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University of the Witwatersrand, Johannesburg 2015

Evaluation of readiness for discharge from the block 4 operating theatres Post Anaesthetic Care unit.

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, in partial fulfilment of the requirements for the degree, Masters of Medicine in Anaesthesia

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7-17-2015

DECLARATION

I, Mpucuko Nxumalo, declare that this research report is my own work. It is being submitted for the degree of Master of Medicine at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.



Signature

Signed at: University of the Witwatersrand, Johannesburg

On this date: 17 July 2015

ABSTRACT

BACKGROUND:

The first of the three phases of recovery from anaesthesia following surgery is critical and is associated with a lot of documented complications. The creation of Postanaesthetic Care Units (PACU) has helped introduce a structured environment for the management of the recovery phase following anaesthesia by providing continuous monitoring and assessment of patients' clinical parameters until they are ready for discharge back to their respective wards. While the SASA practice guidelines (1) mandate that the patients are the responsibility of their anaesthesiologist until they are discharged from recovery, the decision to discharge the patients is often entrusted to the PACU nurses. Structured objective criteria for the assessment of readiness for discharge should therefore be used in the form of a score to effect a safe and timeous discharge of patients from the PACU. The Modified PAR score, recommended by the SASA practice guidelines is objective, reproducible and applicable to most post-anaesthesia situations.

OBJECTIVES:

The objectives of the study were to describe the Modified PAR (Post Anaesthesia Recovery) scores of patients on admission to the PACU, describe the Modified PAR scores of the patients deemed ready for discharge by the nurses, and describe the Modified PAR scores of the patients determined by the researcher at the time of discharge. Also, to describe the time to discharge for patients who are ready for discharge according to the Modified PAR score, and to correlate the scores recorded by the researcher and those by the nurses when patients were deemed ready for discharge.

METHOD:

A prospective, descriptive, contextual study design was used. Eighty adult patients presenting for elective and emergency surgery in Block 4(i.e. the main theatres at Charlotte Maxeke Johannesburg Academic Hospital) theatres who met the inclusion criteria were invited to take part in the study. The Modified PAR score was used by the researcher to assess patients deemed ready for discharge by the PACU nurses. The patients' last clinical indices recorded by the nurses were used to derive the discharge score. Thereafter, the researcher reassessed the patients' readiness for discharge by re-evaluating their clinical

indices and deriving a discharge score. The patients were deemed not ready for return to the ward when their discharge scores were < 9 and deemed ready when the scores were ≥ 9. Those patients deemed not ready for discharge by the researcher were kept in the PACU until they had met the criteria for discharge.

RESULTS:
Thirty two (40%) patients were admitted to the PACU with scores of ≥ 9.

Eleven (13.75%) patients deemed ready for discharge by the nurses were not ready according to their Modified PAR scores of < 9. Sixty nine (86.25%) patients had Modified PAR scores ≥ 9, meeting the criteria for discharge. The researcher's reassessment of the patients yielded similar results to those derived from the PACU nurses' assessments.

Patients admitted to the PACU with scores ≥ 9 spent a mean time to discharge of 21.56 minutes (SD=11.16 minutes) and the time range was 5-45 minutes indicating a prolonged length of stay after readiness for discharge.

A strong correlation was determined between the Modified PAR scores derived from the indices as recorded by the nurses and those by the researcher which was statistically significant($r=0.7243$, $p<0.001$).

CONCLUSION:
The use of Modified PAR score should be formally implemented when discharging patients from the PACU. This will ensure that the patients are discharged safely and timeously.

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CHAPTER 1: OVERVIEW OF THE STUDY

1.1 Introduction

In this chapter the following will be discussed: the background to this study; the problem statement; aim and objectives of the study; research assumptions; demarcation of the study field; ethical considerations; a summary of the research methodology; the significance of the study; validity and reliability of the study and an outline of the research report.

1.2 Background

Anaesthesia and surgery are processes that inflict a stressful impact on human's physiological function. The recovery phase postanaesthesia is therefore as important as the intraoperative phase and needs to be managed with utmost care. The standards of practice during this phase should be comprehensively structured and well understood by the personnel involved in the recovery of patients in the postanaesthesia phases following surgery (2).

The high mortality in the immediate post-anaesthesia period, observed in the earlier practice of anaesthesia resulted in the development of post-anaesthetic care units (PACU), also known as recovery rooms (2). Hegarty et al (2) cited Muller- Smith's definition of the PACU as "the environment in which patients are cared for in the initial period postanaesthesia and surgery". It became apparent from the World War II experience that patients needed to be cared for in a designated location whilst recovering from anaesthesia following surgery. (3). Leykin et al is cited by Hegarty et al (2) describing the aims of the PACU as follows:

- "to support patients in the **removal** of the pharmacological effect of anaesthesia;
- to attain **haemodynamic** stabilisation of patients;
- to monitor for and treat potential **complications;**
- to ensure patient's comfort;
- to discharge patients who meet a certain **minimum standard of fitness** to appropriate environments."

To ensure that patients are discharged from the PACU efficiently, safely and expeditiously, different discharge scores or criteria have been developed (2, 4). Most of these discharge scores or criteria consist of clinical parameters as indicators. Patients have to meet a certain number of predetermined indicators before being assessed clinically fit for discharge from the PACU.

The use of PACU discharge scores internationally is becoming more pertinent with the shift from inpatient to ambulatory surgery. It is reported that 50 to 70% of all surgeries are conducted on an outpatient basis with an anticipated increase to 85% in the near future (4).

Examples of discharge scores include the Post Anaesthesia Recovery score (PAR) also known as the Aldrete score (2), the Post Anaesthesia Discharge Scoring System (PADSS) (2, 5) and the Respiration Energy Alertness Circulation Temperature (R.E.A.C.T) (2). It is important to note that discharge scores each have advantages and limitations that need to be taken in account when implemented. It is also important to emphasize that discharge scores are of no value unless properly implemented by the multidisciplinary team involved in the postanaesthesia care (2).

1.3 Problem statement

Postanaesthesia care at Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) is currently mainly rendered by the nursing staff. During office hours “recovery” sisters with various levels of training and experience are allocated to the PACU. After hours “scrub” sisters who were involved in the surgery are responsible for the postanaesthesia care of the patient.

To render a safe PACU service it is important that the patient has undergone satisfactory recovery which can be evaluated using a discharge score. Currently there are no formal discharge criteria to determine the patients’ readiness for discharge from the Block 4 PACU at CMJAH. There is a perception that some patients are discharged prematurely or that discharge is delayed. The extent of this problem is not known.

1.4 Aim

The aim of this study was to evaluate the readiness for discharge of the patients discharged from the Block 4 PACU at CMJAH using the Modified PAR score.

1.5 Objectives

- describe patients' Modified PAR scores on admission to the PACU
- describe the Modified PAR score when patients are deemed ready for discharge from the PACU by the nurses
- describe the Modified PAR scores as recorded by the researcher following patients being deemed ready for discharge from the PACU by the nurses
- describe the time to discharge from the PACU of patients with a modified PAR score of ≥ 9
- describe the number of patients deemed ready for discharge from the PACU by the nurses with the Modified PAR score of < 9
- correlate the Modified PAR scores derived from patients' clinical indices as recorded by the PACU nurses and those determined from the researcher's reassessment when patients were deemed ready for discharge.

1.6 Research assumptions

The following research definitions will be used in this study.

Recovery: is a process of three phases that describe the patient's emergence from the anaesthetic. In this study the term is used to describe the nursing recovery process of the patient.

Post Anaesthetic Care Unit (PACU): a designated area for patients' recovery in the postoperative period and also referred to in the literature review as the "recovery area" or "recovery room". In this study it will be the recovery room in Block 4 at CMJAH.

PAR score: is also known as the Aldrete score and comprises the following clinical indices: activity; respiration; circulation; consciousness; Oxygenation. In this study it is referred to as the Modified PAR score due to the inclusion of the oxygen saturation. PACU nurses at CMJAH do not formally use the Modified PAR score to evaluate readiness for discharge of the patients but they chart all five indices which can be used to derive a Modified PAR score.

Ready for discharge from PACU: for the purposes of this study a score of nine or more would indicate readiness for discharge from the PACU.

1.7 Demarcation of the study field

The study will be conducted in the Block 4 PACU at CMJAH. CMJAH is a 1200 bed central hospital which is a referral centre for numerous regional hospitals around Gauteng. The hospital is located in Johannesburg, Gauteng and is affiliated to the University of the Witwatersrand. CMJAH has 23 theatres and performs on average 23 000 surgical cases annually.

Block 4 forms half of the theatre complex where all elective cases of general surgery, orthopaedics, vascular surgery, cardiothoracic surgery and all forms of emergency surgery are conducted.

