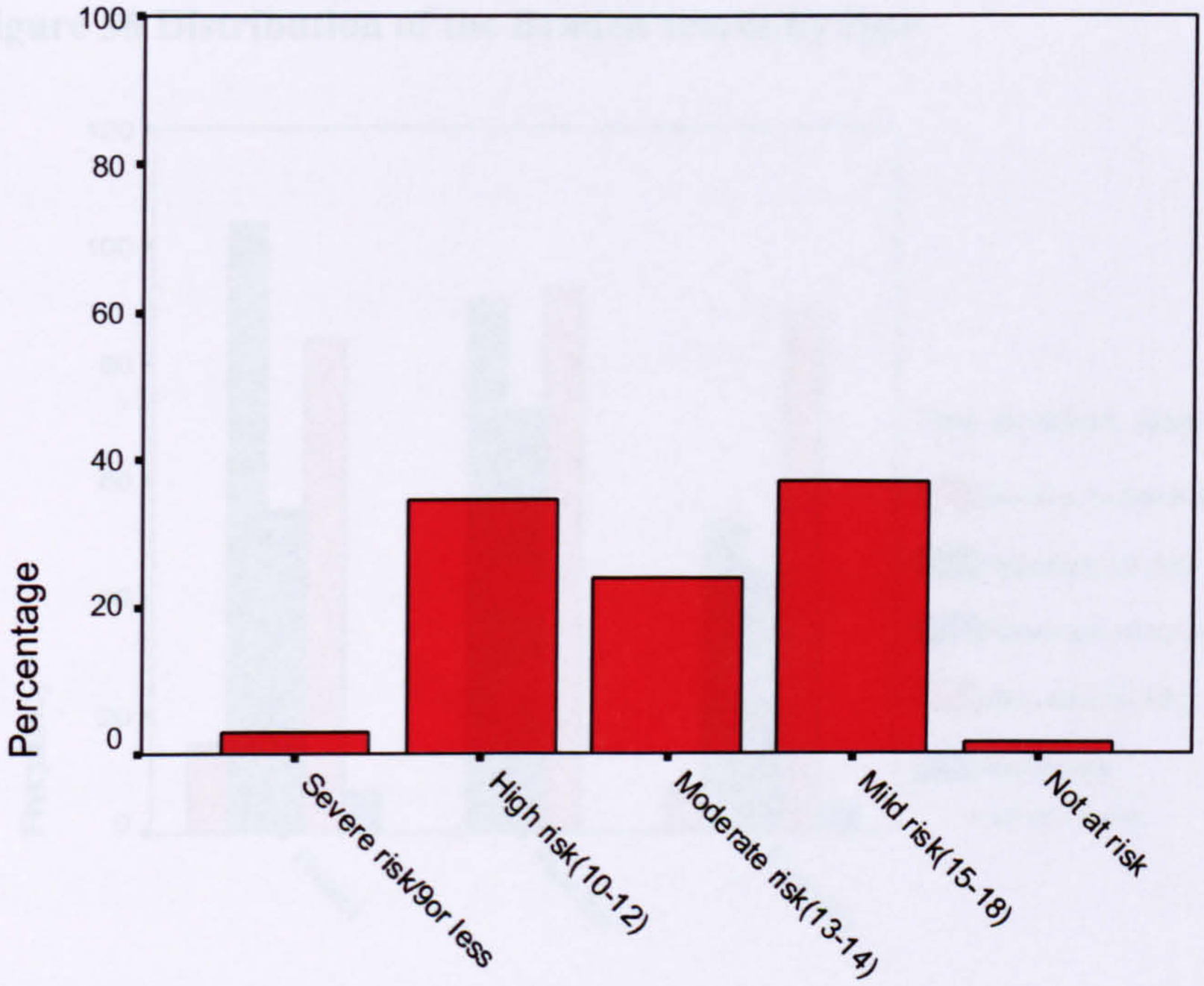


Figure 37 Distribution of the Braden scores by the group

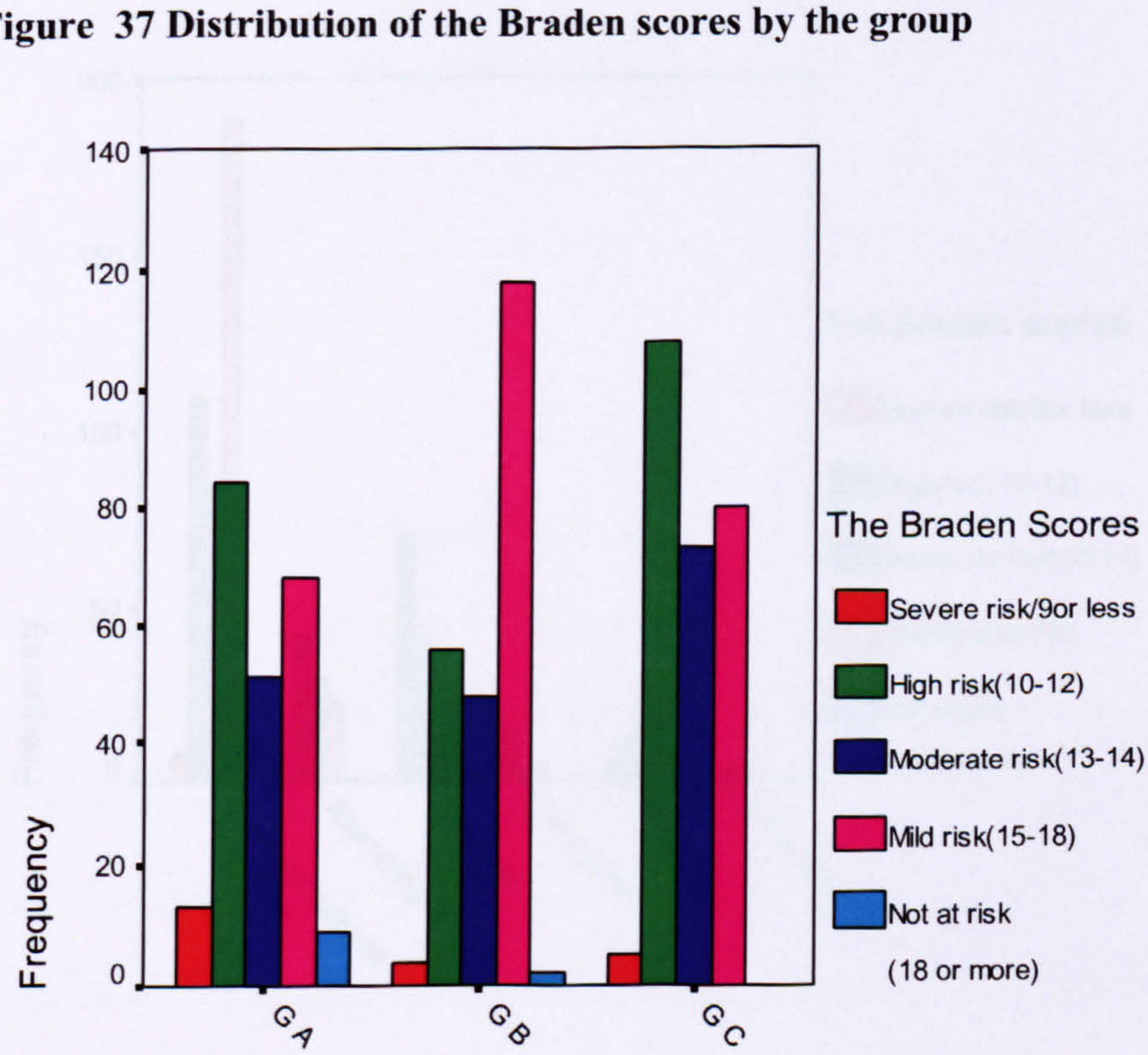


Figure 38 Distribution of the Braden scores by type

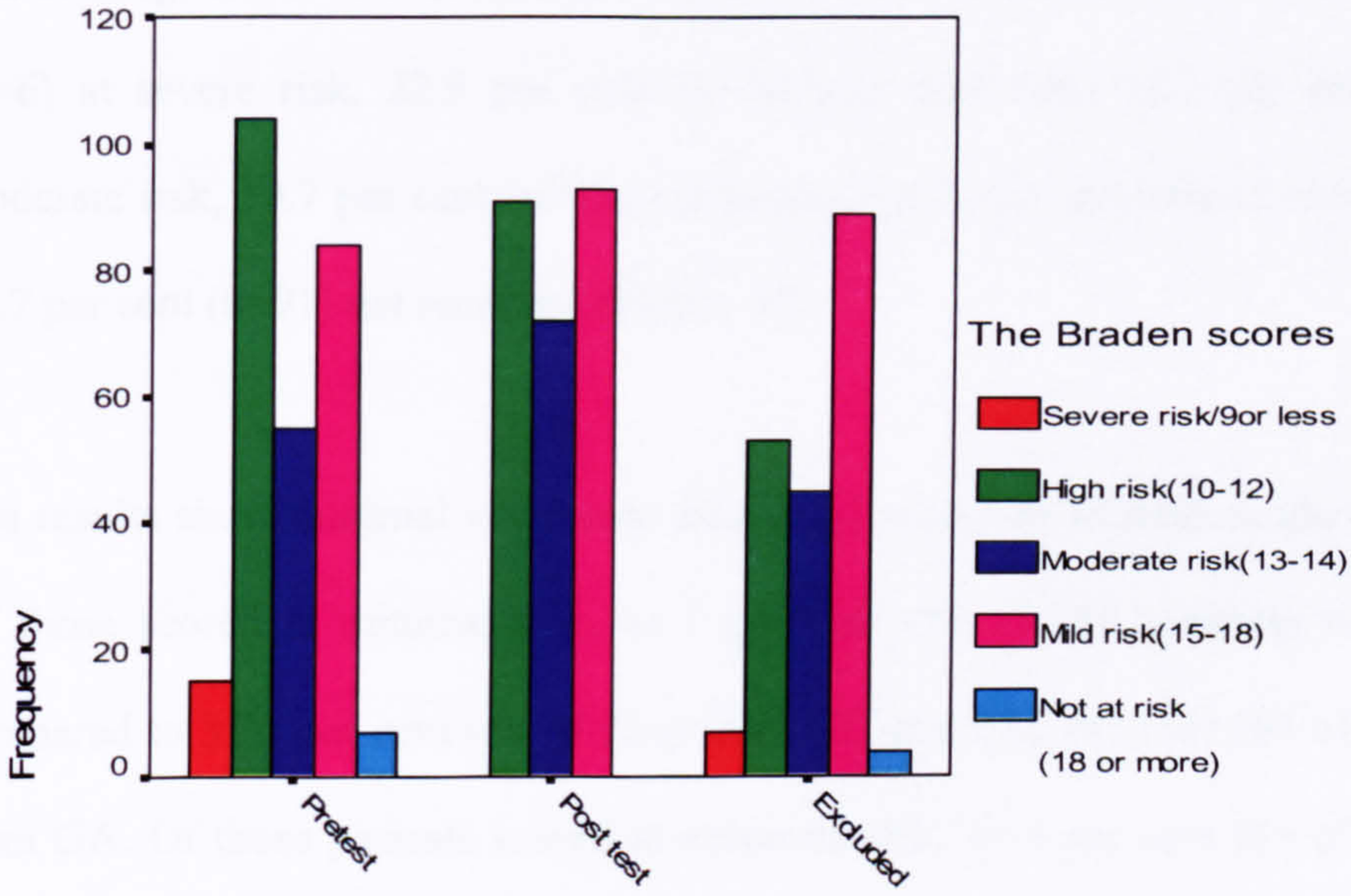
