

AN AUDIT OF THE TIME SPENT BY PATIENTS IN THE POST ANESTHETIC CARE UNIT BEFORE AND AFTER THE INTRODUCTION OF A DISCHARGE CRITERIA SCORING SYSTEM AT TYGERBERG ACADEMIC HOSPITAL

Thesis presented by
Dr Sean Dwyer
MBChB (Stell), DA (SA), FCA (SA)

For completion of the degree

MMed (Anesthesiology)

Faculty of Health Sciences, University of Stellenbosch

Promotor:

Dr M De Kock

MSc (Stell), MBChB (Stell), MMed (Anes), FCA (SA)
Department of Anesthesiology and Critical Care
University of Stellenbosch

2013

Declaration

By electronically submitting this thesis, I hereby declare that the work contained in this assignment is my own original work and has not previously, in its entirety or in part, been submitted at any university for a degree.

January 2014

copyright stellenbosch university
all rights reserved

SUMMARY

BACKGROUND

Post anesthesia discharge criteria scoring systems have been used successfully to aid discharge from the post anesthetic care unit (PACU) for over 40 years. They do not replace, but rather act in conjunction with good clinical judgment, and provide concise, standardized documentation of a patient's readiness for discharge. ^{1,2,3,4,5}

In order to improve patient safety, provide clear documentation and to aid future audit, a discharge criteria scoring system was developed for use in our PACU (Addendum A). It is a modification of the Aldrete Scoring System and the modified Post Anesthetic Discharge Scoring System (PADSS) proposed by Chung.¹

There is a steadily increasing patient burden on the existing medical infrastructure in South Africa. Tygerberg Academic Hospital is no exception, and because of the high demand on our theatre services, optimal efficiency is essential.

We speculated that our discharge criteria scoring system might increase the efficiency of our PACU when compared to the traditional time based system. The more healthy patients, undergoing minor procedures, could potentially spend less time in PACU, allowing the nurses to focus on problem cases. Increasing the speed of transit might also help prevent delays in theatre due to lack of bed space in PACU.

Our primary endpoint was to compare the duration of time spent by patients in the PACU at Tygerberg Academic Hospital, from the moment they are admitted, to the time they are discharged to the ward, before and after the introduction of a discharge criteria scoring system.

While planning the audit, one of the factors that staff identified as contributing to delayed discharge from PACU, was the time it took for the wards to collect their patients.

A secondary objective, therefore, was to assess the amount of time that elapsed between calling the ward to collect the patient, and the patient leaving PACU.

METHODS AND MATERIALS

Prior to commencing the audit, approval was obtained from the Human Research Ethics Committee of the Faculty of Health Sciences of the University of Stellenbosch and Tygerberg Academic Hospital.

The Audit, its purpose and possible benefits, was discussed with representatives of the nurses working in PACU, and written consent was obtained from those who would be involved in the data collection (Addendum B).

Audit forms (Addendum C), collection boxes, and posters reminding staff to participate in the audit were prepared.

Our first audit was performed over approximately a week in August 2012. During this period, the traditional time-based discharge system was still in operation. Data was captured from 327 patients. Audit forms were placed in a collection box, which was cleared daily by the primary investigator.

The discharge criteria scoring system was introduced to the PACU staff in January 2013. The nurses were trained in its use, and a one month period was allowed for all involved to become accustomed to the new system.

A second audit was performed in February 2013, again over a week, during which we gathered data from 313 patients.

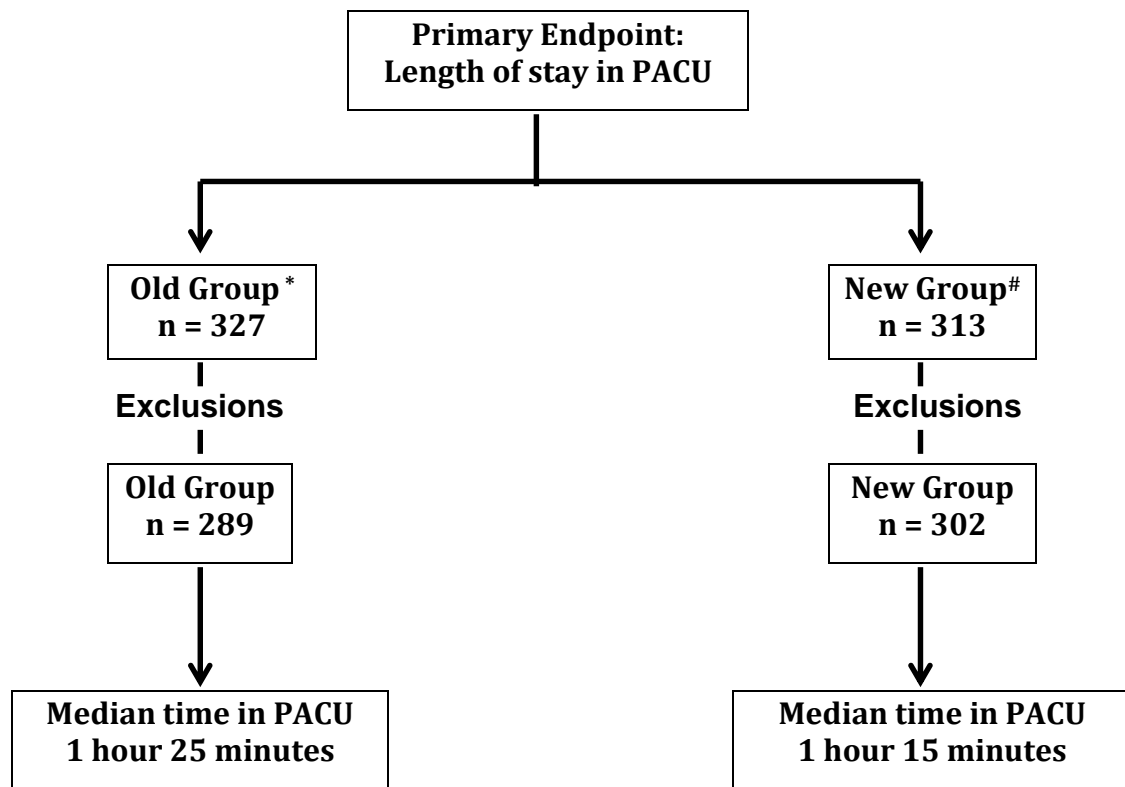
RESULTS

The median value of the time spent by patients in the PACU decreased from 1 hour 25 minutes, to 1 hour 15 minutes, after introduction of the discharge criteria scoring system. This was statistically significant (p -value = 0.003).

The median time between calling the ward to collect a patient, and the patient leaving recovery, was 15 minutes.

CONCLUSION

The main finding of the study was that the introduction of a discharge criteria scoring system decreased the median duration of time spent by patients in the post anesthetic care unit at Tygerberg Academic Hospital.