1.8 Ethical considerations

Approval to conduct the study was obtained from the relevant authorities. Anonymity and confidentiality were maintained in the study. This study was conducted adhering to South African Good Clinical Practice Guidelines (6) and the Declaration of Helsinki (7).

1.9 Research methodology

1.9.1 Study design

A prospective, descriptive, contextual research design was used.

1.9.2 Study population

All adult in-patients scheduled for elective and emergency surgical procedures under both general and regional anaesthesia in Block 4 operating theatres at CMJAH.

1.9.3 Study sample

Sampling method

A consecutive, convenience method of sampling was used.

Sample size

In consultation with a biostatistician a sample size of 73 patients was obtained using the StatCalc utility of the Epi-Info programme. The value was based on the expected frequency

of 5% (8) of patients not being ready for discharge from the PACU at the time of discharge as reported in previous studies.

Inclusion and exclusion criteria

The inclusion criteria for this study were:

- adult patients 18 years and older
- having had elective or emergency procedures
- assessed by the nursing staff as ready for discharge.

The exclusion criteria for this study were:

- patients who did not consent to inclusion in the study
- patients who had received premedication
- patients who could not communicate effectively with the researcher.

1.9.4 Data collection

Suitable patients who presented for surgery in the waiting area in Block 4 theatres were identified by the researcher and invited to take part in the study and those who consented were enrolled in the study. Patients were conveyed from theatre postoperatively to the Block4 PACU, where they were recovered following standard current procedure. Patients declared ready for discharge by the PACU nurse were re-evaluated by the researcher at their respective PACU station using the Modified PAR score.

1.9.5 Data analysis

Data were entered on an Excel spreadsheet and analysed in consultation with a biostatistician, using descriptive and inferential statistics.

1.10 Significance of the study

There is a perception that some patients are discharged from the PACU before they have appropriately recovered from anaesthesia and others remain longer than necessary following readiness for discharge. Early discharge from the PACU is not safe for the patients and remaining longer than necessary is misuse of a scarce resource. There currently is no formal scoring system to determine patients' readiness for discharge from Block 4 PACU.

The Modified PAR score is practical, reliable, reproducible and applicable to most post-anaesthesia situations and renders autonomy to the PACU nurses in discharging patients

safely (2, 9). This scoring tool has been proven safe and effective in the USA and most of Latin America (10) and its use may contribute to more appropriate discharging of patients from Block 4 PACU .

1.11 Validity and reliability

Measures were taken to ensure validity and reliability in this study.

1.12 Research report outline

This research report consists of five chapters: Chapter 1 presents an overview of this research report; Chapter 2 is a review of the current relevant literature; Chapter 3 describes the research methodology; Chapter 4 presents results and the discussion thereof; Chapter 5 summarises the study, addresses its limitations, makes recommendations and presents a conclusion.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

In this chapter, literature relevant to this study will be reviewed. Firstly, a brief history of the postanaesthetic care unit will be reviewed. Secondly, postanaesthesia recovery including its complications will be reviewed. Thirdly, normal postanaesthetic care and complications associated with it will be reviewed. Following this, a brief review of the postanaesthetic care unit (PACU) including guidelines as advocated for by various professional associations of anaesthesiology will be discussed. Discharge criteria scores will be briefly reviewed with more focus cast on the Modified Postanaesthetic Recovery (PAR) score. Lastly, various studies that have used the Modified PAR score as discharge criteria to discharge patients from the PACU are reviewed.

2.2 History of the PACU

"During the early years, the body of knowledge regarding anaesthesia was limited and practitioners with limited preparation often administered anaesthesia" (11). Hence, provisions for a recovery room or PACU were not always a feature when planning a hospital (12). Although both the fields of surgery and anaesthesia were in their infancy in the early 1800's, initial reports of rooms especially reserved for patients who were either severely ill or had undergone a major surgical procedure had already emerged from England. At the Newcastle Infirmary, five two-bedded rooms positioned next to the operating theatres were reserved for high risk postoperative patients and were described as some sort of a PACU in as early as 1801 (11, 13).

On the 16th October 1846 at Massachusetts General Hospital in Boston, Dr W.T.G. Morton successfully demonstrated the safe and effective administration of inhaled general anaesthesia on a patient who had a congenital venous malformation of the neck ligated in the presence of an assembled operative gallery. Observing success of the procedure Dr JC Warren, founder of the New England Journal of Medicine and the Massachusetts General Hospital remarked, "Gentlemen, this is no humbug." (11, 14). Barone et al (11) commented that it was on that day that modern anaesthesia emerged along with the requirement to develop recovery rooms in that country. In 1873, an English dental surgeon, Dr Charles Tomes is said to have delivered the first description of an early recovery room in the United

States of America when he addressed dental students of Harvard University at a graduation (11). He had also written to the British Medical Journal on February 24, 1873, detailing the use of two designated areas when administering ether, the preoperative induction room and a separate recovery area (11). As the sciences of surgery and anaesthesia continued to grow, so did the reports on the increasing number of recovery rooms in different locations in the world viz. in 1904 at Boston hospital; in 1923 at Johns Hopkins; in 1932 at Cook County Hospital; in 1938 at the New Britain General Hospital; in 1942 at the Mayo Clinic; in 1944 at the New York Hospital and 1945 at the Ochsner clinic (11).

A noticeable increase in recovery rooms was documented during the World War II (3, 11). The nursing shortage in the United States of America was cited as a reason for this increase as it had been determined that more postoperative patients in a recovery area could receive a safer level of care from fewer nurses (11).

Added to this optimal usage of nursing care was the fact that recovery rooms saved lives and had advantages which were documented in a landmark report published in the Journal of the American Medical Association in 1947. The report was based on a review of all fatalities (n=306) that had taken place within 24 hours after the induction of anaesthesia over a period of 11 years. Causes of these fatalities were documented, some of which are still prevalent in postanaesthesia today. Forty seven percent of these deaths were declared to have been preventable. The authors concluded that a third of the 47% deaths could have been averted had different management and postoperative nursing care been employed (11) .

After this report more hospitals established recovery rooms which were under the direction of the discipline of anaesthesiology, run by specially trained nurses and supported with equipment essential for patients' resuscitation (11, 13). In 1949, the Operating Room Committee of New York Hospital was quoted as stating that "an adequate recovery room service is a necessity to any hospital undertaking modern surgical therapy" (11). In 1951, Lowenthal and Russell (15) produced criteria: "Requirements and Advantages to a Recovery Area" which are said to still be valid today.

These reports and the increased involvement of anaesthetists in the planning of new hospitals were a major influence in the 1960's on the development of PACUs (13). The

evolution of the PACU in recent years has had to keep up with developments in surgery and anaesthesia, especially with the advent of ambulatory surgery. Ambulatory surgery has introduced additional stressors and challenges, including the need for specialised nursing care in the immediate postanaesthesia period (3, 11, 13).

2.3 Post anaesthesia recovery

The normal postanaesthesia patient recovery and the complications that influence this recovery are discussed in this section.

2.3.1 Normal postanaesthesia recovery

Recovery is a process defined by a continuum of phases that overlap but are distinct from each other (16). The phases are early (phase one), intermediate (phase two) and late recovery (phase three). Phase one begins in the operating room when anaesthetic agents are stopped and the patient is allowed to emerge from anaesthesia. This phase continues in PACU where the patient is monitored and supervised by PACU nursing staff until the patient attains a state of readiness for discharge from the PACU. Phase two starts after the patient's discharge from PACU until criteria for discharge from the hospital has been reached. Phase three starts after discharge from the hospital and continues until the patient has achieved his/her pre-anaesthetic physiological state (13, 16, 17).

2.3.2 Complications influencing recovery

Interest in identifying problems during the recovery period in PACU has increased as patient care has become more sophisticated (18). Cohen et al (19) described the outcome of a nine-year postanaesthetic follow-up program in a large teaching hospital, the Health Sciences Centre in Winnipeg between the periods of 1975-1978 and 1979-83. The results showed a PACU complication rate of 3.1% and 5.9% between the periods of 1975-1978 and of 1979-1983, respectively.

In 1987 Zelcer and Wells (20) documented PACU complications over a period of one month and reported that 30% of PACU patients (n=443) had at least one complication. Complications observed were deranged cardiovascular variables (15%), nausea and vomiting (5.4%) and adverse respiratory events (2.25%) (18).

Hines et al (18) conducted a two and a half year survey in a PACU at a Yale teaching hospital in 1992. They observed 18 473 PACU patient admissions with an age range from 3 weeks to 92 years. The most frequent complications identified were nausea and vomiting (9.8%), upper airway problems requiring support (6.9%) varying from simple airway manoeuvres to mechanical ventilation and hypotension requiring treatment (2,7%).