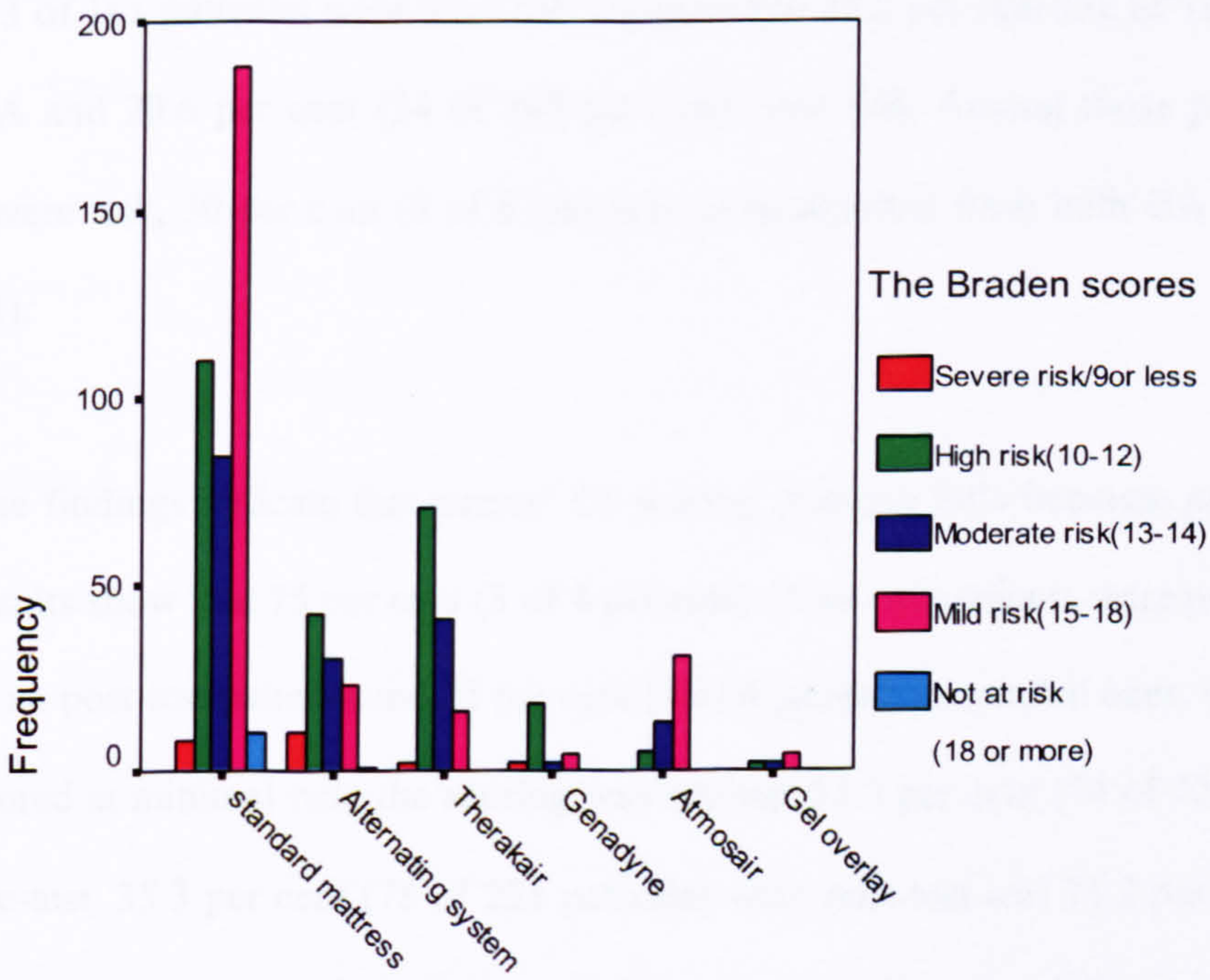


Figure 39 Distribution of the Braden scores by protective mattresses



4.2 The clinical Judgment (CJ) scores

The findings show that the nurses' CJ scores were distributed as follows: 0.8 per cent (n=6) at severe risk, 22.9 per cent (n=165) at high risk, 32.3 per cent (n=232) at moderate risk, 30.7 per cent (n=221) at minimal risk, 0.6 per cent (n=4) at no risk and 12.7 per cent (n=91) not recorded (Figure 40).

