



*COLLEGE OF MEDICINE AND HEALTH SCIENCES
SCHOOL OF MEDICINE AND PHARMACY
DEPARTMENT OF SURGERY*

**APPLICABILITY OF THE MODIFIED EARLY WARNING
SCORE (MEWS) IN PREDICTING OUTCOME OF PATIENTS
UNDERGOING ABDOMINAL SURGERY AT CHUK.**

*Submitted in partial fulfillment of the requirements
for the award of the Degree of Master of Medicine in
General Surgery, University of Rwanda*

By: Dr URIMUBABO Jean Christian

Supervisor: Dr NTAKIYIRUTA George

Kigali August 2016

DECLARATION

The researcher:

I hereby declare that this dissertation “**Applicability of the Modified Early Warning Score (MEWS) in predicting post-operative outcome of patients undergoing abdominal surgery at CHUK.**” is my own work and it has not been submitted by me to any other University for the award of a degree.

Signed.....

Date: March 2016

Dr Jean Christian URIMUBABO

The supervisor:

I hereby declare that this dissertation: “**Applicability of the Modified Early Warning Score (MEWS) in predicting post-operative outcome of patients undergoing abdominal surgery at CHUK.**” was submitted by Dr Jean Christian URIMUBABO with my approval.

Signed.....

Dr George NTAKIYIRUTA

Date: March, 2016

ACKNOWLEDGEMENTS

First of all, my gratitude goes to Dr NTAKIYIRUTA George who accepted to supervise this work, his simplicity, patience, availability and meticulous analysis and corrections made to this work; for his devotion for surgery postgraduate program, teachings and continuous corrections kept me on the right tract in my training,

I acknowledge Dr NTIRENGANYA Faustin for his scientific support and moral encouragement that helps me all the way and his devotion for surgery postgraduate program, teachings and continuous corrections kept me on the right way in my training.

Special thanks go to Professor Kathryn CHU, Dr Vanessa Fawcett, Dr Jennifer RICKARD, Dr Robert RIVIELLO, Dr FURARA Charles, Professor Emmanuel KAYIBANDA, Dr Costas AINOWA for your scientific support and moral encouragement which helps me all the way.

I cannot forget to thank the Surgery departments of University Teaching Hospital of Kigali, the University Teaching Hospital of Butare, King Faisal Hospital and Rwanda Military hospital consultants, residents, anaesthesiologists, anaesthetists and nurses, for your daily support.

I am also grateful to MoH and HRH program who contribute a lot to my surgical training.

Lastly, to you members of my family, parents, your love and support drove my progress to success.

For you all cited or forgotten, who contributed to my training in general surgery, I say thank you.

Jean Christian URIMUBABO, MD

DEDICATION

To my beloved wife and best friend, UWERA Assumpta

Our son RUGWIRO Adly Orlin

My Parents,

My Brothers and sisters

Patients I worked on

This book is dedicated.

Contents

DECLARATION	i
ACKNOWLEDGEMENTS	ii
DEDICATION	iii
LIST OF TABLES	vi
TABLES OF FIGURES	vi
ABSTRACT	viii
CHAPTER I: INTRODUCTION	1
1.1 Background	1
1.2 Problem statement	2
1.3 Rationale	3
1.4. Research question	4
1.5. Objectives the study	4
a. General	4
b. Specific	4
CHAPTER II: LITERATURE REVIEW	4
2.1 Introduction	4
2.2 The Modified Early Warning Score	4
CHAPTER III: METHODS	7
3.1 Study description	7
3.2 Study design	7
3.3 Study population	8
3.4 Selection of study population	8
a. Inclusion criteria	8
b. Exclusion criteria	8
3.5 Study setting	8
3.6 Measurement of outcomes	8
3.7 Sampling method	9
3.8 Sample size calculation	9
3.9 Data collection	9
3.10 Data processing and analysis	10
3.11 Ethical considerations	10