These above mentioned PACU complications remain a source of morbidity. The most frequently occurring complications are nausea and vomiting, upper airway complications and hypotension, which will be discussed in more depth (13, 17, 18). Other complications that have been reported include a decreased level of consciousness and delirium, hypothermia, respiratory events including hypoventilation and hypoxaemia and cardiovascular problems such as ischaemia and dysrhythmias (13, 18).

Postoperative nausea and vomiting

Postoperative nausea and vomiting (PONV) is not uncommon after administration of general anaesthesia, affecting 20-30% of all patients (14). PONV is regarded as one of the most unpleasant postoperative symptoms and may persist for up to five days post-surgery (21). It can disrupt the surgical site recovery, increase the risk of aspiration, complicate analgesia management and can delay day-case discharge (13).

The aetiology of PONV in the post-anaesthesia period is multifactorial and includes the type of surgical procedure performed and the type of anaesthetic (14). Surgical procedures that irritate the peritoneum e.g. laparoscopy and strabismus surgery have been associated with elevated incidence of nausea and vomiting (14, 17, 18).

General anaesthesia is associated with an increased incidence of PONV. However, a lower incidence of PONV is reported to be linked to the administration of propofol during induction than when other hypnotic anaesthetic agents are administered for induction (22). Several postulations have been proposed due to lack of the exact mechanism of action of propofol in effecting antiemesis. Included in these postulations are inhibitory effects on vagal nuclei, chemoreceptor zone and other centres involved PONV (23). In animal models, it has been exhibited that nerve conduction in the olfactory cortex is retarded (24) and that in the area postrema serotonin levels reduced (25).

The general treatment and prevention of PONV is based on antagonising the neurotransmitters affecting the physiology of PONV (14). These antagonists include dopamine antagonists, anti-histamines, muscarinic receptor antagonists, serotonin receptor antagonist and neurokinin-1 receptor antagonists (21) . Corticosteroids are also with successful results (14, 21).

Apfel et al (26) listed four risk factors for developing PONV: “history of PONV or motion sickness, female sex, non-smoking status and the administration of postoperative opioids” (17).

Upper airway complications

Upper airway complications include: airway obstruction, laryngospasm, oedema of the glottis, the presence of vomitus, secretions or blood in the airway, and mechanical compression of the airway e.g. by a haematoma post-thyroidectomy. Most of these problems result in hypoxaemia which is a major contributor to mortality and morbidity (14).

In an unconscious patient the most probable cause of airway obstruction is the floppy tongue obstructing the posterior pharynx (14, 27). Obstruction can be partial and present with deranged respiratory sounds. Total or complete obstruction will result in the absence of respiratory sounds accompanied by paroxysmal breathing efforts between the chest and the abdomen (14). A manoeuvre comprising of a chin-lift, tilting the head and a jaw thrust, with or without the insertion of an nasal or oral airway usually resolves the problem (14, 27).

Laryngospasm causes a forceful apposition of the vocal cords and is clinically marked by high pitched crowing sounds when the glottis is partially closed and marked by silence when glottis is completely closed. The common causes are instrumentation or stimulation by secretions, blood or vomitus. It usually is successfully managed by a jaw-thrust manoeuvre, insertion of an oral airway and delivery of 100% oxygen via a bag-valve-mask device. In severe cases the administration of an rapid onset depolarizing muscle relaxant such as succinylcholine may be necessary to relax the vocal cords (14).

Oedema of the glottis is often the result of the use of airway instrumentation and head and neck surgery, especially in young children and is alleviated by the use of intravenous

corticosteroids. Mechanical airway obstruction caused by haematomas after head and neck surgical procedures is usually successfully relieved by opening the surgical wound and evacuating the haematoma (14).

Hypotension

Reduced venous return to the heart, excessive arterial vasodilatation and left ventricular dysfunction are all causes of hypotension. In PACU the most common cause of hypotension is hypovolaemia which may result from inappropriate intraoperative fluid management, tissue fluid shifts or haemorrhage. Hypotension can be concealed by hypothermia that causes vasoconstriction. Hypotension then emerges with venodilatation that is caused by a rise in temperature (14). Neuraxial anaesthesia produces relative hypotension associated with venodilatation produced by alpha blockade. Hypotension can occur despite a normal intravascular volume (5).

A pneumothorax is another clinical entity that presents with hypotension in the face of normal intravascular volume. A pneumothorax can be identified by tracheal deviation, unilateral decrease of breath sounds and hyperresonance on percussion which would require prompt management with intercostal drainage (14).

Treatment of hypotension is usually required when the blood pressure is reduced beyond 30% of the preoperative baseline. Successful treatment will depend on the accurate identification of the cause of the hypotension. An increase in blood pressure with passive leg raise or after a fluid challenge with colloid or crystalloid at 10 ml/kg or with a bolus of 250 ml of colloid confirms hypovolaemia as the cause of hypotension (14, 28). Fluid replete patients may require the use of vasopressors and inotropes (14).

2.4 Post-anaesthetic care

The American Society of Anaesthesiologists and European Society of Anaesthesiology (29, 30) defined post-anaesthesia care as “activities undertaken to safely manage the patient following completion of a surgical procedure and the concomitant primary anaesthetic care, including identification and immediate treatment of early complications of both anaesthesia and surgery before they develop into deleterious effects.”

To ensure quality delivery of such postanaesthesia care, the American Society of Anaesthesiologists has prescribed five basic standards which should be used in all locations. The anaesthesiologist's discretion may exceed the basic standards if necessary (27). The five standards are:

"Standard I: All patients who have received anaesthesia of any type shall receive appropriate post-anaesthesia care.

- A PACU or equivalent area shall be available to receive patients.
- All patients who receive anaesthesia care shall be admitted to the PACU unless specifically ordered by the anaesthesiologist.
- Policies and procedures of the PACU shall govern care and be reviewed and approved by the Department of Anaesthesiology.
- Design, equipment and staffing of the PACU shall meet all accrediting and licensing requirements in force.

Standard II: Patients transported to PACU shall be accompanied by a member of the anaesthesia care team who knows the patient and shall be appropriately monitored and treated during transport.

Standard III: Upon PACU arrival the patient shall be re-evaluated and a report given to the responsible PACU nurse by the transporting member of the team.

- The patient's status on arrival in PACU shall be documented.
- A review of the intraoperative course shall be provided to the PACU nurse.
- The anaesthesia care team member shall remain in the PACU until the PACU nurse accepts responsibility for the patient.

Standard IV: The patient shall be evaluated continually in the PACU.

- Evaluation shall use methods appropriate to the patient's condition.
- Particular attention should be given to oxygenation, ventilation, circulation and temperature.
- Oxygenation shall be assessed quantitatively during early recovery (does not apply to the labour patient post regional anaesthesia).

- An accurate PACU report shall be maintained.
- The use of a PACU scoring system is encouraged on admission, at appropriate intervals, and at discharge.
- General medical supervision and coordination of patient care in the PACU shall be the responsibility of an anaesthesiologist.
- A policy should be in place to assure the presence in the facility of a physician capable of managing complications and provide cardiopulmonary resuscitation of patients in the PACU.

Standard V: A physician is responsible for discharging the patient from the PACU.

- If discharge criteria are used, they must be approved by the Department of Anaesthesiology and the medical staff.
- Discharge criteria may vary based on the destination of the patient when leaving the PACU.
- In the absence of the responsible physician, the PACU nurse may determine that the patients meet the discharge criteria, and record the name of the responsible physician on the record" (30).

Various factors such as the design of the PACU, the availability of equipment and medication, staffing, and management and supervision of care contribute to rendering safe postanaesthesia care.

Vimlati et al (29) suggested that "the quality of immediate postoperative care" should be monitored and adherence to local and international standards should be audited to ensure safe postanaesthesia care.

The PACU, staffing, management and supervision of care will be discussed briefly.

2.5 PACU

The Society of Anaesthesiologists of South Africa (SASA) practice guidelines (1) and the Association of Anaesthetists of Great Britain and Ireland recommendations (31) stipulate specific design features for the PACU. “The area should be part of the operating complex. The number of bed/trolley areas must be sufficient to accommodate peak periods and there should be a minimum of 1.5 spaces per operating room. The bed/trolley area must be 9 to 12 square meters, with easy access to the patient’s head.”

Each bed/trolley area should have: an oxygen outlet; two general power outlets; suitable lighting with correct colour balance; “appropriate facilities for mounting and/or storing the necessary equipment and for the patient’s chart”; and medical suction complying with national standards (1).

Provision must be made for a nurses’ station, a storage area for clean linen, equipment and medication, and a utility room. There must be suitable amenities for scrubbing up procedures. A wall clock should be “clearly visible from each bed space”. Communication facilities such as an emergency calling system and a telephone should be available. Climate control to operating standards is desirable. Portable X-ray equipment should have easy access to the PACU (1).