The results show minimal variability among CJ scores in relation to the patient group. Of those scored at minimal risk, 41.2 per cent (91 of 221 patients) were from GB compared to 31.2 per cent (69 of 221) from GC and 27.6 per cent (61 of 221 patients) from GA. Of those patients scored at moderate risk, 41.4 per cent (96 of 232 patients) were from GC compared to 34 per cent (79 of 232 patients) from GA and only 24.6 per cent (57 of 232 patients) from GB. Of those patients scored at high risk, 44.2 per cent (73 of 165 patients) were from GC compared to 35.2 per cent (58 of 165 patients) from GA and 20.6 per cent (34 of 165 patients) from GB. Among those patients scored at severe risk, 50 per cent (3 of 6 patients) were reported from both GA and GC (Figure 41).

The findings indicate that nurses' CJ scoring changed little between patient types. The results show that 75 per cent (3 of 4 patients) of no risk patients were pre-test compared to no post-test patients and 25 per cent (1 of 4 patients) excluded ones. Of those patients scored at minimal risk, the scoring was similar: 33.5 per cent (74 of 221 patients) were pre-test, 35.3 per cent (78 of 221 patients) were post-test and 31.2 per cent (69 of 221 patients) were excluded. Some variability was evident in relation to those scored at

moderate risk (36.6 per cent (85 of 232 patients) in pre-test compared to 43.1 per cent (100 of 232 patients) in post-test and 20.3 per cent (47 of 232 patients) in the excluded patient group). Of those patients scored at high risk, 38.2 per cent (63 of 165 patients) were in pre-test compared to 40 per cent (66 of 165 patients) in post-test and 21.8 per cent (36 of 165 patients) excluded. It was noted that those patients scored at severe risk in pre-test were twice (66.6 per cent (four of six patients)) the number of the patients in the post-test (Figure 42).

The findings describe the nurses' CJ in relation to the protective mattresses. It was noted that all patients scored at no risk were provided a standard mattress. Of those scored at minimal risk, 64.3 per cent (142 of 221 patients) used standard mattress compared to 14 per cent (31 of 221 patients) using alternative systems, 11.3 per cent (25 of 221 patients) using Atmosair, 9 per cent (20 of 221 patients) Therakair, 0.9 per cent (2 of 221 patients) Genadyne and only 0.45 per cent (1 of 221 patients) using Gel overlays. Of those patients scored at moderate risk, 45.2 per cent (105 of 232 patients) used the standard mattress while 15.1 per cent (35 of 232 patients) used alternative systems, 25 per cent (58 of 232 patients) Therakair, 5.6 per cent (13 of 232 patients) Genadyne, 8.2 per cent (19 of 232 patients) Atmosair and only 0.9 per cent (2 of 232 patients) used Gel overlays.

The results show an appropriate utilisation of protective mattresses among patients scored at high risk. It was reported that, 42.4 per cent (70 of 165 patients) of those patients scored at high risk used standard mattresses compared to 20.6 per cent (34 of 165 patients) using alternative, 27.2 per cent (45 of 165 patients) Therakair, 5.6 per cent

(9 of 165 patients) Genadyne, 1.8 per cent (3 of 165 patients) Atmosair and only 2.4 per cent (4 of 165 patients) using Gel overlays. Among those patients scored at severe risk, 50 per cent (3 of 6 patients) were nursed with alternative systems compared to 33.4 per cent (two of six patients) with Therakair, 16.6 per cent (1 of 6 patients) with standard mattresses; other protective mattresses were not used (Figure 43).

The findings also describe the nurses' CJ scores in relation to the Braden scores. They show that both coincided at 68.7 per cent (152 of 221 patients) of patients scored at minimal risk. Furthermore, both scoring systems were correlated (Table 1) especially among those patients who scored moderate risk, 37 per cent (87 of 232 patients) of whom, for example, who were scored on this level by CJ were scored at high risk by the Braden scale. Of those patients who scored at high risk by CJ, 67.8 per cent (112 of 165) were also rated as such by the Braden scale. Among those patients who scored at severe risk by CJ, only 16.6 per cent (1 of 6 patients) scored the same by using the Braden (Figure 44).

