

## Prevalence and Risk Factors for Prolonged Post Anesthesia Care Unit Stay among Adults at a Referral Hospital in Kigali, Rwanda

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### Abstract

#### Background

Prolonged length of stay (PLS) in the post-anesthesia care unit (PACU) after surgical operations continues to be a challenge worldwide. In Rwanda, few studies have explored the determinants of prolonged PACU stay. Therefore, the purpose of this study was to identify the prevalence and risk factors associated with prolonged stay in PACU among adult patients at one of the referral hospitals in Kigali, Rwanda.

#### Methodology

A retrospective cross-sectional design was used. A sample of 126 patient files was selected using simple random sampling. Bivariate analysis was conducted using chi-square tests for categorical variables and independent t-tests for continuous variables.

#### Results

The study revealed that 61.9% of the adult patients who underwent surgical operations had prolonged lengths of stay in PACU. This prolongation was seen to be associated with different factors: Age, pre-existing diseases ( $P=0.039$ ), type of surgery, duration of operation ( $P=0.042$ ), type of anesthesia, and intraoperative and postoperative complications ( $P=0.022$ )

#### Conclusion

This study identified a big number of PLS after surgical operations. Proper attention to the issue is recommended. Future research should identify appropriate intervention to reduce PLS and associated negative effects

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**Keywords:** length, stay, PACU, Adult, Rwanda

## Background

Post-Anaesthesia Care Units (PACUs) were introduced in 1923 to minimise post-operative mortality and morbidity rates. [1,2] The length of stay (LOS) in the PACU is measured from when the patient is admitted to the PACU to when the patient is stable enough to be discharged from the PACU.[3,4] However, different factors may cause a long stay in PACU. The patient is considered to stay long in PACU if he or she spends more than two hours.[3,4]

The prolonged LOS reduces patient satisfaction and affects the quality of care, including theatre efficiency. Aside from that, the long LOS is associated with an increasing risk of developing various complications such as congestion, nosocomial infection, Deep Venous Thrombosis (DVT) due to delayed mobility, starvation, malnutrition because of delayed oral intake and psychological and physical discomfort of patients. Furthermore, the complications resulting from a prolonged LOS in PACU can increase the prevalence of morbidity and mortality among patients who underwent surgery.[4,5] Economically, prolongation of the duration of stay in PACU causes additional cost to patients, families, as well as the institution.[6] This is because to stay a long in PACU exposes patient to pay much money for hospitalization and reduced time of usual work. On the other hand, hospitals earn low income since only low numbers of patients are being operated on in this case.[4,5]

Worldwide, there is a rising issue of PACU's prolonged length of stay due to different factors. For instance, a study conducted in Ethiopia to determine the amplitude and factors associated with delayed discharge from PACU found that 61.8% had prolonged lengths of stay in the PACU due to a small number of people whose job is to move patients between wards, a shortage of nurses who care patients in PACU and inadequate equipment like beds, so delayed discharge was a big problem.[1] However, the study focused on non-clinical factors and left out other factors.

Similarly, in a qualitative study done in Australia to find out the attitude of nurses regarding non-clinical factors that accelerate the length of stay, most study participants argued that discharge delay from non-clinical factors was happening every single day. Yet, the statistics of delays were not calculated.[7]

Additionally, in the Kingdom of Saudi Arabia, it was reported that among 7985 patients, 206, which is 2.58% of patients, had prolonged stays in PACU due to perioperative cardiovascular and respiratory diseases and other reasons like neurological issues and the type of procedures.[5] Furthermore, patients with complications either intraoperative or post-operative used to have elevated mean of PACU, Length of Stay (LOS), time taken by procedure, nature of the surgery, type of anaesthesia, anaesthesia technique and duration of anaesthesia have been revealed to be predictors of PACU LOS. The findings from the study suggested that different reasons can alter the time someone might stay in PACU.[8,7,9] Also, a study conducted in the UK indicated that the time spent in PACU was influenced by postoperative residual curarization (PORC) in which time between 323 to 299 minutes spent in PACU while non-PORC spent 243 to 183 minutes prevalence of PORC was 22%.[10]

The study carried out in the PACU at in Abu Dhabi, United Arab Emirates revealed that among 43 participants with prolonged stay in PACU, the main cause was unavailability of ward beds 25.5% followed by poor pain management 18.6%.[3] Moreover, other factors found were hemodynamic instability, desaturation, delay in waking up, postoperative bleeding, and waiting for a surgeon's order among others.[10, 11] Another study conducted in Kenyatta hospital in Kenya, identified that 44% of patients experience a prolonged stay in PACU. According to the same study, the main contributing to delays were logistics including unavailability of patients lifts for transportation and patients age over 35 years old

as well as patients preexisting conditions. [12]