“Each bed/trolley space should be provided with: an oxygen flow meter and nipple; suction equipment”; an automated non-invasive blood pressure monitor with suitably sized cuffs; a stethoscope; pulse oximeter; and means of measuring body temperature (1).

In the PACU there should be: an assortment of O_2 administrating devices; a minimum of two self-inflating manual resuscitators; equipment and medications for airway management and endotracheal intubation; emergency medications; a variety of intravenous equipment and fluids; acute pain management medication and equipment; syringes and needles; ECG monitor and patient warming devices (1).

“There should be immediate access to: a monitoring defibrillator preferably with pacing facility”; a blood warmer; “a thermostatically controlled warming cupboard for intravenous solutions”; refrigerator for medication and blood; a procedure light; a range of suitable medications; a surgical tray for procedures; access to diagnostic services; a peripheral nerve

stimulator; equipment appropriate to a patient's condition e.g. wire cutters and a ventilator (1).

The recovery bed/trolley must have a firm mattress and should be able to tilt to at least 15° and allow the patient to sit up. It is important that the bed/trolley be easy to manoeuvre, have functional brakes, a pole from which intravenous solutions can be hung, provision for monitoring and mounting of equipment during transport. The bed/trolley must have straps or side-rails which must be able to drop below the base or be easily removed (1).

Staffing of the PACU

It is the responsibility of the institution to appoint PACU staff that are appropriately trained and competent in postanaesthesia care (32). The PACU staff must be available at all times. The ratio of PACU staff to patients should be flexible to accommodate individual patient needs. However the ratio should be no less than 1:2 and 1:1 if the patient has not recovered protective reflexes (1).

Scribante and Perrie (32) drew the attention to the fact that little is known of the profile of nurses working in the PACU in South Africa. The authors describe the profile of PACU nurses in three academic and three private hospitals in Johannesburg. No PACU bay: theatre ratio could be determined for these hospitals, with staff reporting that they used the PACU bays creatively to accommodate patients. Therefore no nurse: patient ratio could be determined, however all units reported that a nurse: patient ratio of 1:1 or 1:2 is appropriate. When confronted how they managed to achieve these ratios with the available staff complement one of the responses was: "we cope with what comes our way". The study also highlighted that only 40.5% of the nurses had a six month anaesthetic nurse qualification. This is not in keeping with the recommendations by the SASA practice guidelines (1)

PACU management and supervision

SASA guidelines (1) stipulate that there should be "written protocols for safe patient management" in the PACU. "A written routine for checking the equipment and drugs" should be in place. Patient observations should be documented at suitable intervals and this record should form part of the patients' records. Patients should only be discharged from the PACU when the anaesthesiologist deems it safe to discharge them with the aid of validated criteria (1). In an editorial, Lundgren (33) emphasised that "the patient remains

the responsibility of the anaesthesiologist and must be discharged by the anaesthesiologist from the recovery room."

Discharge scoring systems are management tools that contribute to safe postanaesthesia care. Discharge scoring and in particular the Modified PAR score that is the focus of this research will be discussed in more depth in the next section.

2.6 Discharge criteria scores

Aldrete (3) recognised the need for a standardised method of assessment and documentation of the clinical condition of patients admitted to the PACU for recovery. This method would document the patients' condition on arrival in the PACU, the course of return of protective reflexes and also indicate the point at which transfer to the wards where less intensive nursing care is – would be safe. Early attempts by Carignan et al (34) to quantify recovery were too complex. It eventually became obvious that use of frequently applied clinical symptoms and signs should be central in the establishment of discharge criteria (3). The criteria should be developed on the basis of well-defined principles to minimise risk of cardiac, central nervous system or respiratory depression after discharge (29, 31). Vimlati et al (29) emphasise that use of scoring has a positive influence on the quality of patient care and safety.

For a discharge criteria score to be of value and effective it must be reproducible, practical by using commonly observed clinical parameters and has to be applicable to most, if not all recovery situations in the PACU. User-friendliness of the chosen discharge score will ensure that it is used by PACU staff (5). It is important that the discharge criteria score that is chosen for use should be appropriate for the context of the PACU (1).

There are numerous discharge scoring systems used in different parts of the world that have been developed in congruency with their respective contexts and include the following:

- A time-based discharge criterion which uses a minimum specified period of time that has to be spent in PACU before the patient is ready for discharge (2).
- The Modified PAR scoring system which assigns a sum of numerical scores from five clinical parameters i.e. activity, respiration, circulation, consciousness and oxygen saturation (2).

- The Post Anaesthesia Discharge Scoring system (PADSS), developed by Chung in 1993 to discharge post-ambulatory surgery patients. This score includes pain, nausea and vomiting, surgical bleeding and fluid intake and output, in addition to parameters observed in the Aldrete score (2, 5).
- Modified PADSS, from which, in 1995 the fluid intake and output was removed (2, 5).
- Salim's Coma Score which assigns numerical values to airway, behaviour and consciousness (2).
- White and Song discharge criteria which are used to fast-track patients from the operating theatre, to phase two recovery areas. Their scoring system assesses the same parameters as the Modified PADSS (2).

For the purposes of the study the Modified PAR score will be discussed in more detail.

2.7 Modified PAR score

In 1970, almost two decades after Dr Virginia Apgar had presented the Apgar score, a method of evaluating neonates at birth, at the 27th Congress of International Anaesthesia Research Society, Doctors Antonio Aldrete and Diane Kroulik developed the Post-Anaesthesia Recovery Score (PAR), a variant of the Apgar score (35). They had recognised the disorganised pattern of documentation and assessment of patients' clinical indices including vital signs and complications during their transit stay in the PACU (3).

Aldrete and Kroulik (35) saw the need to set up a point system that would not only indicate the patients' progression to full recovery but also mark the point at which the patients' discharge from the PACU to the ward was objectively considered safe. The authors refer to the earlier attempts at standardising recovery from anaesthesia that had been made by Carignan and colleagues (34) as being too complex and adding a burden to the PACU personnel (35). Reason dictated to Aldrete and Kroulik that a scoring system, using only the commonly observed patient clinical signs, had to be practical, reproducible and applicable to most, if not all post-anaesthetic situations (3, 5, 35).

The PAR score observes five signs which are a gauge of the patient's functional disturbance (3, 10, 35). Each clinical index is assigned a score of zero, one or two, which indicates the degree of disturbance. Zero represents the lowest and two the highest score. The highest discharge total score that can be allocated is 10. The clinical indices are activity, respiration,

circulation, consciousness and colour (35). In 1995 Aldrete substituted SaO_2 for colour after pulse oximetry had been received as a more precise tool for measuring blood oxygenation (10). Aldrete and Kroulik originally named the score the Post-Anaesthesia Recovery (PAR) score; modifications to the score were made by Aldrete following submissions by various authors (10). In the literature the terms Modified PAR score and the Modified Aldrete score are used interchangeably.

These clinical indices are described below.

Activity: Assesses muscle activity as the patient starts to move his/her extremities including the head, spontaneously or on command. If all four limbs can be moved then a score of two is assigned. If only two limbs can be mobilised, a score of one is assigned and a score of zero if none can be moved. Observing activity is also a reliable and useful method of assessing patients recovering from neuraxial and other regional forms of anaesthesia as the receding or the non-receding block can easily be assessed (14).

Respiration: A strong cough reflex is a good marker of being able to expectorate and clear secretions from the lower respiratory tract as well being able to effect gaseous exchange. A score of two is assigned to a deep breath and a strong cough. Dyspnoea or a limited respiratory effort is scored as one. Zero is assigned to absent respiratory activity (14).

Circulation: Blood pressure variations are clinically indicative measurements of circulation. It is measured during regularly timed intervals from arrival in PACU through to discharge. A score is assigned to the percentage variations in the systolic blood pressure from baseline. A score of two is given to the systolic pressure value that is within 20% of the pre-anaesthetic value, one is assigned if the pressure value ranges beyond 20% but within 50% of the pre-anaesthetic value, and zero if the pressure value falls beyond the 50% value (3, 10).

Consciousness: The use of a painful stimulus is not an accepted method of assessing the level of consciousness. An ability to answer questions is assigned a score of two whilst a score of one is assigned to arousal when called by name and a zero if there's no response to auditory stimulation. The sign of consciousness also influences the activity and respiration signs (14).

Oxygenation: Before the advent and acceptance of pulse oximetry, the "degree of oxygenation was evaluated by skin colour" i.e. pink was scored as two, pallor or jaundice was scored as one and cyanosis as zero (35). At present with the use of pulse oximetry, a score of two is given if SaO_2 is greater than 92% on room air and if supplemental oxygen is needed to maintain SaO_2 above 90% a score of one is given (10). In 1992 Aldrete and Wright proposed that a score of zero be given for SaO_2 less than 90% regardless of whether the patient is receiving supplemental oxygen, breathing spontaneously or requiring mechanical ventilation or not (10, 36).