Summary of Primary Endpoint: Length of stay in PACU

*Old Group = Time based discharge system

#New Group = Discharge criteria scoring system

OPSOMMING

AGTERGROND

Puntestelsels as ontslag kriteria na narkose, word vir die afgelope 40 jaar suksesvol gebruik as maatstaf om pasiënte uit die herstelkamer te ontslaan. Hierdie kriteria vervang nie goeie kliniese oordeel nie, maar is 'n addisionele hulpmiddel om te bepaal of die pasiënt gereed is vir ontslag en om noukeurige, gestandaardiseerde dokumentasie te verseker.^{1,2,3,4,5}

'n Nuwe puntestelsel vir ontslag is vir die herstelkamer van Tygerberg Akademiese Hospitaal ontwikkel om pasiëntesorg en dokumentasie te verbeter, asook om ouditering in die toekoms te vergemaklik (Addendum A). Hiervoor is die *Aldrete Scoring System* en die gemodifiseerde PADSS, voorgestel deur Chung, aangepas.¹

Die bestaande mediese infrastruktuur in Suid-Afrika beleef tans 'n geleidelike toename in die getal pasiënte. Tygerberg Akademiese Hospitaal is geen uitsondering nie en as gevolg van die hoë aanvraag na ons teaterdienste, is uiterste doeltreffendheid noodsaaklik.

Ons vermoede was dat hierdie aangepaste puntestelsel doeltreffendheid in die herstelkamer sou verbeter in vergelyking met die meer tradisionele tyd-gebaseerde sisteem. Gesonde pasiënte wat kleiner prosedures ondergaan, sal waarskynlik na 'n korter periode ontslaan kan word wat die verpleegpersoneel in staat sal stel om meer aandag aan probleem gevalle te gee. Bespoediging van die pasiëntvloei behoort onnodige vertraging van teatergevalle weens 'n tekort aan beddens in die herstelkamer, te beperk.

Die primêre doel van die studie was om te bepaal of die gebruik van die aangepaste puntestelsel as ontslag kriteria in Tygerberg Akademiese Hospitaal, die tydperk wat die pasiënt in die herstelkamer deurbring, verkort.

Die herstelkamer verpleegsters het beweer dat die saal personeel 'n lang tyd gevat het om hulle pasiente in herstelkamer te kom haal.

Vervolgens is 'n sekondêre doelwit ingesluit om die tydperk te bepaal vandat die saalpersoneel in kennis gestel word, totdat die pasiënt die herstelkamer verlaat.

METODE

Goedkeuring is verkry van die Menslike Navorsing en Etiese Komitee van die Gesondheidswetenskap Fakulteit van die Universiteit van Stellenbosch en Tygerberg Akademiese Hospitaal voor die aanvang van die studie.

Die studie, asook die doel en moontlike voordele daarvan is vooraf bespreek met verteenwoordigers van die herstelkamer verpleegpersoneel en skriftelike toestemming is verkry van al die deelnemers wat betrokke sou wees by die data versameling (Addendum B).

Oudit vorms (Addendum C), versamelhouers en inligtingsplakkate vir die betrokke personeel is voorberei.

Die aanvanklike oudit is in Augustus 2012 oor 'n periode van ongeveer een week uitgevoer. Tydens hierdie oudit is die tradisionele tydgebaseerde sisteem gebruik. Inligting van 327 pasiënte is versamel. Die oudit vorms is in die versamelbokse geplaas en is daagliks deur die primêre navorser verwyder.

Die aangepaste puntstelsel as ontslag kriteria, is in Januarie 2013 in die herstelkamer geïmplementeer. Die verpleegpersoneel het opleiding ontvang waarna die aangepaste puntstelsel vir een maand gebruik is om te verseker dat die personeel vertrouwd is daarmee.

In Februarie 2013, is 'n tweede oudit oor 'n tydperk van een week uitgevoer, waartydens inligting van 313 pasiënte versamel is.

RESULTATE

Na die implementering van die aangepaste puntstelsel as ontslag kriteria, het die mediane tyd wat pasiënte in die herstelkamer deurbring afgeneem van 1 uur en 25 minute tot 1 uur en 15 minute. Hierdie afname is statisties betekenisvol (p -waarde = 0.003)

Die mediane tyd vandat die saal in kennis gestel is totdat die pasiënt die herstelkamer verlaat, was 15 minute.

GEVOLGTREKKING

Die hoof bevinding van die studie is dat die mediane tydperk wat die pasiënte in die herstelkamer deurbring verminder is deur die implementering van die aangepaste puntstelsel as ontslag kriteria in Tygerberg Akademiese Hospitaal.

Acknowledgements

I would like to thank the following people:

The late Dr. Pieter le Roux, for his guidance, and for the design of the new PACU forms and protocol poster.

Dr. Marianna de Kock, for developing the discharge criteria, and for supervising me in Pieter's absence.

Mr. Justin Harvey of the Centre for statistical consultation, University of Stellenbosch for the statistical analysis.

Dr Rozanne van Wijk for translating the summary into Afrikaans.

CONTENTS

1. Introduction.....	1
2. Aim of this study.....	5
2.1 Primary Endpoint of the Study	
2.2 Secondary Endpoint of the Study	
3. Methods and Materials.....	6
3.1 Ethical Approval	
3.2 Informed Consent	
3.3 Inclusion Criteria	
3.4 Exclusion Criteria	
3.5 Conducting the Audit	
3.6 Statistical Methods	
4. Results.....	8
5. Discussion.....	12
6. Conclusion.....	15
References.....	16
Addendum A: The discharge criteria scoring system used in this study.....	18
Addendum B: Informed Consent.....	19
Addendum C: Data Collection Sheet.....	21
Addendum D: Ethics Committee Approval.....	22
Addendum E: Permission to conduct research at Tygerberg Hospital.....	23

List of Figures

Figure 1: Histogram illustrating the length of time spent by patients in PACU while using the time based discharge system.

Figure 2: Histogram illustrating the length of time spent by patients in PACU while using the discharge criteria scoring system.

Figure 3: Boxplot illustrating the length of time spent by patients in PACU, before and after the introduction of the discharge criteria scoring system.

List of Tables

Table 1: The Aldrete Scoring System and PADSS

Table 2. Age in each group.

Table 3. Percentage of Males and Females in each group.

Table 4. Percentage of patients in each ASA category.

Table 5. Duration of Anesthetic in each group.

Table 6. Time spent in PACU.