Although prolonged length of stay in PACU is a common global issue often associated with complications and reduced quality of care, there is limited research on this topic in Rwanda. At the University Teaching Hospital of Kigali (UTK/CHUK), a major referral and teaching hospital serving a large portion of the Rwandan population, few studies have explored PACU-related challenges; however, their focus has not specifically been on the length of stay and its associated factors. The present study intended to identify the prevalence and associated factors of prolonged stay in PACU to inform policymakers, and practitioners about the current situation. The findings can contribute to evidence-based practice interventions to address the challenges related to prolonged LOS at the CHUK.

## Methodology

### Study design and setting

This study used a retrospective cross-sectional design to determine the prevalence and risk factors associated with prolonged length of stay in the post-anesthesia care unit (PACU) among adult patients. The study was conducted at one of the referral hospitals located in Kigali, Rwanda. The hospital is a tertiary-level facility that serves as a major surgical referral center and provides comprehensive perioperative services, including a dedicated PACU for post-operative monitoring and stabilization.

### Study population and sampling

The study population consisted of adult surgical patients who were admitted to the PACU for monitoring and stabilization following various surgical procedures. A total of one hundred twenty six patients files were randomly selected using a simple random sampling strategy and patients aged 18 years and above who underwent surgical interventions during the defined study period were considered eligible for inclusion.

Patients from gynecology and obstetrics specialties were excluded from the study.

### Data collection

The data were collected using an adopted tool from a study conducted in Abu Dhabi, United Arab Emirates on identification of risk factors contributing to prolonged stay in PACU.[3] The form was used to collect demographic characteristics, clinical, surgical, anesthesia-related, and outcome data relevant to the study objectives. Patient records were reviewed retrospectively, and data were extracted from surgical logbooks, PACU admission/discharge registers, and individual patient files.

### Data processing

All collected data were reviewed for completeness and consistency. The data were then entered into Microsoft Excel, cleaned, and subsequently exported to SPSS version 25 for statistical analysis.

### Data analysis

Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to describe the study population. The prevalence of prolonged PACU stay was calculated as the proportion of patients staying more than 2 hours. Bivariate analysis was conducted using chi-square tests for categorical variables and independent t-tests for continuous variables. The statistical significance was set at  $p < 0.05$ .

### Ethical consideration

Ethical approval was obtained from the University of Rwanda, College of Medicine and Health Sciences Institutional Review Board (IRB) (CMHS/IRB/428/2023) and permission to collect data was obtained from the referral hospital. Given the retrospective nature of the study and the use of anonymized patient data, a waiver of informed consent was granted.

## Results

### Social demographic characteristics of participants

Table 1 indicates that the majority of patients were young adults, with most falling within the 15–25-year age group, followed by those aged 26–35 years. Fewer patients were in the middle-aged categories, and the smallest proportion comprised older adults aged 56 years and above. In terms of gender distribution, most participants were male. In terms of ASA physical status classification, the majority of patients, 72 (57.1%), were classified as ASA I, followed by 42 patients (33.3%) categorized as ASA II, 10 patients (7.9%) as ASA III, and 2 patients (1.6%) as ASA IV.

**Table 1. Social demographic characteristics of study participants (n=126)**

Variables	Category	Frequency	Percent
<b>Age</b>	15-25	35	27.8
	26-35	24	19
	36-45	25	19.8
	46-55	14	11.1
	Above 55	28	22.2
<b>Gender</b>	Male	87	69
	Female	39	31
<b>ASA Classification</b>	I	72	57.1
	II	42	33.3
	III	10	7.9
	IV	2	1.6