The Modified PAR score is shown in Figure 2.1

		Admission	5 min	15 min	30 min	45 min	60 min	Discharge
Activity								
Able to move 4 extremities voluntary or on command	2							
Able to move 2 extremities voluntary or on command	1							
Unable to move extremities voluntary or on command	0							
Respiration								
Able to breathe deeply and cough freely	2							
Dyspnoea and limited breathing	1							
Apnoeic	0							
Circulation								
BP ± 20% of pre-anaesthetic level	2							
BP ± 20% to 49% of pre-anaesthetic level	1							
BP ± 50% of pre-anaesthetic level	0							
Consciousness								
Fully awake	2							
Arousable on calling	1							
Not responding	0							
O2 Saturation								
Able to maintain O2 saturation >92%	2							
Needs O2inhalation to maintain O2 saturation >92%	1							
O2 saturation <90% even with O supplement	0							
Totals								

Figure 2.1: Modified PAR Score (10)

The modification of the PAR score

The early preliminary use of the PAR score is documented by Aldrete (3) on the evaluation of a group of 300 patients who had had surgery conducted on them and had received various forms of anaesthesia through different anaesthetic techniques. He also cited Perez-Tamayo et al and Holzgrove as having used the same score, with the clinical variables observed every 30 minutes after arrival at the PACU (3). He then cited himself and McDonald reporting on the use of the same score to assess a group of 2670 patients at shorter intervals of 15 minutes for the first hour and every hour thereafter.

For approximately 25years the PAR score had been accepted as the suggested discharge criteria for patients from the PACU before modifications were made to it (10). Before then, the PAR score had been endorsed by the Joint Commission of Accreditation of Health Care Organisation in the United States of America including other similar regulatory bodies in other countries in South America and Spain in Europe (10). The availability of the value of SO_2 prompted recommendations from Soliman et al; Kamal et al; Chung et al as cited by Aldrete (10) to be included in the score by replacing the colour index in the original score (35). Other modifications have been driven by the increase in ambulatory surgical practice (3, 5). However, the Modified PAR score remains a suitable tool to determine inpatients' readiness for discharge from PACU, as it assesses phase I recovery before the patients are discharged to the wards for further monitoring (3, 5). It is not suitable for determination of home readiness following ambulatory surgery (5, 37). Therefore in response to the requirements of ambulatory surgery the Post-Anaesthesia Recovery Score for Ambulatory Patients (PARSAP) was described (3). The modification was the inclusion of the following measures : pain; dressing ; ambulation; urine output; fast-feeding (3).

The use of the Modified PAR score to determine readiness for discharge

Brown et al (9) conducted a study with the primary aim of determining whether inpatients discharged from PACU "by a nurse following predetermined discharge criteria (Modified PAR score) reduces PACU length-of-stay and increases efficiency compared with the standard anaesthesia practice of contemporaneous discharge by a physician". The result was not only a 24% decrease in PACU time in the group that was nurse-evaluated using

predetermined discharge criteria but also the patients were no different from those discharged by physicians in terms of adverse events.

Truong et al (38) conducted a prospective cohort analysis, comparing the efficiency of the time-based discharge criteria to the Modified PAR Score, with pain and temperature added, in the PACU at Royal Darwin Hospital. Their primary finding was that the use of the Modified PAR score was associated with a shorter recovery time compared to the "traditional time-based discharge criteria".

Limitations of the PAR score

It is recognised by Aldrete that although he and Kroulik developed the PAR score, it falls short on considering other complications that mandate continued PACU stay and management or transfer of the patient to a critical care unit (3). These conditions include cardiac dysrhythmias not causing any blood pressure derangements, considerable bleeding at the surgical site, uncontrollable pain and significant nausea and vomiting (2, 6, 11). One or more these of complications can be present with a PAR score above nine, in which case the patient should be kept in PACU or be transferred to the critical care unit (3).

Chung (37) and the reviewed literature confirmed that the Modified PAR score is only valid for scoring inpatients. It should not be used to determine discharge readiness after ambulatory surgery (5, 37).

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

This chapter includes the aim and objectives of the study, ethical considerations, research methodology, data analysis and the validity and reliability of the study.

3.2 Aim of the study

The aim of this study was to evaluate the readiness for discharge of patients discharged from the Block 4 PACU at CMJAH using the Modified PAR Score.

3.3 Objectives

- describe patients' Modified PAR scores on admission to the PACU
- describe the Modified PAR score when patients are deemed ready for discharge from the PACU by the nurses
- describe the Modified PAR scores as recorded by the researcher following patients being deemed ready for discharge from the PACU by the nurses
- describe the time to discharge from the PACU of patients with a modified PAR score of ≥ 9
- describe the number of patients deemed ready for discharge from the PACU by the nurses with the Modified PAR score of < 9
- correlate the Modified PAR scores derived from patients' clinical indices as recorded by the PACU nurses and those determined from the researcher's reassessment when patients were deemed ready for discharge.

3.4 Ethical considerations

Approval to conduct the study was obtained from the Human Research Ethics Committee (Medical) (Appendix 1) and the Postgraduate Committee (Appendix 2) of the University of the Witwatersrand.

The CEO of CMJAH was approached for permission to conduct this study in the hospital (Appendix 3). The nursing manager of the Block 4 PACU was notified of the study prior to data being collected.

The researcher identified suitable participants in the waiting area of Block 4 PACU, explained the study and invited them to participate. Those agreeing to participate were given an information letter (Appendix 4) and asked to sign an informed consent form (Appendix 5). Anonymity was maintained as no identifying information was requested from the participants or used in data collection. Only the researcher and supervisors had access to the raw data thereby ensuring confidentiality. Participation was voluntary and participants were informed that they could withdraw from the study at any time with no repercussions. The collected data will be securely stored for a period of six years following completion of the study.

This study was conducted adhering to South African Good Clinical Practice Guidelines (6) and the Declaration of Helsinki (7).

3.5 Research methodology

3.5.1 Research design

Burns and Grove (39) describe a research design as a blueprint for a study. The research design determines the methods by which the researcher obtains subjects, collects data and interprets results (40).

This study design was prospective, descriptive and contextual.

A prospective study is a study in which the subjects are identified and then followed forward in time (40) as in this study.

A descriptive study is a study where more information is required in a particular field through the provision of a picture of the phenomenon as it occurs naturally (40). In this study the readiness for discharge of patients in the Block 4 PACU will be described.

This study is contextual in nature as it was conducted within a specific context. De Vos (41) describes context as a “small-scale world” of amongst others, gangs, clinics, hospital wards, or critical care units. The context for this study was the Block 4 PACU at CMJAH.

3.5.2 Study population

All adult inpatients scheduled for elective and emergency surgical procedures in Block 4 operating theatres at CMJAH.

3.5.3 Study sample

Sampling method

A convenience method of sampling was used, as is appropriate for descriptive studies (39). Convenience sampling is a non-random sampling method where the most readily accessible individuals or units are included in a study (40). Consenting patients presenting to Block 4 theatres were included in the study until the desired sample size was reached.

Sample size

In consultation with a biostatistician a sample size of 73 patients was obtained using the StatCalc utility of the Epi-Info programme. The value was based on the expected frequency of 5% (8) of patients not being ready for discharge from the PACU at the time of discharge as reported in previous studies.

Inclusion and exclusion criteria

The inclusion criteria for this study were:

- adult patients 18 years and older
- having had elective or emergency procedures
- assessed by the nursing staff as ready for discharge.

The exclusion criteria for this study were:

- patients who did not consent to inclusion in the study
- patients who had received premedication
- patients who could not communicate effectively with the researcher.

3.5.4 Data collection

Data collection method

The researcher collected data in the following manner. Suitable patients who presented for surgery in the preoperative waiting area of the Block 4 theatres were identified by the researcher and invited to take part in the study. The study was explained in the language most comprehensible to the patient, as the researcher speaks several African languages, and an information letter (Appendix 4) was given to the patient. If the patients agreed to take part in the study, written consent was obtained (Appendix 5).