Table 1 Correlation between Reversed Braden Scores and CJ scores

			Reversed Braden scores	CJ scores
Spearman's rho	**Reversed Braden Scores**	**Correlation Coefficient**	1.000	.589(**)
		Sig. (2-tailed)	.	.000
		N	719	628
	CJ scores	Correlation Coefficient	.589(**)	1.000
		Sig. (2-tailed)	.000	.
		N	628	628

** Correlation is significant at the 0.01 level (2-tailed).

Figure 40 Distribution of CJ scores

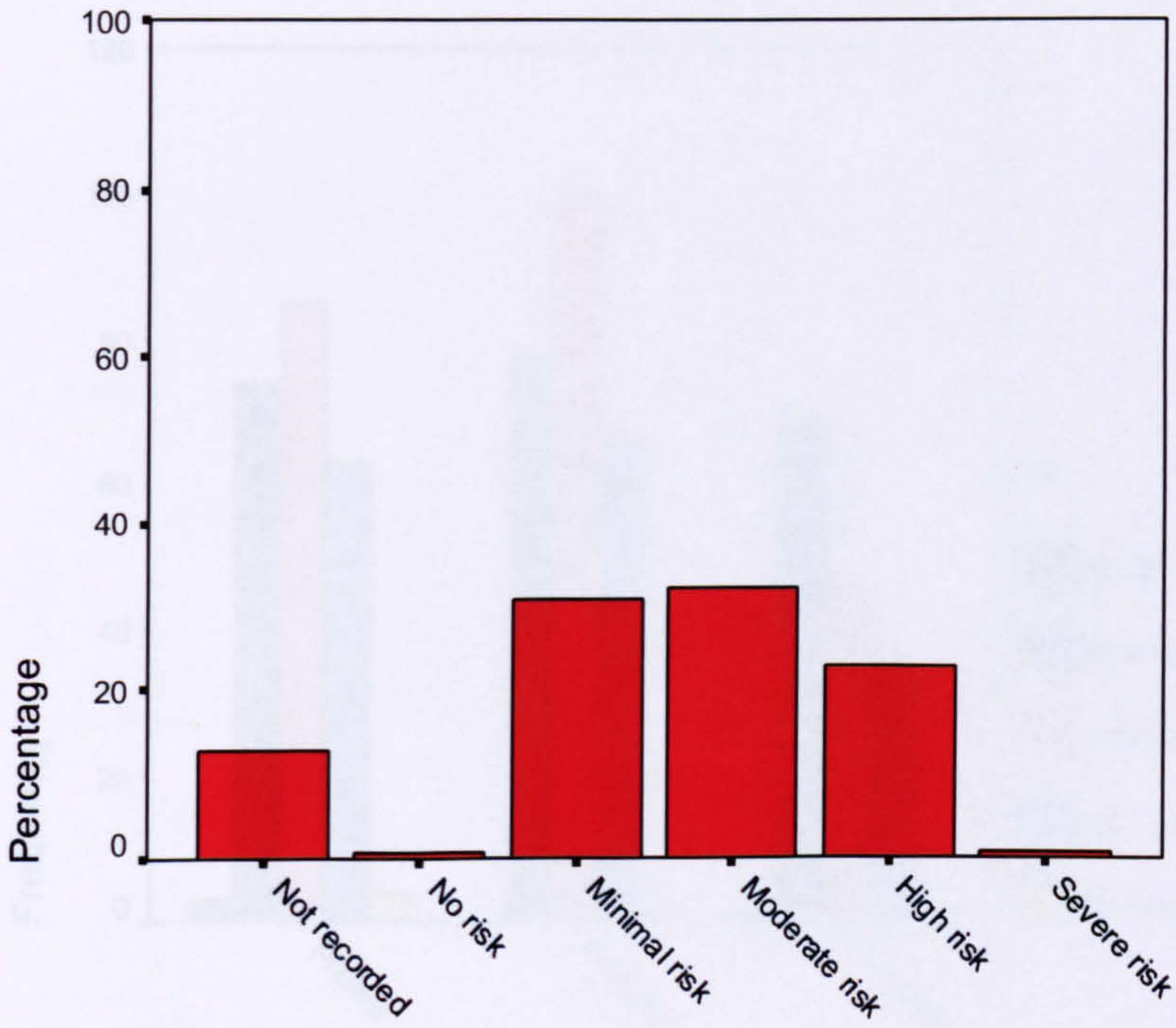


Figure 41 Distribution of CJ scores by patients' group

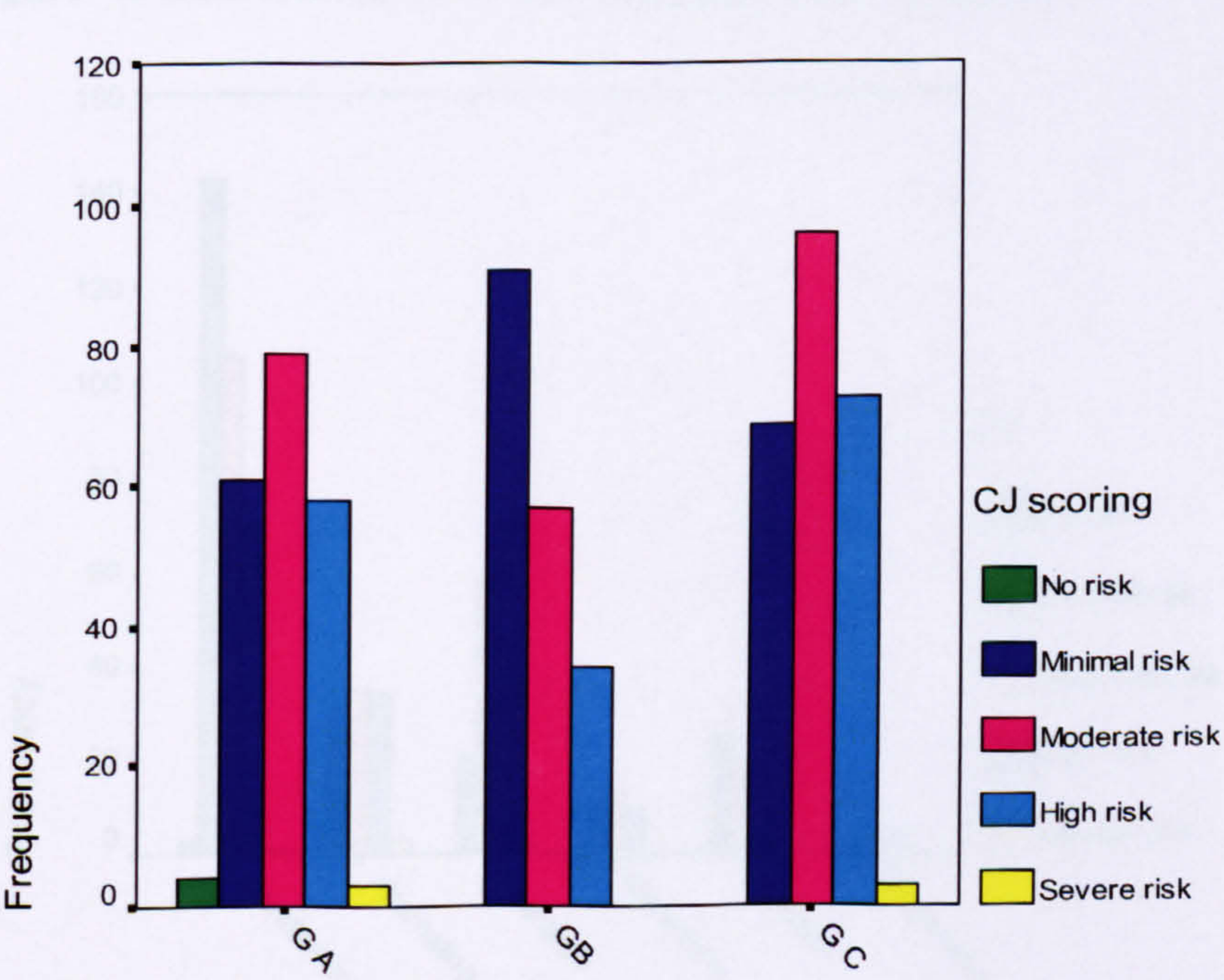