Table 7. Time between calling the ward and leaving PACU

1. INTRODUCTION

Post anesthesia discharge criteria scoring systems have been used successfully to aid discharge from the post anesthetic care unit (PACU) for over 40 years. They do not replace, but rather act in conjunction with good clinical judgment, and provide concise, standardized documentation of a patient's readiness for discharge. ^{1,2,3,4,5}

RESPONSIBILITY

Anesthetists bear the primary responsibility for discharging patients from the post anesthetic care unit (PACU). ^{6,7} This task may be delegated to appropriately trained recovery staff, on the condition that they operate in accordance with strict discharge criteria. ⁶ If there is any doubt as to whether a patient fulfills the criteria, the responsible anesthetist must assess the patient and decide on further management. ^{6,7}

PHASES OF RECOVERY

Recovery from anesthesia occurs in three phases. Phase I, describes the period from discontinuation of anesthesia to the return of protective reflexes and motor function, and normally occurs in the PACU. Phase II begins on discharge from PACU, and is judged to be complete when the patient is ready for discharge home. Phase III continues at home, under the supervision of a responsible adult, until the patient returns to preoperative psychological and physical function. ^{1,2}

DISCHARGE CRITERIA SCORING SYSTEMS

The Aldrete scoring system, the first to gain widespread use in the discharge of patients from PACU, is a modification of the Apgar score used to assess infants. ¹ It is simple, practical and easy to remember, and has been extensively validated in the assessment of transition from Phase I recovery to Phase II recovery. ² The Aldrete score considers respiration, oxygen saturation, consciousness, circulation (blood pressure) and activity (Table 1).

With the steady increase in the numbers and complexity of day case, or ambulatory procedures, it became important to identify criteria that could be used to determine when patients could safely go home. ³ To this end the Post-Anesthetic Discharge Scoring System (PADSS) was developed by Chung ^{4,5}, while Aldrete produced the Modified Post anesthetic Recovery Score (PARS). ² Both essentially added scores for bleeding, pain, ambulation, nausea and vomiting, as well as the ability to void and tolerate oral fluids.

VOIDING AND ORAL INTAKE

The importance of these last two factors, voiding and oral intake, has long been controversial, and they were subsequently omitted from the modified PADSS score (Table 1).^{3,5}

Schreiner et al. found that requiring children to drink before hospital discharge, appeared to increase the rate of vomiting and prolong the duration of hospital stay.⁸ Omitting the need to drink before discharge did not increase the need for readmission. Various authors have supported similar conclusion for adults.⁹

Insisting that patients pass urine can lead to delays in discharge. There is evidence that outpatients, not at high risk of urinary retention, can be safely discharged before they have voided without urinary retention problems at home.^{3,9,10}

Risk factors for postoperative urinary retention include a history of postoperative urinary retention, neuraxial anesthesia, pelvic, urological or rectal surgery, perioperative catheterization and inguinal hernia repair.^{3,10} These high risk patients should demonstrate ability to void before being discharged home.

That said, a study by Mulroy et al. suggests that it may be safe to discharge day surgery patients who have had neuraxial anesthesia with short acting drugs for low risk surgical procedures.¹⁰ It should be noted that in this study the PACU staff excluded bladder volumes of more than 400ml before discharging patients in their "accelerated" pathway. (Accelerated pathway: those not required to void before being discharged home.)

SCORING SYSTEMS versus TIME or PHYSICIAN BASED DISCHARGE

In 2004, Truong and colleagues of The Queen Elizabeth Hospital in South Australia, prospectively compared the efficiency of a clinical scoring system to the traditional time based criteria for discharging patients from their PACU.¹¹

They based their scoring system on the initial Aldrete Score, adding the variables of pain and temperature. Their primary end point was recovery time, but they also considered the effect of other factors that the literature has shown to influence PACU length of stay. These include age, gender, ASA class, day case or emergency surgery, surgery type and duration, use of an endotracheal tube (ETT), muscle paralysis, intraoperative opioids and antiemetics.

They found no difference in unadjusted recovery time between their two groups. Subsequent regression analysis identified an increased tendency for early discharge in the scoring system group; while longer surgery, use of an ETT, prescription of opioids and antiemetics, tended to be associated with longer PACU stay.

Interestingly, and consistent with the authors own experience, a number of studies have recognized that organizational and administrative problems can contribute significantly to PACU length of stay. These include waiting for physician release, bed availability on the ward, and nursing availability for transport. ^{11,12,13,14}

Brown and colleagues looked at whether inpatients, discharged by a nurse using predetermined discharge criteria, would have a reduced PACU length of stay compared to those discharged directly by a physician. They looked at 1198 ASA I to III patients over 18 years old, after general anesthesia, and were able to demonstrate a 24% reduction in time spent in PACU. There was no difference in occurrence of adverse effects and in fact "vitals signs were more stable" on admission to the ward in the discharge criteria group. ¹⁴

AGE

During this literature review, we did not come across studies using similar systems for the discharge of pediatric patients, or commentary as to what age the application of such systems becomes appropriate. Consequently, for this study, we elected to use the same age exclusion as Truong et al, which was patients 12 years and younger. The audit and use of the discharge criteria scoring system, is therefor limited to adult patients.

OBJECTIONS

Not everyone is in favor of the discharge criteria scoring systems in their present form. In 2011, Neal O'Donnell, a registered nurse involved in research in this field, wrote to the editor of the South African Journal of Anesthesia and Analgesia challenging the modified Aldrete criteria as the gold standard for deciding if adult patients are "ward ready".

He asserted that some of the criteria are inappropriate, others are poorly defined, and that such scoring systems reflect a lack of trust of the professional qualities of the nurses employed in the PACU.

Interestingly, the alternatives he proposes, which include increased recovery room nurse training, and a more complicated, nuanced discharge assessment, are, in his own words, "...in the present economic climate, probably impossible." ¹⁵

We believe, in the resource scarce environment prevalent in most of South Africa, a more practical approach is required. In a letter to the editor in 2007, Antonio Aldrete, who pioneered the Aldrete scoring system, wrote: "... for any assessment tool to succeed, in the hundreds of thousands of patients having surgery every day, it must be kept simple, easy to apply, and suitable for PACU nurses to use repeatedly." ¹⁶

Our study, similar to Truong's, sought to investigate the effect that a discharge criteria scoring system would have on length of stay in the PACU when compared to a time based system.

Table 1. Discharge Scoring Systems	
The Aldrete Scoring System*	The Post Anesthetic Discharge Scoring System (PADSS)†
Respiration	Vital signs
Able to take deep breath and cough = 2	BP & pulse within 20% preop = 2
Dyspnea/shallow breathing = 1	BP & pulse within 20-40% preop = 1
Apnea = 0	BP & pulse within >40% preop = 0
O ₂ saturation	Activity
Maintains >92% on room air = 2	Steady gait, no dizziness or meets preop level = 2
Needs O ₂ inhalation to maintain O ₂ saturation >90% = 1	Requires assistance = 1
O ₂ saturation >90% even with supplemental oxygen = 0	Unable to ambulate = 0
Consciousness	Nausea & vomiting
Fully awake = 2	Minimal/treated with p.o. medication = 2
Arousable on calling = 1	Moderate/treated with parenteral medication = 1
Not responding = 0	Severe/continues despite treatment = 0
Circulation	Pain
BP ± 20 mm Hg preop = 2	Controlled with oral analgesics and acceptable to patient:
BP ± 20-50 mm Hg preop = 1	Yes = 2
BP ± 50 mm Hg preop = 0	No = 1
Activity	Surgical bleeding
Able to move 4 extremities = 2	Minimal/no dressing changes = 2
Able to move 2 extremities = 1	Moderate/up to two dressing changes required = 1
Able to move 0 extremities = 0	Severe/more than three dressing changes required = 0

Table from Heather Ead's article: From Aldrete to PADSS: Reviewing Discharge Criteria After Ambulatory Surgery

Table 1: The Aldrete Scoring System and PADSS

2. AIM OF THIS STUDY

There is a steadily increasing patient burden on the existing medical infrastructure in South Africa. Tygerberg Academic Hospital is no exception, and because of the high demand on our theatre services, optimal efficiency is essential.