Patients were transferred from theatre postoperatively to the Block 4 PACU, where they were recovered following handover from the anaesthetist and the scrub nurse. There was no interference from the researcher with the handing over and the nursing recovery process of the patient participating in the study. The researcher documented the patient's Modified PAR score on admission to the Block 4 PACU discretely. Then the researcher requested to be notified when patients were ready for discharge to the ward. Patients declared ready for discharge by the PACU nurse were re-evaluated by the researcher at their respective PACU station, using the same monitors used during their recovery. This was done to retain reliability and validity of the measurements. The researcher then determined the patient's readiness for discharge using the Modified PAR scores (Appendix 6) by deriving scores from the last set of clinical indices recorded by the PACU nurse when she deemed the patients ready for discharge and from those measured by the researcher during the re-evaluation. Data was collected over an extended period of time (19 May 2014 - 11 July 2014) when it was convenient for the researcher; this also prevented the PACU nurses from modifying their current practice due to their being aware that the study was being conducted in their area of practice. If a patient had a Modified PAR Score of <9 the patient was retained and recovered further up until such time that they had achieved a score of ≥ 9. See Figure 3

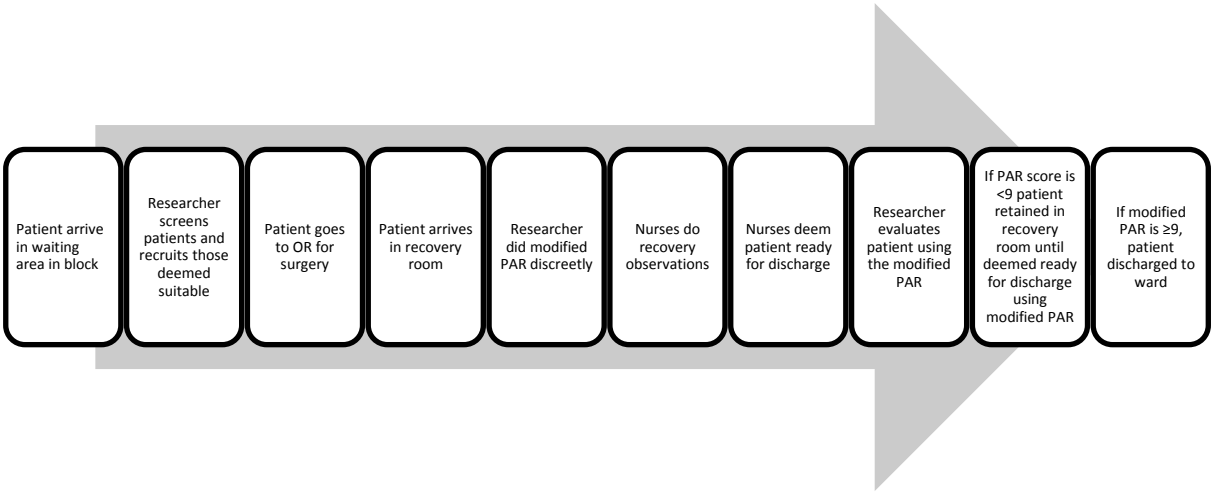


Figure 3.1 **Flow Diagram of data collection**

The following data were collected on a data collection sheet (Appendix 6).

- Demographics and pre-operative blood pressure.
- Five clinical parameters of the Modified PAR score namely activity, respiration, circulation, consciousness and oxygen saturation that were recorded at specific intervals:
    - on admission to PACU (standard current practice)
    - prior to discharge from PACU (standard current practice)
    - on re-examination by the researcher.
- The Modified PAR Score was calculated for each of the specific intervals.

3.5.5 Data analysis

Data was captured on a Microsoft Excel spreadsheet and analysed using STATISTICA version 9.1 for Windows. In consultation with a biostatistician descriptive and inferential statistics were performed. Data was summarised using frequencies, percentages, means and standard deviations (SD) and ranges. Spearman Rank correlation was used to correlate the discharge scores recorded by the researcher and those derived from clinical indices recorded by PACU nurses, as these were not normally distributed. Kolmogorov-Smirnoff was used to assess the normality of data distribution. A p value of 0.05 was considered statistically significant.

3.6 Validity and reliability

The validity of a study refers to the truth or accuracy of a claim. This is important during the research process and provides a basis for deciding which decisions are useful for patient care (40).

Reliability of a measure represents consistency of measurements of a particular tool and shows the magnitude of random error in the measurement method (40).

The validity and reliability in this study were attained through the following measures:

- the sample size was determined in consultation with a biostatistician;
- an appropriate study design was used;
- a validated scoring tool was used;

- all data was collected by the researcher;
- data was analysed in consultation with a biostatistician.

3.7 Summary

In this chapter the aim and objectives, ethical considerations, research methodology, data analysis and validity and reliability were discussed. In the following chapter the results of the study are reported and discussed.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

The aim of this study was to evaluate the readiness for discharge of patients discharged from the Block 4 PACU at the CMJAH. In this chapter the results will be presented according to the objectives of this study. This will be followed by a discussion of the results. The objectives of this study were to:

- describe patients' Modified PAR scores on admission to the PACU
- describe the Modified PAR score when patients are deemed ready for discharge from the PACU by the nurses
- describe the Modified PAR scores as recorded by the researcher following patients being deemed ready for discharge from the PACU by the nurses
- describe the time to discharge from the PACU of patients with a modified PAR score of ≥ 9
- describe the number of patients deemed ready for discharge from the PACU by the nurses with the Modified PAR score of < 9
- correlate the Modified PAR scores derived from patients' clinical indices as recorded by the PACU nurses and those determined from the researcher's reassessment when patients were deemed ready for discharge

4.2 Results

Data was collected from the anaesthetic charts as recorded by the PACU nurses and from the clinical re-evaluation by the researcher of the patients deemed ready for discharge from the Block 4 PACU. These were patients who had presented for both elective and emergency surgery in the Block 4 theatres between 19 May and 11 July 2014. Descriptive and inferential statistics were used to analyse this data. Numbers are rounded off to two decimal places and therefore percentages may not add up to 100%.

Modified PAR scores of patients deemed ready for discharge by the PACU nurses were derived from the clinical indices in the anaesthetic charts recorded by the nurses prior to discharge. The modified PAR score consists of the same indices i.e. Activity, respiration, circulation, consciousness, and oxygen saturation.

4.2.1 Demographic profile of the patients

Data was collected from 80 patients during the study period. Of these patients 35 (43.75%) were male and 45 (56.25%) were female. The mean age of patients was 45.26 years (SD 18.32 years). Sixty eight (85%) patients had surgery performed during the day and 12 (15%) patients at night. Of the 80 cases, 59 (73.75%) were elective and 21 (26.25%) were emergencies. A general anaesthetic was administered to 58 (72.50%) patients, a regional anaesthetic to 14 (17.50%) and 8 (10%) patients received both a general and a regional anaesthetic.

4.2.2 Patients modified PAR scores on admission to the PACU

A modified PAR score was determined for each of the participating patients on arrival in the PACU from the operating theatre. 32 (40%) had a modified PAR score of ≥ 9 and 48 (60%) had scores < 9. The actual scores are shown in Table 4.1.

Table 4.1 Modified PAR scores on admission to PACU

Modified PAR score	Number of patients (n)	Percentage of patients (%)
10	11	13.75
9	21	26.25
8	26	32.50
7	13	16.25
6	7	8.75
5	2	2.50

4.2.3 Modified PAR scores of patients deemed ready for discharge from the PACU by the nurse

Of the 80 patients, 69 (86.25%) patients had a modified PAR score of ≥ 9, satisfying the criteria for discharge. Eleven (13.75%) patients deemed ready for discharge by the PACU nurses had Modified PAR scores of <9, not satisfying the criteria for discharge and hence were retained in PACU by the researcher to undergo further recovery. The actual scores are shown in Table 4.2**.**

Table 4.2 Modified PAR scores derived from indices recorded by the PACU nurses of patients deemed ready for discharge

Modified PAR score	Number of patients (n)	Percentage of patients (%)
10	20	25.00
9	49	61.25
8	6	7.50
7	4	5.00
6	0	0.00
5	1	1.25

4.2.4 Modified PAR scores of patients deemed ready for discharge from the PACU done by the researcher

The researcher repeated the modified PAR scores on each of the patients immediately following the patient being deemed ready for discharge from the PACU by the nurses. These scores are shown in Table 4.3.

Table 4.3 Modified PAR scores determined by the researcher once deemed ready for discharge from the PACU

Modified PAR score	Number of patients (n)	Percentage of patients (%)
10	36	45.00
9	33	41.25
8	6	7.50
7	5	6.25

Again, 69 (86.25%) patients who had modified PAR scores of ≥ 9 were deemed ready for discharge. 11 (13.75%) patients were not ready for discharge according to their Modified PAR scores of <9. The number of patients ready for discharge and those not ready for discharge according to the PAR scores were the same for the researcher and the nurses but the actual scores were not the same. This is shown in Fig. 4.1.