Figure 42 Distribution of CJ scores by patients' type

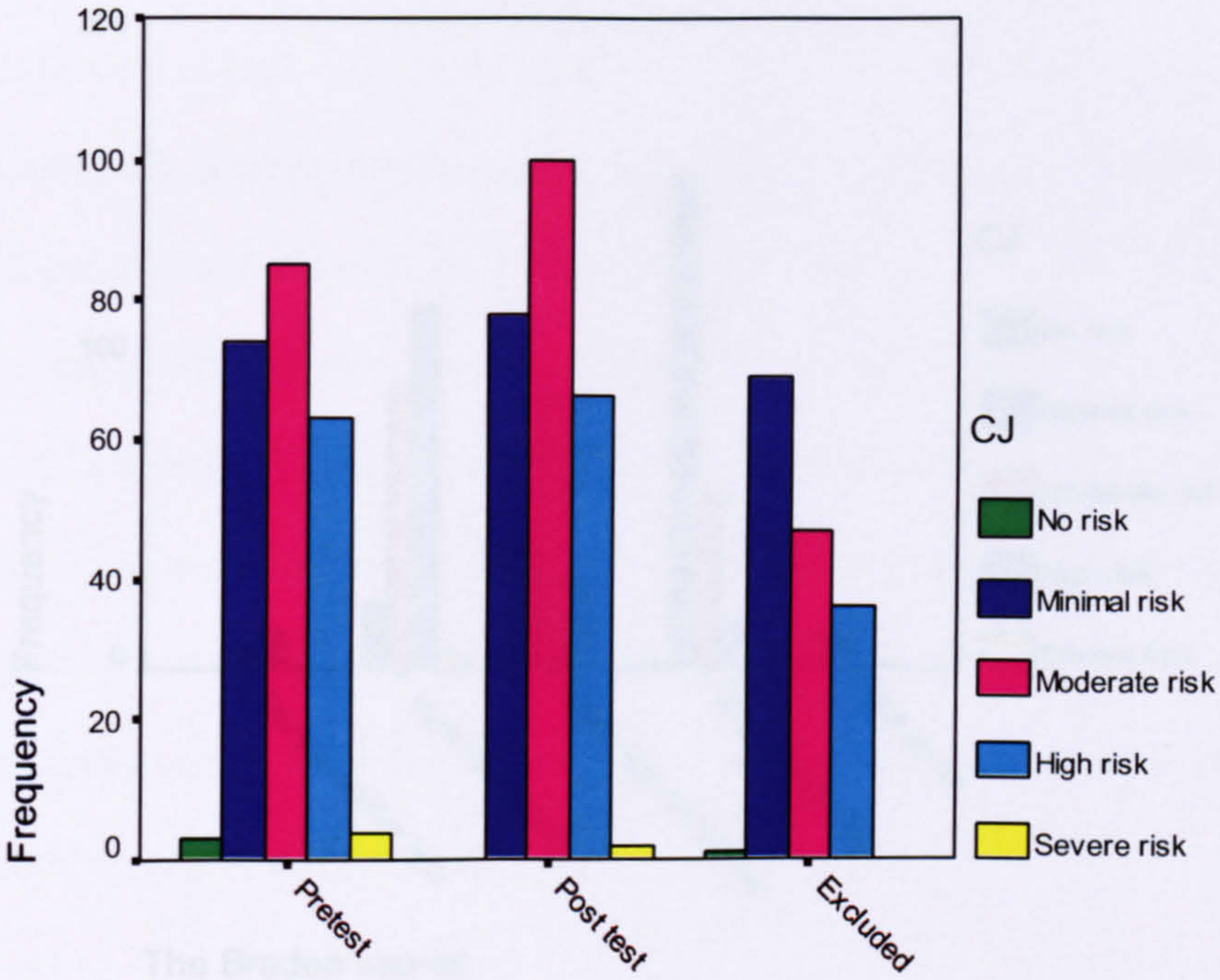


Figure 43 Distribution of CJ scores by protective mattresses

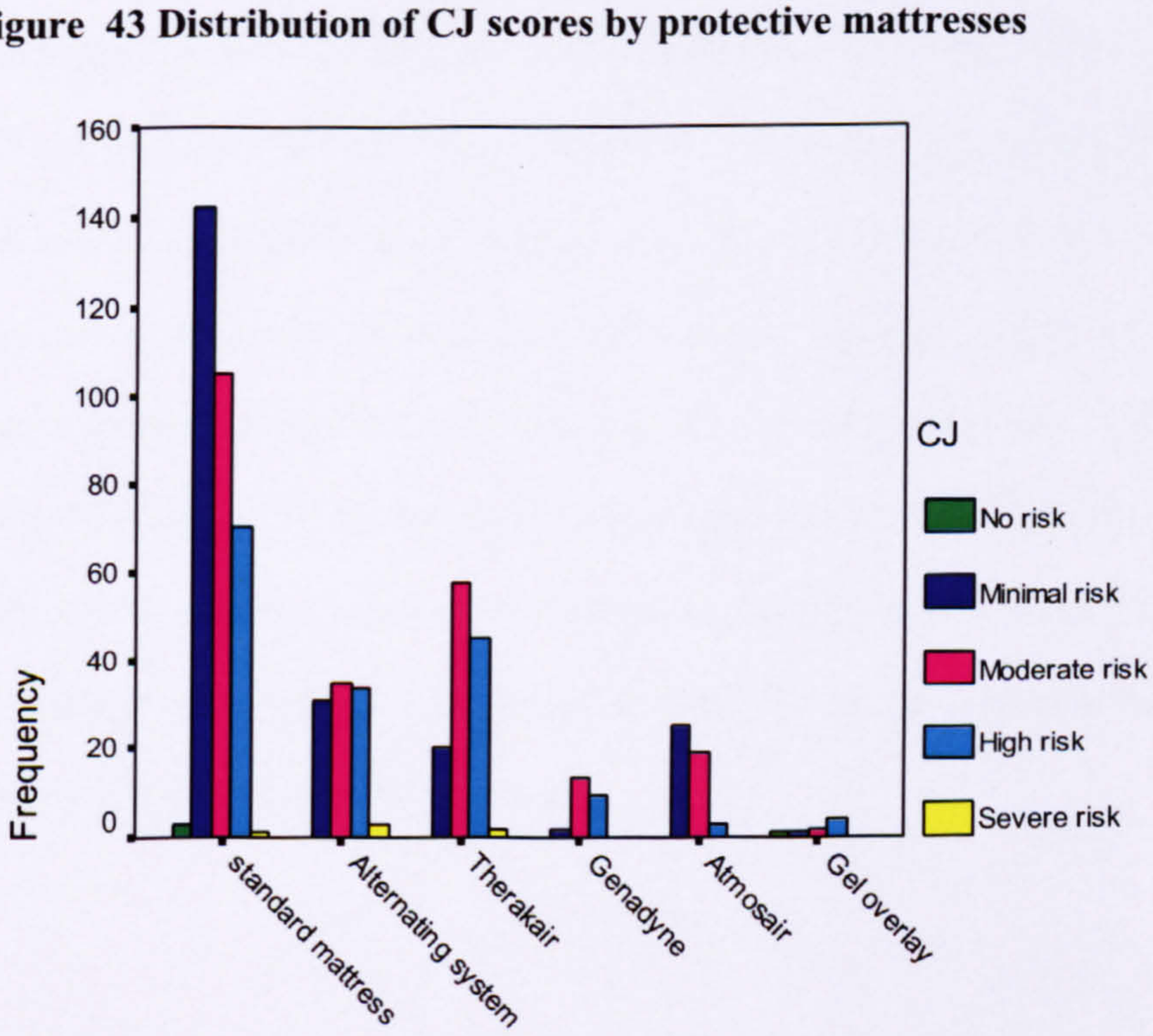
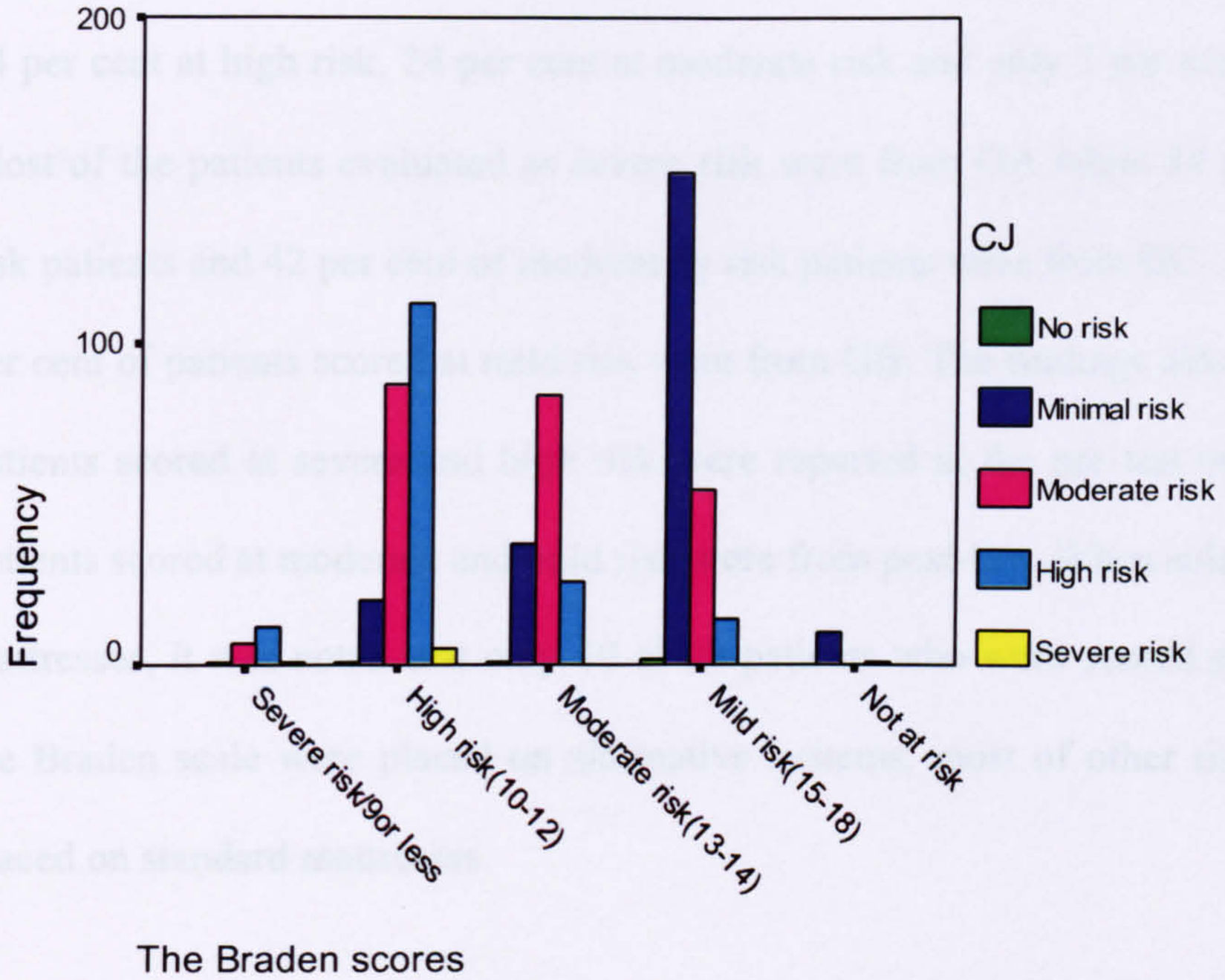