In order to improve patient safety, to provide clear documentation and to aid future audit, a discharge criteria scoring system was developed for use in our PACU.

We saw this as an opportunity to audit the time spent by patients in the PACU, before and after the introduction of the new system, in order to determine whether or not it improved efficiency.

While planning the audit, one of the factors that staff identified as contributing to delayed discharge from PACU, was the time it took for the wards to collect their patients. We decided to audit this, in order to establish if this was a valid claim, and possibly identify an area for improvement.

2.1 PRIMARY ENDPOINT OF THE STUDY

To compare the duration of time spent by patients in the PACU at Tygerberg Academic Hospital, from the moment they are admitted, to the time they are discharged to the ward; before and after the introduction of a discharge criteria scoring system.

2.2 SECONDARY ENDPOINT OF THE STUDY

To assess how much time lapses between the PACU staff calling the ward to collect a patient, and the patient leaving the PACU.

3. METHODS AND MATERIALS

3.1 ETHICAL APPROVAL

Prior to commencing the trial, approval was obtained from the Human Research Ethics Committee of Health Sciences of the University of Stellenbosch and Tygerberg Academic Hospital (Addendum D).

3.2 INFORMED CONSENT

In this audit, patients were not exposed to any procedure or unconventional practice, and besides anonymous demographic data, no personal information was recorded. A waiver of individual informed consent was thus granted.

The Audit, its purpose, and possible benefits, was discussed with representatives of the nurses working in PACU, and written consent was obtained from those who would be involved in the data collection (Addendum B).

3.3 INCLUSION CRITERIA

- a. Patients admitted to PACU and discharged to the ward.
- b. Older than 12 years of age.

3.4 EXCLUSION CRITERIA

- c. Patients transferred to ICU or sent directly back to theatre.
- d. Younger than 12 years old.
- e. Incorrectly completed or illegible audit forms.

3.5 CONDUCTING THE AUDIT

Audit forms (Addendum C), collection boxes and posters reminding staff to participate in the audit, were prepared. The Audit form consisted of a single sheet and captured patient age, sex and ASA status, type of procedure, duration of anesthetic, time in the recovery room, and any complications delaying discharge from PACU.

Our first audit was performed over approximately a week in August 2012. During this period, the traditional time-based discharge system was still in operation.

The time-based system involved recording initial observations (blood pressure, pulse, respiratory rate and oxygen saturation) and making a note of position, any supplementary oxygen given, the condition of the wound or dressings, and the fluid administered. Patients were then kept for a minimum of one hour in PACU, after which they were discharged to the ward if comfortable, alert, and observations remained within normal limits. Any concerns were discussed either with the anesthetist involved in the case, or

the anesthetist assigned to the PACU that day. Patients who had had spinal anesthetics were kept until they could move their legs.

Data was captured from 337 patients. Audit forms were placed in a collection box, which was cleared daily by the primary investigator.

The new discharge criteria scoring system was introduced to the PACU staff in January 2013. Nurses were trained in its use, and a one month period was allowed for all involved to become accustomed to using the system.

The discharge criteria scoring system involved working through the 'Recovery Room Discharge Protocol' illustrated in Addendum A.

Patients older than 12 years, those who had obstructive sleep apnoea, those booked for the intensive care unit and those for whom there were specific instructions from the anesthetist involved, were excluded from the protocol. These patients were recovered according to the traditional time-based system, or as instructed.

Initial observations were taken, and after 15 minutes, the patients were given a score (0, 1 or 2) for each of the 9 variables. These included respiration, oxygen saturation, systolic blood pressure, consciousness, activity, pain, nausea and vomiting, surgical bleeding and temperature. The sum of the scores was then expressed as a total out of a possible 18.

If there were no scores equal to zero, and the total score was greater than 16, patients were eligible for discharge. If the score was less than 16, or if there were any zero scores, the patient was kept for another 15 minutes, and scored again.

If after one hour, the patient still did not meet discharge criteria, or if at any time the responsible nurse felt there was cause for concern, an anesthetist was called to assess the patient.

A second audit was performed in February 2013, again over a week, during which we gathered data from 315 patients.

3.6 STATISTICAL METHODS

Analysis of the data revealed that the various time epochs were not normally distributed. Consequently, the statistical significance of the primary and secondary outcomes was determined by applying the Mann-Whitney U Test for nonparametric comparisons.

A Mann-Whitney U Test was also used to determine if there was a significant difference in the median age and duration of anesthetic between the two groups.

A Pearson Chi-square test was used to determine if there was a significant difference between the groups regarding sex and severity of illness (ASA score).

4. RESULTS

Results are presented as median values, together with the interquartile range.

4.1 DEMOGRAPHICS AND DESCRIPTIVE PARAMETERS

Once exclusion criteria had been applied, groups included 289 patients discharged according to time (we called this the “Old” group), and 302 patients discharged according to the discharge criteria scoring system (The “New” group).

The groups were similar with regard to age, both having a median value of 36 years, and an age distribution as illustrated in Table 2.

	Median	Lowest Value	Lower Quartile	Upper Quartile	Highest Value
OLD	36	13	26	52	88
NEW	36	13	26	53	90

Table 2. Descriptive statistics for Age in each group.

There were significantly more women in the New group than in the Old group (p-value = 0.005, Table 3).

	Male	Female
OLD	43%	57%
NEW	35.4%	64.6%

Table 3. Percentage of Males and Females in each group.

The patients in the New group had significantly higher ASA scores (p-value = 0.0003, Table 4).

ASA	1	2	3	4	5
OLD	45.5%	44.8%	8.9%	0.4%	0.4%
NEW	42.8%	36.0%	20.5%	0.7%	0.0%

Table 4. Percentage of patients in each ASA category.

The median duration of anesthetic was 1 hour 25 minutes in the Old group, and 1 hour 20 minutes in the New group. This difference was not statistically significant (p-value = 0.22, Table 5).

	Median	Lowest Value	Lower Quartile	Upper Quartile	Highest Value
OLD	1h25min	15min	55min	2h	6h45min
NEW	1h20min	15min	55min	2h	7h50min

Table 5. Descriptive statistics for Duration of Anesthetic in each group.