### Risk factors affecting PACU LOS and their association with prolonged stay

This Table 2-4 has shown that of a total of 126, 28(22.2%) had preexisting diseases. Concerning the type of surgery, around 40 (31.7%) belonged to General surgery, 29(33%) to Orthopedics, 25(18.8%) to ENT, 26(20.6) to Neurosurgery, and 6(4.8%) to Urology. Regarding the operation duration, 65(51.6%) lasted between 2-4 hours, and 37(29.4%) took 1-2 hours. A duration of less than 1 hour was found in 13(10.3%) of surgeries, while surgeries which lasted longer than 4 hours were 11(8.7%). Regarding the anaesthesia techniques, 92(73%) belonged to General anaesthesia, 32(25.4%) and 2(1.6) belonged to Spinal anaesthesia and Peripheral nerve block respectively. On the side of intraoperative events, 8(6.3%) had intraoperative events while 118(93.7%) did not have intraoperative events. About surgery categories 81(64.3%) were elective and 45(35.7%) were emergency. About hypnotic used 75(59.5%) were propofol, 16(12.7%) both ketamine and propofol were used and 2(1.6%) were ketamine alone. Concerning PACU crisis, 2(1.6%) took place while 124(98.4%) had no PACU crisis. When considering the correlation between risk factors and prolonged length, the current study identified having preexisting disease, the ASA class, Anesthesia technique and intraoperative event as factors with strong association with prolonged length of stay in PACU. The P value was less than 0.005 in the above-mentioned factors.

**Table 2. Correlation between risk factors and prolonged stay (n=126)**

Variables		Length of stay, n(%)			Chi <sup>2</sup>	P value
		Prolonged	Not prolonged	Total		
<b>Age</b>	15-25	19	16	35(27.8)	7.166	0.127
	26-35	18	6	24(19)		
	36-45	14	11	25(19.8)		
	46-55	6	8	14(11.11)		
	>55	21	7	28(22.22)		
<b>Gender</b>	Male	56	31	87(69.04)	0.723	0.395
	Female	22	17	39(30.95)		

**Table 3. Correlation between risk factors and prolonged stay (n=126)**

Variables	Length of stay, n(%)			Chi2	P value	
	Prolonged	Not prolonged	Total			
<b>Pre-existing disease</b>	Yes	22	6	28(22.22)	4.24	0.039
	No Pre-existing disease	56	42	98(77.80)		
<b>ASA Class</b>	ASAI	34	38	72(57.18)	15.663	0.001*
	ASAI	34	8	42(33.33)		
	ASAI	8	2	10(7.93)		
	ASAI	2	0	2(1.60)		
<b>Type of surgery</b>	General surgery	25	15	40(31.7)	1.129	0.890
	Orthopedics	17	12	29(23)		
	Neurosurgery	18	8	26(20.9)		
	Urology	3	3	6(4.8)		
	ENT	15	10	25(18.8)		
<b>Category of surgery</b>	Elective	47	34	81(64.3)	1.448	0.229
	Emergency	31	14	45(35.7)		
<b>Operation duration</b>	<1 hour	9	4	13(10.3)	1.847	0.605
	1-2 hours	20	17	37(29.4)		
	2-4 hours	41	24	65(51.6)		
	>4hours	8	3	11(8.7)		

\* means P value with less than 0.05 which indicate a strong association with prolonged LOS in PACU

**Table 4. Correlation between risk factors and prolonged stay (n=126)**

Variables	Length of stay, n(%)			Chi2	P value	
	Prolonged	Not prolonged	Total			
<b>Anesthesia technique</b>	G.A.	62	30	92(73)	6.347	0.042*
	S. A	16	16	32(25.4)		
	PNB	0	2	2(1.6)		
<b>Hypnotic used</b>	Ketamine	1	1	2(1.6)	3.915	0.141*
	Propofol	47	28	75(59.5)		
	Ketamine and propofol	14	2	16(12.7)		
<b>Intra-op. event</b>	Yes	8	0	8(6.3)	5.257	0.022*
	No event	70	48	118(93.7)		
<b>PACU Crisis</b>	Yes	2	0	2(1.6)	1.251	0.263
	No PACU crisis	76	48	124(98.4)		

\* means P value with less than 0.05 which indicate a strong association with prolonged LOS in PACU

## Discussions

The purpose of this study was to identify the prevalence and associated factors of prolonged length of stay in the PACU at one of the referral hospitals in Kigali Rwanda. Overall the study identified that out of 126, study participants, 78 of them had a prolonged stay in PACU which reflects a prevalence of 61.9%. This prevalence is much higher compared to the study done in a Tertiary Care Hospital in Saudi Arabia in which the prevalence was 2.58%.[13] This difference is probably due to the sample size or the period of data collection. Our study demonstrated an average of 2.58 hours spent in PACU. These results are dissimilar from what was found in a study conducted by the University of California at the San Diego health system which revealed an average time spent in PACU of 1.5 hours. [14] This difference is probably due to the increased quality of care and the presence of anesthetists compared to the present study.