Figure 44 Distribution of CJ scores by the Braden scores



A table was constructed (Appendix Q, table 9), and the results show that the Braden scoring varied throughout the sample. 37 per cent of patients were scored at mild risk, 34 per cent at high risk, 24 per cent at moderate risk and only 3 per cent at severe risk. Most of the patients evaluated as severe risk were from GA while 44 per cent of high risk patients and 42 per cent of moderately risk patients were from GC. Additionally, 44 per cent of patients scored at mild risk were from GB. The findings also show that most patients scored at severe and high risk were reported at the pre-test stage while those patients scored at moderate and mild risk were from post-test. When selecting protective mattresses, it was noted that only 10 of 22 patients who were scored at severe risk on the Braden scale were placed on alternative systems, most of other risk groups being placed on standard mattresses.

When using the CJ scoring, the sample showed 32 per cent of patients scored at moderate risk while 31 per cent were at minimal risk, 23 per cent at high risk and only 0.8 per cent at severe risk. The distribution of CJ scores was variable among groups. 41 per cent of moderately risk and 44 per cent of high risk patients were from GC while 41 per cent of minimal risk were from GB. Patients scored as severe risk were distributed equally between GA and GC. The patients in the pre-test and post-test stages had relatively similar CJ scores in the minimal, moderate and high risk categories. Only three of six patients scored at severe risk were placed on alternative systems. Moreover, the findings show that the Braden scale and CJ scores coincided at 68 per cent among minimal and high risk patient groups.