4.2 PRIMARY OUTCOME

There was a 10 minute decrease in the median time spent by patients in the PACU after introduction of the discharge criteria scoring system. This was statistically significant (p-value = 0.003, Table 6).

	Median	Lowest Value	Lower Quartile	Upper Quartile	Highest Value
OLD	1h25min	15min	1h 5min	1h 55min	5h 5min
NEW	1h 15min	15min	55min	1h 55min	8h15min

Table 6. Descriptive statistics for Time spent in PACU.

The times spent by patients in PACU are illustrated in Figure 1 and Figure 2, and compared in Figure 3 (Boxplot).

4.3 SECONDARY OUTCOME

The median time which elapsed between calling the ward, and the patient leaving the PACU, was 15 minutes, both in the Old and the New group.

	Median	Lowest Value	Lower Quartile	Upper Quartile	Highest Value
OLD	15 min	0 min	10min	30min	2h
NEW	15 min	0 min	10min	30min	6h 55min

Table 7. Descriptive Statistics for Time between calling the ward and leaving PACU

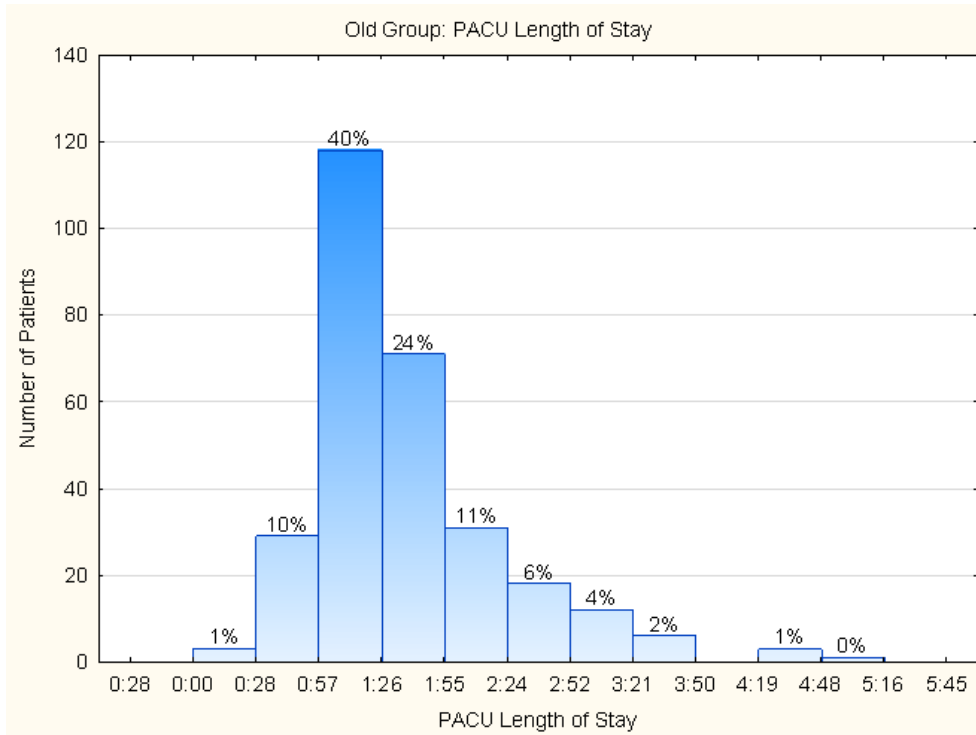


Figure 1:
Histogram illustrating the length of time spent by patients in PACU while using the time based discharge system.

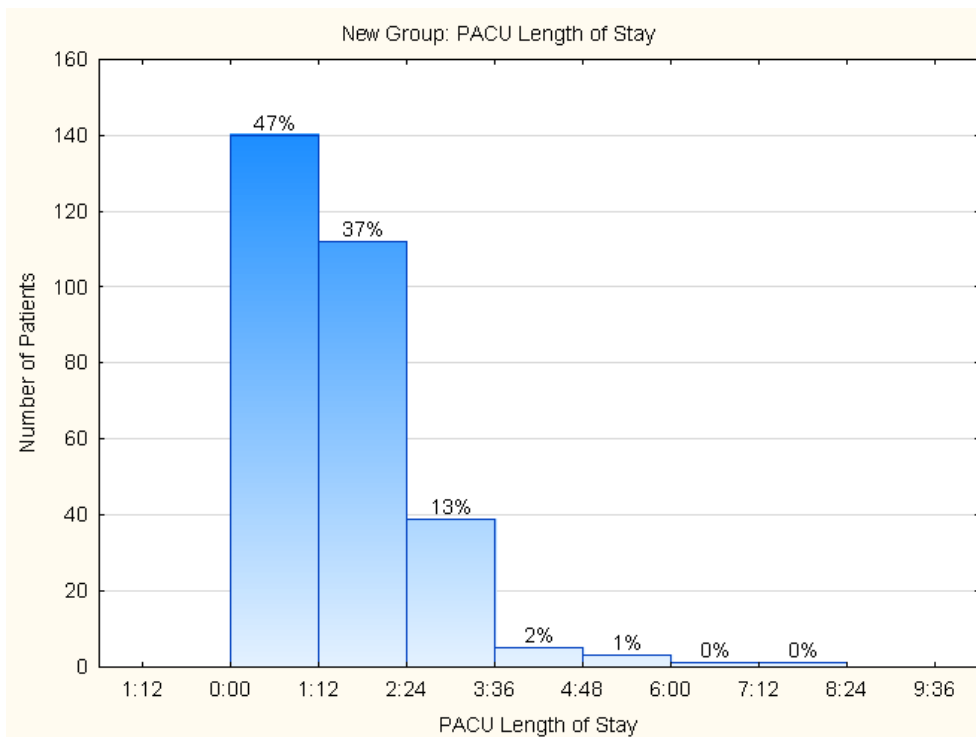


Figure 2:
Histogram illustrating the length of time spent by patients in PACU while using the discharge criteria scoring system.