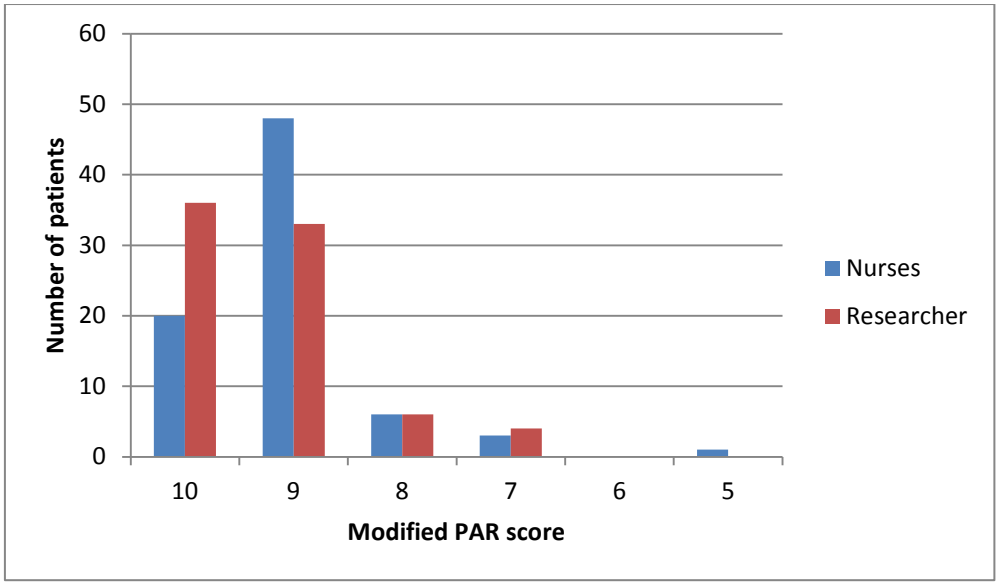


Figure 4.1: Modified PAR scores derived from the indices recorded by nurses and those determined by researcher for patients deemed ready for discharge from PACU by the nurses

4.2.5 Time to discharge of patients admitted with a modified PAR score of ≥ 9

Of the 80 patients included in the study, 32 (40%) entered the PACU with a Modified PAR score of ≥ 9. Of these patients, 11 (34.38%) had a score of 10 and 21(65.63%) had a score of 9. The mean time to discharge from the PACU for these patients was 21.56 minutes (SD 11.16 minutes). The overall time that patients remained in the PACU following readiness for discharge according to the Modified PAR score was 18.79 minutes (SD 11.96 minutes); this included those ready for discharge on admission. The time to discharge ranged from 5 – 45 minutes.

4.2.6 Number of patients deemed ready for discharge by the nurses with a modified PAR score of < 9

Eleven (13.75%) patients who had Modified PAR scores of < 9 were deemed ready for discharge from the PACU by the nurses. Six of 11 patients had a score of 8, 4 had a score of 7 and 1 had a score of 5. This is shown in Table 4.2

4.2.7 Correlation between the modified PAR scores recorded by nurses and those recorded by the researcher when the patient was deemed ready for discharge from the PACU

As the Modified PAR scores recorded by the nurses and the researcher were not normally distributed (Kolmogorov-Smirnoff 0.3509 and 0.2615 respectively), a correlation was done using Spearman's Rank test.

There was a strong correlation between the Modified PAR scores recorded by the nurses and by the researcher which was statistically significant ($r = 0.7243$, $p = <0.001$).

4.3 Discussion

Although, as emphasized in an editorial by Lundgren (33), the patient, following anaesthesia, remains the responsibility of the anaesthesiologist and must be discharged by the anaesthesiologist from the recovery room, the responsibility for discharging patients is usually delegated to a responsible PACU nurse (42). This makes the use of discharge criteria essential in order to ensure that patients are ready to be safely discharged from the PACU. In this study the Modified PAR score criteria were used to assess patients' readiness for discharge from the PACU. All the patients in this study had either received a general anaesthetic or regional anaesthesia with sedation. Patients who had received regional anaesthesia and sedation were included as all the parameters of the Modified PAR score needed to be satisfied before they could be safely discharged.

Thirty two (40%) of the patients admitted to the Block 4 PACU had a Modified PAR score of ≥ 9 on admission and were therefore, according to the score, ready for discharge immediately. It is however reasonable to retain these patients in the PACU at least until a second set of observations is done approximately 10 minutes later before discharging the patients to an area where they are less likely to receive the same standard of care and to ensure no adverse outcome following anaesthesia.

The time to discharge of the patients scoring ≥ 9 on the Mod PAR score was 21.56 minutes (SD = 11.16 minutes). In a study by Brown et al (9), in the group of patients in which the nurse determined readiness for discharge using discharge criteria, the mean time to discharge was 31.1 minutes (SD= 49.1 minutes). This was almost 10 minutes longer than the delay in discharging patients in the current study. Despite this, the length of stay in the

PACU in the group of patients discharged by the nurses in the study by Brown et al (9) was significantly shorter than in the group of patients who were discharged by the anaesthesiologist (31.1 minutes versus 68.6 minutes). This was often due to unavailability of the anaesthesiologists once they had been notified by the PACU nurse. The authors of the study concluded that when PACU nurses determined readiness for discharge using predetermined discharge criteria there was a 24% decrease in the length of time that patients spent in the PACU following readiness for discharge. Also, there was no increase in adverse events and therefore patient outcome was not compromised.

Of the patients deemed ready for discharge from the PACU by the nurses in this study, 11 (13, 75%) scored < 9 and were therefore deemed ready for discharge prematurely. The minimum nurse to patient ratio in the PACU, as recommended by SASA (1), should be a minimum of 1:2; the researcher observed, however, that this ratio was often below this recommended ratio in Block 4 PACU. The scrub nurse on duty after 16h00 had to remain in the PACU and recover the patient which may have led to a hasty discharge as the scrub nurse had other responsibilities to attend to. This makes the use of discharge criteria essential in order to ensure that patients are ready to be safely discharged from the PACU. It has however been noted that that attaching numbers to a clinical sign should never replace professional judgement and common sense (43). Ead (4) further states that a discharge score is only “part of the discharge assessment”.

No similar studies to our study could be identified in the literature. Interesting to note is that Alberts (43) in an informal survey at Kalafong hospital, where the Modified PAR score is used, concluded that PACU nurses knowledge of the use of the score was better than that of the anaesthesiology registrars.

However it is important to note that Scribante and Perrie (32) in a pilot study to determine the profile of recovery room nurses in Johannesburg hospitals, reported that 57.1% of nurses working in the selected hospitals were professional nurses and 42.9% were enrolled nurses. Professional and enrolled nurses do to not have similar undergraduate training and would therefore not have the same knowledge base of recovery room care. Further, only 35.7% of professional nurses and 4.8% of enrolled nurses had an anaesthetic nurse qualification, a six month course that is not accredited by the South African Nursing Council.

There is currently no South African Nursing Council accredited course available for recovery room nurses in South Africa. This research was done in one of the hospitals included in the Scribante and Perrie (32) study and the profile of the Block 4 PACU nurses may have influenced the premature discharges and prolonged time to discharge identified in their study.

CHAPTER 5: SUMMARY, LIMITATIONS, RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

In this chapter the summary of the study will be presented. The limitations of the study will be addressed, recommendations for clinical practice and further research made and a conclusion presented.

5.2 Summary of the study

5.2.1 The aim of the study

The aim of this study was to evaluate the readiness for discharge of the patients discharged from the Block 4 PACU at CMJAH using the Modified PAR score.

5.2.2 Objectives of the study

- describe the patients modified PAR scores on admission to the PACU
- describe the modified PAR score when patients are deemed ready for discharge from the PACU by the nurses
- describe the modified PAR scores as recorded by the researcher following patients being deemed ready for discharge from the PACU by the nurses
- describe the time to discharge from the PACU of patients with a modified PAR score of ≥ 9
- describe the number of patients deemed ready for discharge from the PACU by the nurses with the Modified PAR score of < 9
- correlate the Modified PAR scores derived from patients' clinical indices as recorded by the PACU nurses and those determined from the researcher's reassessment when patients were deemed ready for discharge.

5.2.3 Summary of the methodology used in the study

The research design was that of a prospective, descriptive and contextual study design. In consultation with a biostatistician a sample size of a minimum of 73 patients was determined and a convenience sampling method was used to select patients.

All adult patients presenting for elective and emergency surgery in Block 4 theatres who met the inclusion criteria of the study were invited to take part in the study. The Modified

PAR score was used by the researcher to derive the patients' discharge scores using the patients' last clinical indices recorded by the PACU nurse when deemed ready for discharge. Thereafter the researcher reassessed the patients' clinical indices by re-evaluating them physically to derive Modified PAR scores. The patients were deemed ready for discharge when the researcher's scores were ≥9 and not ready for discharge when the scores were < 9, in which instance the patients were retained until their scores were ≥ 9.