a. Confidentiality.....	10
b. Informed consent.....	11
c. Ethical approval.....	11
3.12 Study limitation.....	11
CHAPTER IV: RESULTS.....	11
4.1 Demographic data.....	11
4.1.1 Age:.....	11
4.1.2 Sex:.....	12
4.1.3 past medical history.....	12
4.1.4 Past Surgical History.....	12
4.1.5 Elective versus Emergency.....	13
4.1.6 Post operative diagnosis.....	13
4.1.6 Post abdominal surgery major complications.....	14
4.1.7 The Modified Early Warning Score.....	15
4.1.8 Post laparotomy in hospital mortality.....	16
4.1.9 Unplanned intubation.....	16
4.1.10 Admission to ICU/HDU.....	16
4.2 Cross tables.....	17
4.2.1 Rate of outcome by MEWS.....	17
4.2.1.1 MEWS day 1.....	17
4.2.1.2 MEWS day 2.....	17
4.2.1.3 MEWS day 3.....	18
4.2.2 Rate of Complication by MEWS.....	18
4.2.2.1 MEWS day 1.....	18
4.2.2.2 MEWS day 2.....	18
4.2.3 Rate of Admission to ICU/HDU by MEWS.....	19
4.2.3 Hospital stay by MEWS.....	20
4.3 Logistic regression analysis.....	21
4.3.1 MEWS in predicting complication.....	21
4.3.2 ROC curve MEWS complication predictor.....	22
4.3.3 ROC curve MEWS predicting admission to ICU/HDU.....	22
4.3.4 MEWS in predicting outcome.....	23
CHAPTER V: DISCUSSION.....	23

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS	26
REFERENCES	27
APPENDIX 1: QUESTIONNAIRE	30
APPENDIX 2: CONSENT FORM.....	33
APPENDIX 3: ASSENT FORM	36
APPENDIX 4: ETHICAL APPROVALS	40

LIST OF TABLES

Table 1 Modified Early Warning Score (MEWS)	5
Table 2 Risk stratification.....	10
Table 3: Age.....	11
Table 4: Sex	12
Table 5: Past medical history.....	12
Table 6: Past Surgical History	13
Table 7: Elective versus Emergency.....	13
Table 8: Post operative diagnosis	14
Table 9: Post abdominal surgery major complications.....	14
Table 10: The Modified Early Warning Score day 1 postoperative	15
Table 11: The Modified Early Warning Score day 2 postoperative	15
Table 12: The Modified Early Warning Score day 3 postoperative	15
Table 13: Post laparotomy in hospital mortality.....	16
Table 14: Post laparotomy unplanned intubation	16
Table 15: Post laparotomy admission to ICU/HDU	16
Table 16: Rate of outcome by MEWS day 1.	17
Table 17: Rate of outcome by MEWS day 2	17
Table 18: Rate of outcome by MEWS day 3	18
Table 19: Rate of Complications by MEWS day one.....	18
Table 20: Rate of Complications by MEWS day two.....	19
Table 21: Rate of Admission to ICU/HDU by MEWS day one.....	19
Table 22: Rate of Admission to ICU/HDU by MEWS day one.....	19
Table 23: Hospital stay	20
Table 24: Hospital stay by MEWS	20
Table 25: MEWS in predicting complications.....	21

TABLES OF FIGURES

Figure1: ROC curve MEWS complication predictor.....	22
Figure2: ROC curve MEWS predicting admission to ICU/HDU.....	22

Figure3: MEWS in predicting outcome 23

LIST OF ABBREVIATIONS

- **APACHE:** Acute Physiological and Chronic Health Evaluation
- **ASA:** American Society of Anesthesiologist
- **CHUK:** Centre Hospitalier Universtaire de Kigali (University Teaching Hospital of Kigali)
- **CMHS:** College of Medicine and Health Sciences
- **E-PASS:** Estimation of Physiologic Ability and Surgical Stress
- **EWS:** Early Warning Score
- **HDU:** High Dependency Unity
- **ICA:** Intermediate Care Area
- **ICU:** Intensive Care Unity
- **IRB:** Institutional Review Board
- **MEWS:** Modified Early Warning Score
- **MODS:** Multiple Organ Dysfunction Score
- **MPM:** Mortality probability Model
- **NSQIP:** National Surgical Quality Improvement Program
- **POSSUM:** Physiological and Operative Severity Score for enUmeration of Mortality and Morbidity
- **P-POSSUM:** Portsmouth Physiological and Operative Severity Score for the enUnumeration of Mortality and Morbidity.
- **SAPS:** Simplified Acute Physiology Score
- **SAS:** Surgical Apgar Score
- **SEWS:** Standardized Early warning Score
- **SOFA:** Sequential Organ Failure Assessment

ABSTRACT

Introduction: MEWS has been developed to ensure timely identification of patients at risk of deterioration and to prevent delay in intervention or transfer of critically ill patients. This score has been evaluated in many settings, but little is known of its applicability to hospitals in low resource settings. The objective of the study is to predict the prognosis of patients admitted to the surgical wards post abdominal surgery using Modified Early Warning Score.