The study findings identified preexisting disease, ASA class, types of surgery, category of surgery, operation duration, type of anesthesia, a hypnotic drug used, intra-operative event and PACU crisis as risk factors that prolonged stay in PACU. Patients with preexisting disease indicated a strong association with prolongation of stay in PACU. Out of 28 patients who had preexisting diseases, 22 of them had a prolonged stay in the PACU which is a significant number. A study done in a Tertiary Care Hospital of Saudia Arabia revealed that diabetes and hypertension are the most common diseases that cause prolonged LOS in PACU.[13] However, our study focused on the impact of diseases in general to LOS in PACU without considering each disease.

This study also linked prolonged LOS in PACU with ASA in which a significant p-value of 0.001 was found. Both patients with ASA I and II prolonged equally with 34(26.94%). Regarding ASA III, out of ten cases, only two patients prolonged LOS in PACU.

Concerning ASA IV, out of two patients no one prolonged in PACU. Most of the critical incidents were ASA I and II, suggesting that critical incidents may occur in patients with few comorbidities. However, according to the ASA classification, the more advanced the ASA, the more the patient has many comorbidities with an advanced risk of critical prevalence.[1,11,15] Surprisingly, the findings from this study contradict what ASA classification determine as risk of prolonged length of stay in PACU. Besides, the findings are similarly to the study conducted in Singapore which found that most patients around 55.8 % were of ASA status of either I or II/. [16]

This study revealed a strong association between type of anesthesia and LOS in PACU. For example, of 92 patients anaesthetized under general anesthesia 62 of them were prolonged in PACU which represents a percentage of 67%. The findings correlate with the findings from a study conducted in a tertiary hospital in Saudi Arabia in which 65% of patients who prolonged in PACU had received GA. This study has also shown that peripheral nerve block (PNB) is adventitious even though its performance is at a low level. Out of 126, only two were anaesthetized under PNB and between those no one prolonged LOS in PACU suggesting a need to consider local regional anesthesia where possible.[13]

The intraoperative event was found to impact LOS in PACU p-value of 0.022. This research did not focus on which events but intended to identify the LOS in PACU. During this study, it was found that both intra-operative events and post-op crises led to prolonged LOS in PACU.

Emergency and elective surgeries with longer durations above four hours have been shown to increase prolonged stay in PACU as shown in a study conducted at the University of California[14]. However, since this study was retrospective, finding out non-clinical factors that are associated with the length of stay in PACU was not possible.

A prospective research could be a best approach to identify non clinical factors associated with prolonged LOS.

### Limitations of the study

Firstly, the sample was collected from a single hospital, which may limit the generalizability of the findings to the broader population of patients in Rwandan hospitals. Additionally, certain age groups, such as pediatric patients, were not included in the study. This omission may affect the consistency of the data results and limit the understanding of the research variables.

Furthermore, the retrospective nature of this study presented a limitation, as some patients' files were incomplete and lacked the comprehensive information required for analysis. Additionally, identifying non clinical factors which might have caused the prolonged LOS was not possible within a retrospective design.

### Conclusion and Recommendations

This study examined the prevalence and risk factors associated with prolonged stays in the PACU among adult patients at a referral hospital in Kigali who underwent surgical operations. Various risk factors were identified, including age, ASA grade, duration of the operation, type of surgery, type of anesthesia, and intraoperative and postoperative complications such as bleeding and respiratory crises, as well as surgical specialties.

Addressing this issue requires a multidisciplinary approach that leverages technical skills, collaborative abilities, and necessary expertise. However, some clinical challenges, such as postoperative complications, may be unavoidable. The PACU team is equipped to provide comprehensive care for all patients requiring extended monitoring and management following surgery.

This study found that general anesthesia was strongly associated with prolonged PACU stay, whereas peripheral nerve block

(PNB) had the least association. Therefore, promoting the use of PNB whenever clinically appropriate at CHUK may help reduce the prevalence of prolonged PACU stays and improve patient flow.

Additionally, during data collection, researchers noted that some patient files were incomplete. It is thus recommended that healthcare staff at UTHK/CHUK ensure all patient records are thoroughly and accurately completed to enhance the quality of clinical care and support future research efforts. Prospective research is recommended to further investigate non-clinical factors associated with prolonged Length of Stay (LOS) in the Post-Anesthesia Care Unit (PACU).

### Conflict of interest

None to declare

### Author contributions

EM, EI, and AY contributed to the conceptualization of the study, and were involved in the design, methodology development, data collection, data analysis, and drafting of the manuscript. All authors reviewed and approved the final version of the manuscript.

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