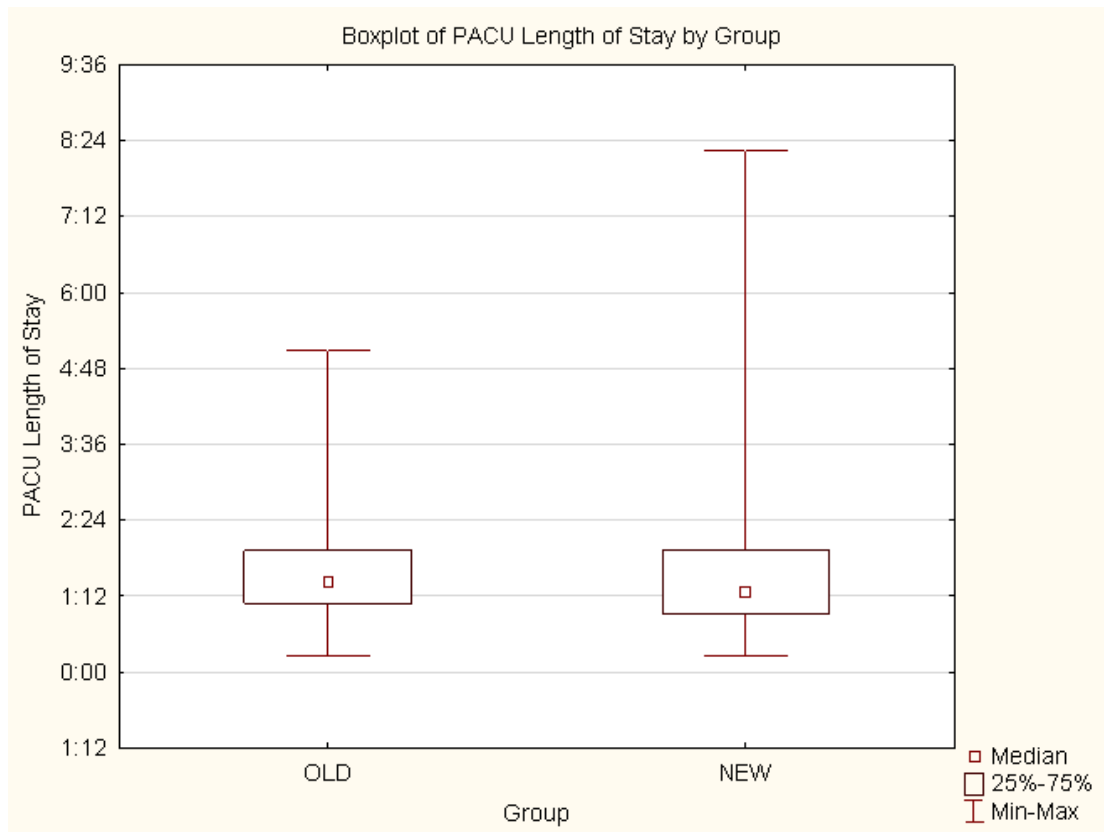


Figure 3: This boxplot illustrates our primary outcome. It compares the time spent in PACU in each of the two groups, and shows median, maximum and minimum values, as well as the interquartile range.

5. DISCUSSION

We conducted an audit of the time spent by patients in the PACU at Tygerberg Academic Hospital, before and after the introduction of a discharge criteria scoring system.

The “Before” audit was performed while the traditional, time based discharge criteria, was still in use. We referred to this as the “Old” group. The “After” audit was performed 6 months later, using the new discharge criteria scoring system. This we referred to as the “New” group.

The groups were similar with regard to age and the duration of anesthetic to which the patients were exposed. There were statistically significant differences in the number of males and females, and severity of illness (ASA classification score) between the groups.

DIFFERENCE IN GENDER DISTRIBUTION

57% of the patients in the Old group were female, compared to 64.6% in the New group. This was due, at least in part, to there being more Ceasarean sections in the New group (67 CEASAREANS in the New group, and 53 CEASAREANS in the Old group).

While there was no reason to suspect that the difference in gender composition of the groups would influence our results, the uneven distribution of Ceasarean Sections may have had a significant impact.

When considering the box plot of the time spent by patients in PACU, it is clear that, for most patients, this amounted to between 1 and 2 hours. In both groups, however, there were some outliers. One patient in the Old group spent 5 hours in PACU, and one in the New group, over 8 hours.

On reviewing the data, it became apparent that most of the outliers were patients who had had Ceasarean sections. This was due to a specific problem with finding postoperative beds for this population of patients. The uneven distribution of Ceasarean sections may, therefore, have been a confounding factor in our evaluation of the time spent by patients in PACU.

Because the data was not normally distributed, we considered median values, and not means. This attenuated the effect that the larger number of Ceasarean sections, and thus outliers, would have on our results. We also re-processed the data with all the Ceasarean sections removed, and the difference between the median duration of PACU stay, remained unchanged (10 minutes).

DIFFERENCE IN ASA CLASSIFICATION

The significant difference in the ASA classification scores between the Old and New groups was unexpected, and may have influenced our results. The ASA classification is a system for assessing fitness for surgery. A higher score indicates a greater severity of systemic illness. In this study, the patients in the New group had significantly higher ASA scores, and thus were a sicker population, than those in the Old group.

There was no obvious reason for this difference, but intuitively, sicker patients might spend longer in PACU after surgery. It is thus tempting to speculate that we may have found an even greater difference between the two groups had the ASA scores been similar. That said, Truong et al. found in their study that ASA classification was not predictive of PACU length of stay.¹¹

PRIMARY OUTCOME

There was a 10 minute decrease in the median time spent by patients in the PACU after introduction of the discharge criteria scoring system. The median time in the Old group was 1 hour 25 minutes, and in the New group 1 hour 15 minutes.

With a p-value of 0.003, this difference was statistically significant. What we need to consider, is whether or not this decrement has any clinical value.

Saving 10 minutes per patient would equate to improved capacity and quality of care in PACU.

Capacity is crucial, as inability to receive new patients in PACU creates hold ups in theatre, and subsequently cancellations. The knock-on effect is that wards fill up, and both patients and the hospital incur unnecessary costs.

Quality of care may improve as, unless operating at capacity, PACU staff would have more time to spend per patient, and be allowed to focus on the patients that most needed their attention.

Consequently, we think that it is reasonable to consider the 10 minute decrease in the median time spent in PACU, a clinically significant result.

SECONDARY OUTCOME

While planning the audit, one of the factors that staff identified as contributing to delayed discharge from PACU, was the time it took for the wards to collect their patients. This seemed like a realistic concern, and was supported by literature relevant to the subject.^{11,12,13,14}

Consequently, one of the variables we examined was the time that elapsed between calling the ward, and the patient leaving the recovery room. In both the New and Old groups, the median time for this to occur was 15 minutes.

Without a detailed analysis of the variables involved, it is difficult to comment on whether or not this is a reasonable delay. We have already established, however, that decreasing a patient's stay by 10 minutes may be clinically significant. Even if we accept a 15 minute delay as reasonable given staff shortages in the wards, the upper quartile for 'ward pick-up' delay was 30 minutes. This seems to indicate that, in many instances, there is room for improvement, and that this may be an area for intervention and future audit.

LIMITATIONS

In this study, we chose to keep the audit sheets as simple as possible, so as not to add substantially to the workload of the nursing staff in the PACU. Consequently, we focused on our primary and secondary endpoints, and did not capture information about opioid, endotracheal tube and antiemetic use, or surgical time, which previous studies have shown to effect PACU length of stay.¹¹

After implementation and training in the use of the discharge criteria scoring system, we allowed one month for the nursing staff to become accustomed to its use. This was an arbitrary period of time, and we did not conduct tests to make sure that all staff members were equally proficient in the use of the new system. This may have lead to inconsistencies in the way it was applied, though we had no complaints that it was difficult to use.