5.2.4 Results

The number of patients deemed ready for discharge by the nurses but had Modified PAR scores <9 was 11 (13.75%). They had to be retained in PACU until they had achieved scores ≥ 9 for safe discharges to their respective wards. The remaining 69 (86.25%) patients had a Modified PAR score ≥ 9 which met the criteria for discharge.

On patient reassessment by the researcher the results were the same in terms of population percentages of those ready for discharge and those not ready. The only difference documented was the actual scores which did not affect the difference in the percentages of groups observed.

Of the 80 patients that were included in the study, 32 (40%) were admitted to the PACU with scores ≥ 9. These patients spent a mean time to discharge of 21.56 minutes with a standard deviation of 11.16 minutes and the time range was 5-45 minutes indicating that these patients were retained in PACU longer than it was necessary, a burden to an already ailing resource.

There was strong correlation between the Modified PAR scores derived from the indices as recorded by the nurses and those by the researcher which was statistically significant($r=0.7243$, $p=<0.001$).

5.3 Limitations

This was a contextual study done in the Block 4 PACU and the results from the study may not be generalised to the other theatre Blocks at CMJAH or to other hospitals.

Convenience to sampling was used in this study and this may have meant that the results from this study may not reflect a comprehensive view of Block 4 PACU patients' readiness for discharge. The researcher collected data during office hours (07:00 to 16:00) when not on duty in theatre. During office hours the PACU was staffed with 2 full time nurses generally resulting in 1:2 nurse patient ratios. After office hours the "scrub sisters" double up as PACU nurses during the patients' recovery period whilst pressurised by other responsibilities awaiting them within the theatre complex. This may have resulted in patients being discharged prematurely. Also the researcher was the only data collector and the Block 4 PACU has a high turnover of patients. On occasion patients were discharged before they were evaluated by the researcher.

The use of the Modified PAR score is limited in itself because the score is silent on other clinical parameters which are important in the post-anaesthesia period e.g. pain. A number of patients who had achieved scores of ≥ 9 had feature of severe pain. The researcher intervened and retained these patients for the administration of analgesia by the respective anaesthesiologists who had conducted the anaesthetic during the intraoperative period.

5.4 Recommendations

5.4.1 Recommendation for clinical practice

In the literature review it emerges that there is no validated gold standard for discharge criteria however, the SASA guidelines (1) advocate for the use of the Modified PAR score with the context of clinical judgment when discharging patients safely either as in-patients or ambulatory cases (33). The clinical indices currently recorded are actually the parameters of the Modified PAR score and if these indices are derived as a "score" such as the Modified PAR score, the nurses may have a more holistic view of patients' readiness for discharge.

All the nurses working at CMJAH theatres should receive in-service training in the use and limitations of the Modified PAR score.

A large poster of a Modified PAR score should be placed prominently on a wall and or a copy of the Modified PAR score should be completed as part of every recovery record.

It is further recommended that the department of anaesthesiology and hospital management be cognisant of the SASA practice guidelines (1) with regard to the anaesthetists' PACU responsibility and the nurse staffing requirements when staffing PACUs.

5.4.2 Recommendations for further research

If the Modified PAR score is implemented at CMJAH then its impact should be evaluated to ensure safe patient discharge. Further research needs to be conducted evaluating other factors that influence prolonged length of stay in the PACU.

The profile of the PACU nurses in terms of qualifications, knowledge and experience was not assessed in this study. Further research should be undertaken to determine if these variables influence safe patient discharge from the PACUs.

5.5 Conclusion

The discharging of patients from a PACU without using predetermined discharge criteria such as the Modified PAR score results in patients being discharged prematurely, which is unsafe for the patient. Patients may also be retained longer than they should be in the PACU, which is misuse of a scarce resource, due to lack of a formal, simple, numbered and structured tool such as the Modified PAR score.

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APPENDICES

Appendix 1

Permission from Ethics Committee

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr Mpucuko Nxumalo

CLEARANCE CERTIFICATE	M110713
PROJECT	Evaluation of Readiness for Discharge from the Block 4 Operating Theatres Post Anaesthetic Care unit
INVESTIGATORS	Dr Mpucuko Nxumalo.
DEPARTMENT	Department of Anaesthesiology
DATE CONSIDERED	29/07/2011
M1107130DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 30/10/2011 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Ms Juan Scribante

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**
PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

APPENDIX 2

Permission from the Postgraduate committee

Faculty of Health Sciences
Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172040

Reference: Ms Thokozile Nhlapo
E-mail: thokozile.nhlapo@wits.ac.za

24 February 2014
Person No: 567673
PAG

Dr M Nxumalo
18 Oudebosch Estate
Syringa Avenue
Broadacres
2021
South Africa

Dear Dr Nxumalo

Master of Medicine: Approval of Title

We have pleasure in advising that your proposal entitled *Evaluation of readiness for discharge from the block 4 operating theatres Post Anaesthetic Care unit* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix 3

Permission from the CEO



health and social development
Department: Health and Social Development
GAUTENG PROVINCE

CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL

Office of the CEO
Enquiries: L. Mngomezulu
(011): 488-3793
(011) 488-3753
22nd November 2011

Dr. Mpucuko Nxumalo
Anaesthesiology Department
CMJAH

Dear Dr. Nxumalo

RE: **"Evaluation of readiness for discharge from the Block 4 operating theatres post anaesthetic care unit"**

Permission is granted for you to conduct the above research as described in your request provided:

1. Charlotte Maxeke Johannesburg Academic hospital will not in anyway incur or inherit costs as a result of the said study.
2. Your study shall not disrupt services at the study sites.
3. Strict confidentiality shall be observed at all times.
4. Informed consent shall be solicited from patients participating in your study.

Please liaise with the Head of Department and Unit Manager or Sister in Charge to agree on the dates and time that would suit all parties.

Kindly forward this office with the results of your study on completion of the research.

Yours sincerely

Dr. Barney Selebano
Chief Executive Officer

Appendix 4

Information Letter

Evaluations of readiness for discharge from the block 4 Operating theatres Post Anaesthetic Care Unit

Hello Sir/Madam

I am Mpucuko Nxumalo, one of the doctors in the department of anaesthetics and am one of the members responsible for your care during and after your operation. I am conducting a study about carefully observing that you have appropriately recovered from the medicines you received during and after the operation before you are transferred back to the ward. I would like to invite you to participate.

After you have had your operation, you will be transferred to the recovery room where you will be carefully observed by our nursing staff. This is what normally happens after you have had an operation. You will have your breathing and blood pressure checked, blood oxygen saturation checked with the 'finger device' and you will be asked to move your limbs and respond to your name as part of your observations. Again, this is normal procedure. Once, you have adequately recovered I will examine you before you are transferred back to the ward by repeating the checks that the nurse has already done. The benefit to you is that the chances of you being discharged back to the ward before are completely ready will be reduced.

Your participation is voluntary and you will not be penalised should you not want to participate. You can withdraw from this study at any time without having to give a reason. You will still receive the appropriate health care to which you are entitled. I will do my best to keep your identity and results a secret. No names will be put in any results of the study. If you are willing to participate in this study, I will ask you to sign a consent form.

You are welcome to contact the researcher and the Research Ethics Committee, should you need to ask any further questions about the study and your participation.

Researcher:

Dr Mpucuko Nxumalo

Department of Anaesthetics

Tel: 011 488 4343

Research Ethics Committee

Prof Cleaton-Jones

Tel: 011 717 2301

Thank you for reading this letter

Dr Mpucuko Nxumalo

Appendix 5

Informed Consent Form

Research Title: Evaluation Of readiness for discharge from the block 4 Operating theatres Post Anaesthetic Care UNIT.

I _____understand the content of the information letter and I have had the opportunity to ask questions and these have been answered to my satisfaction. I am aware that I may withdraw from the study at any time without any prejudice towards me.

I hereby voluntarily give consent to participate I this study.

…….

(Participant)

……

(Date)

Appendix 6

The Modified PAR score

		Admission	5 min	15 min	30 min	45 min	60 min	Discharge
Activity								
Able to move 4 extremities voluntary or on command	2							
Able to move 2 extremities voluntary or on command	1							
Unable to move extremities voluntary or on command	0							
Respiration								
Able to breathe deeply and cough freely	2							
Dyspnoea and limited breathing	1							
Apnoeic	0							
Circulation								
BP ± 20% of pre-anaesthetic level	2							
BP ± 20% to 49% of pre-anaesthetic level	1							
BP ± 50% of pre-anaesthetic level	0							
Consciousness								
Fully awake	2							
Arousable on calling	1							
Not responding	0							
O2 Saturation								
Able to maintain O2 saturation >92%	2							
Needs O2inhalation to maintain O2 saturation >92%	1							
O2 saturation <90% even with O supplement	0							
Totals								