Each audit ran for about a week, and in each case, a little over 300 patients' data was captured. Still, the groups differed with regard to the number of males and females, and severity of illness in each group. We have already discussed how this may have influenced our results. It is possible that a larger sample size, collected over a longer period, would have evened out these disparities.

We did not think a safety study was necessary as both the Aldrete and PADSS scores have a long history of safe use and have been extensively validated.^{1,2,3,4} That said, because we did not follow up patients in the ward, this study did not generate data describing the effect of our discharge criteria scoring system on postoperative complications or patient satisfaction.

6. CONCLUSION

We found that the introduction of a discharge criteria scoring system significantly altered the PACU length of stay at Tygerberg Academic Hospital, the median duration decreasing by 10 minutes.

It is possible that this decrease may have been greater, had the groups been equal with regard to severity of illness. Future audits might consider a larger sample size over a longer period of time.

Future audits might also capture data about other factors that can affect PACU length of stay, such as opioid, endotracheal tube and antiemetic use, or length of surgical time, which would be instructive to our practice.

Follow up in the ward would allow future investigators to quantify the incidence of early postoperative complications within the context of our discharge criteria scoring system. As mentioned above, we would expect this to be very low.

We also established that the median time it took the ward to collect patients was 15 minutes, though it frequently took longer than this, the upper quartile being 30 minutes. This may be an area for further audit and improvement.

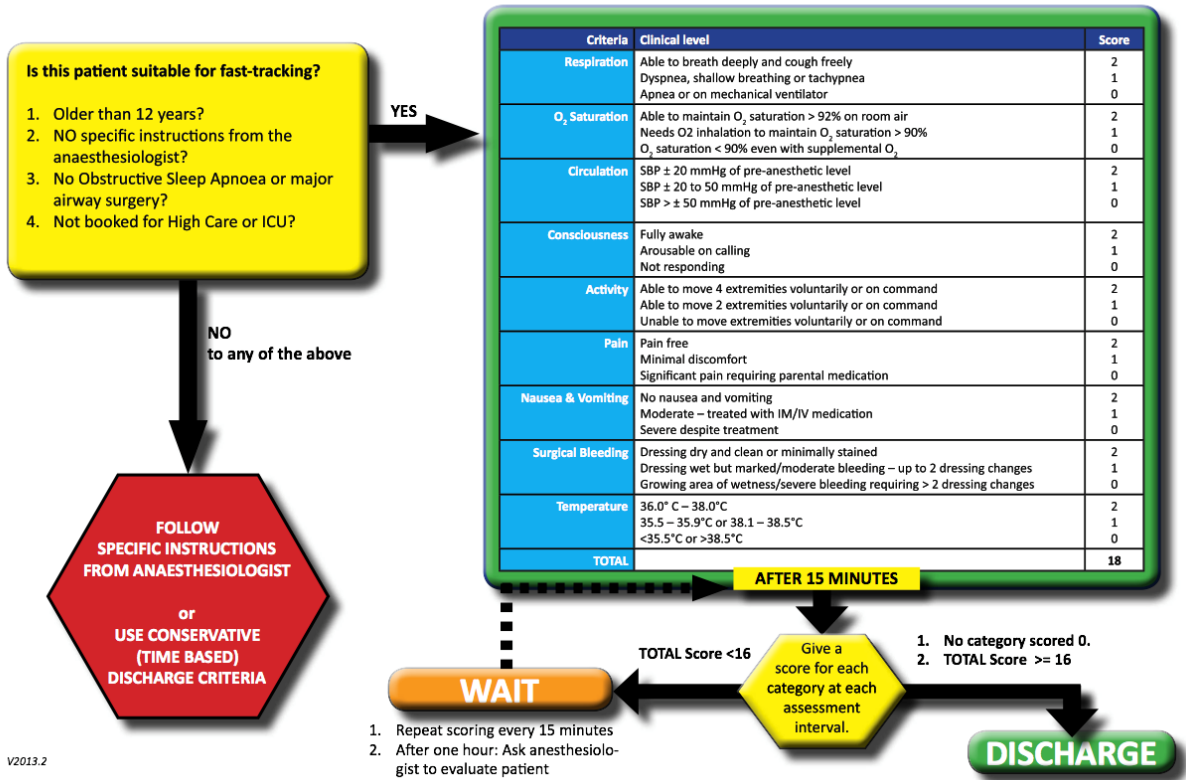
References

1. Ead H. From Aldrete to PADSS: Reviewing discharge criteria after ambulatory surgery. *Journal of perianesthesia nursing*. 2006;21(4):259–67.
2. Aldrete JA. The Post-Anesthesia Recovery Score Revisited. *Journal of Clinical Anesthesia*. 1995;7(February):89–91.
3. Marshall SI, Chung F. Discharge criteria and complications after ambulatory surgery. *Anesthesia and analgesia*. 1999;88(3):508–17.
4. Chung F, Chan VW, Ong D. A post-anesthetic discharge scoring system for home readiness after ambulatory surgery. *Journal of clinical anesthesia*. 1995;7(6):500–6.
5. Chung F. Discharge criteria: a new trend. *Canadian journal of anaesthesia = Journal canadien d'anesthésie*. 1995;42(11):1056–8.
6. Rowbotham D et al. Immediate Postanesthetic Recovery. Guideline published by The Association of Anaesthetists of Great Britain and Ireland. 2002.
7. Practice Guidelines compiled by The South African Society Of Anaesthesiologists. 2006.
8. Schreiner. Should Children Drink before Discharge from Day Surgery. *Anesthesiology*. 1992;76(4):528–533.
9. Beatty a M, Martin DE, Couch M, Long N. Relevance of oral intake and necessity to void as ambulatory surgical discharge criteria. *Journal of perianesthesia nursing*. 1997;12(6):413–21.
10. Mulroy MF, Salinas F V, Larkin KL, Polissar NL. Ambulatory surgery patients may be discharged before voiding after short-acting spinal and epidural anesthesia. *Anesthesiology*. 2002;97(2):315–9.
11. Truong L, Moran L BP. Post Anaesthesia Care Unit Discharge : A Clinical Scoring System Versus Traditional Time-based Criteria. *Anaesthesia and Intensive Care*. 2004;32(1):33–42.
12. Seago JA, Weitz S, Walczak S. Factors Influencing Stay in the Postanesthesia Care Unit: A Prospective Analysis. *Journal of Clinical Anesthesia*. 1998;8180(1):579–587.
13. Duncan PG, Waddle JI, Evers AS, Piccirillo JF. Postanesthesia Care Unit length Assessing Dependent Factors. *Anesthesia and analgesia*. 1998;(87):628–633.

14. Brown I, Jellish WS, Kleinman B, et al. Use of postanesthesia discharge criteria to reduce discharge delays for inpatients in the postanesthesia care unit. *Journal of clinical anesthesia*. 2008;20(3):175–9.
15. Lundgren C. Editorial. *South African Journal of Anaesthesia and Analgesia*. 2011;17(5):319–320.
16. Aldrete JA. Post-Anesthetic Recovery Score. *Journal of the American College of Surgeons*. 2007;205(5):3–4.

ADDENDUM A: The discharge criteria scoring system used in this study.

RECOVERY ROOM DISCHARGE PROTOCOL



V2013.2

ADDENDUM B: Informed Consent PARTICIPANT INFORMATION LEAFLET

TITLE OF THE RESEARCH PROJECT:

An audit of the time spent by patients in the post anesthetic care unit before and after the introduction of a discharge criteria scoring system at Tygerberg Hospital.

REFERENCE NUMBER: S12/11/273

PRINCIPAL INVESTIGATOR: Dr Sean Dwyer

ADDRESS: Department of Anesthesiology and Critical Care, Tygerberg Hospital

CONTACT NUMBER: Extension 5142 or 6123

Dear Colleague

My name is Sean Dwyer and I am a registrar in the department of Anesthesiology and Critical Care Medicine. I would like to invite you to participate in a research project that aims to audit the effect that a discharge criteria scoring system has on the time spent by patients in the post anesthetic care unit. (PACU)

This study has been approved by the **Health Research Ethics Committee (HREC) at Stellenbosch University** and will be conducted according to accepted and applicable National and International ethical guidelines and principles, including those of the international Declaration of Helsinki October 2008.

Why do we need this information?

It will provide us an objective assessment of the effect that this discharge criteria scoring system has on the time spent by patients in the PACU.

This will help management decide on the value of its use, and whether or not it could be of value in other hospitals.

How might you benefit from the new system?

The primary aim of a discharge criteria scoring system is to improve patient safety, and to aid concise, clear documentation of discharge readiness in the notes.

It also has the potential to allow healthy patients, who recover quickly from anesthesia, to be discharged more rapidly to the ward, rather than being observed for a fixed amount of time, regardless of their condition.

This would potentially decrease your patient burden, and allow you to spend more time with the patients who need you most.

What would you need to do?

Complete the data capture sheet for each of the patients you recover for the duration of the study. I have purposefully made this as simple as possible, so it should not take more than 1 minute.

There will be a “before” and “after” audit, and in each instance we aim to get 300 cases, which should take approximately one week.

Please feel free to contact me if you have any questions.

If you are willing to participate in this audit, please sign the attached Declaration of Consent and place it in the a yellow audit box provided.

Yours sincerely

Sean Dwyer
Principal Investigator

Declaration by participant

By signing below, I agree to take part in a research study entitled:

An audit of the time spent by patients in the postanesthetic care unit before and after the introduction of a discharge criteria scoring system at Tygerberg Hospital.

I declare that:

- I have read the attached information leaflet and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.

Signed at (place) On (date)
..... 2012

.....

Signature of participant

ADDENDUM C: The Data collection sheet

Recovery Room Audit

Patient Sticker

Date	
Age	
Sex	
ASA	
Type of Procedure	
Duration of Anaesthetic	
Time of arrival in recovery	
Time when ready for discharge	
Time when you call the ward	
Time on leaving recovery	
Complications in recovery (Which delayed Discharge)	

ADDENDUM D: Ethics Committee Approval



UNIVERSITEIT • STELLENBOSCH • UNIVERSITY
jou kennisvenoot • your knowledge partner

Approved with Stipulations Response to Modifications- (New Application)

21-Jan-2013
DWYER, Sean Pierce

Ethics Reference #: S12/11/273

Title: An audit of the time spent by patients in the postanesthetic care unit before and after the introduction of a discharge criteria scoring system at Tygerberg Hospital

Dear Dr Sean DWYER,

The **Response to Modifications - (New Application)** received on , was reviewed by members of **Health Research Ethics Committee 2** via Expedited review procedures on **17-Jan-2013**.

Please note the following information about your approved research protocol:

Protocol Approval Period: **17-Jan-2013 -17-Jan-2014**

The Stipulations of your ethics approval are as follows:

1. Waiver of individual informed consent granted.

2. Kindly note that you need to apply to the ethics committee of Tygerberg hospital to obtain permission to access hospital files (Dr Mukosi 021 938 5966).

3. At the top of page 2 of the participant informed consent form kindly correct the spelling error 'comlete', it should be 'complete'.

4. Kindly explain in the protocol how the data will be statistically processed, how the calculations will be made and what the significant differences are between these two groups.

Please remember to use your **protocol number** (S12/11/273) on any documents or correspondence with the HREC concerning your research protocol.

Please note that the HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review:

Please note a template of the progress report is obtainable on www.sun.ac.za/rds and should be submitted to the Committee before the year has expired.

The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Translation of the consent document to the language applicable to the study participants should be submitted.

Federal Wide Assurance Number: 00001372

Institutional Review Board (IRB) Number: IRB0005239

The Health Research Ethics Committee complies with the SA National Health Act No.61 2003 as it pertains to health research and the United States Code of Federal Regulations Title 45 Part 46. This committee abides by the ethical norms and principles for research, established by the Declaration of Helsinki, the South African Medical Research Council Guidelines as well as the Guidelines for Ethical Research: Principles Structures and Processes 2004 (Department of Health).

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Contact persons are Ms Claudette Abrahams at Western Cape Department of Health (healthres@pgwc.gov.za Tel: +27 21 483 9907) and Dr Helene Visser at City Health (Helene.Visser@capetown.gov.za Tel: +27 21 400 3981). Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and documents please visit: www.sun.ac.za/rds

If you have any questions or need further assistance, please contact the HREC office at 0219389207.

ADDENDUM E: Permission to conduct research at Tygerberg Hospital



**Tygerberg Hospital and
Mitchells Plain & Tygerberg Oral Health Centres**

REFERENCE: Researches

ENQUIRIES: Dr K Maart

TELEPHONE: 021 938-4141

ETHICS NO: S12/11/273

AN AUDIT OF THE TIME SPENT BY PATIENTS IN THE POSTANAESTHETIC CARE UNIT
BEFORE AND AFTER THE INTRODUCTION OF A DISCHARGE CRITERIA SCORING SYSTEM
AT TYGERBERG HOSPITAL

Dear Dr Sean Dweyer

PERMISSION TO CONDUCT YOUR RESEARCH AT TYGERBERG HOSPITAL

In accordance with the Provincial Research Policy and Tygerberg Hospital Notice No 40/2009, permission is hereby granted for you to conduct the above-mentioned research here at Tygerberg Hospital.

Permission is hereby granted for you to access patient data for this retrospective study.

A handwritten signature in black ink, appearing to read "K Maart".

**DR K MAART
MANAGER: MEDICAL SERVICES**

RESEARCH

Date: 5/11/13