Methods: This was a prospective observational descriptive study for 5 months duration for all patients undergoing abdominal surgery at University Teaching Hospital of Kigali. Patient's age, gender, MEWS calculation, diagnosis, procedure and comorbidities were recorded. The MEWS was recorded 12 hourly for 72 hours. Complications were recorded during the postoperative hospital stay. The cumulative MEWS score was stratified into 3 categories: high risk (above 7), medium risk (4-6) and low risk (0-3). Regression analysis was used to study the relationship between MEWS and major complications.

Results: During the study period, 177 were enrolled in the study. 110 (62.15%) were male and 67 (37.85%) were female. Mean age was 41.23 years. Emergent operations accounted for 73.45% of operations. Complications were recorded in 26 (14.69%) of patients. 18 (10.17%) patients were admitted to ICU/HDU from wards and unplanned intubation were performed in 1.69% of patients. In-hospital postoperative mortality rate was 6.21%. MEWS ranged from 0 to 14 with a median of 3 on the day one postoperative, from 0 to 10 with a median of 2.85 on the day two postoperative and from 0 to 10 with a median of 2 on the day three postoperative. MEWS was associated with post-operative admission in ICU/HDU ($P = 0.000$). MEWS was associated with in-hospital postoperative mortality ($P = 0.000$). Hospital stay extended significantly in relation to increasing MEWS ($P = 0.000$).

Conclusion: The MEWS can be effectively used in patients admitted in surgical wards in a low-resource setting hospitals as an important risk management tool to ensure timely identification of patients at risk of deterioration and to prevent delay in intervention or transfer of critically ill patients.

CHAPTER I: INTRODUCTION

1.1 Background

Many in-hospital complications are predictable and preventable and are often associated with poor clinical monitoring on the ward. Delayed identification of critically ill patients leads to delay in intervention, which causes increased morbidity and mortality. Early signs of serious illness may not be recognized or acted upon, leading to rapid consequent clinical deterioration with important implications for critical care, morbidity, and mortality.¹ In England, the number of preventable deaths remains unclear, however it is estimated to range from 840 to 40 000 per year.² In one study 54% of patients received suboptimal care before intensive care unit (ICU) admission from the ward and 69% of patients were transferred to ICU late in the course of their illness.³ Another study found that 60% of cardiac arrests, deaths or unplanned admissions to ICU were preceded by documented physiological changes.⁴

Early detection, timeliness and competency of clinical response are determinants of clinical outcome in patients with acute illness.

Morgan, Williams and Wright in the UK In 1997 developed Early Warning Scores (EWS), a score of five physiological parameters (heart rate, systolic blood pressure, respiratory rate, temperature and conscious level). Initially it was not developed to predict outcome but to serve as a track-and-trigger system (TTS) to identify early signs of deterioration. Since it has been modified and in addition to the original five physiological parameters in most EWS oxygen saturation has been included.⁵

Modified Early Warning Score or MEWS has been developed to ensure timely identification of patients at risk of deterioration and to prevent delay in intervention or transfer of critically ill patients. MEWS is a scoring system, calculated from physiological parameters including blood pressure, respiratory rate, oxygen saturation, pulse rate and conscious level. It can be measured at the patient's bedside.⁶ Derangement of each parameter receives a number which is proportional to the deviation of that parameter from the normal range, and the sum of these numbers is used to calculate an overall MEWS. These scores can be calculated at an hourly rate to allow monitoring of patients who are considered at risk. A threshold value of 3 is usually used for MEWS, with poor outcome as the score increases.

Modified Early Warning Score can be used in a surgical setting to monitor acute admissions requiring emergency surgery and to monitor patients admitted in surgical wards postoperatively. MEWS can predict the need for critical care admission and mortality following emergency surgery. The evolution of MEWS preoperatively significantly predicts the outcome following emergency surgery.⁶ MEWS may allow also improvement in the quality and safety of management provided to surgical ward patients.⁷ This study is assessing the applicability of MEWS in stratifying post-operative risk in patients admitted in general surgery wards at CHUK after abdominal surgery.

1.2 Problem statement

The effectiveness of critical care services varies between hospitals. Abdominal surgeries represent about 30% of all procedures done at CHUK, and are associated with mortality of about 14% and complications of 20.5% in emergency laparotomies.^{8,9}

Many patients in general surgical wards have clinical and physiological deterioration which is evident for many hours prior to cardiopulmonary arrest. In those patients, arrest often occurs after a period of slow and progressive physiological deterioration that went unrecognized or poorly treated.^{1,2,3,4}

Currently at CHUK, identification of patients who are deteriorating are based on clinical judgment and traditional vital signs including heart rate, respiratory rate, blood pressure, temperature and pulse oximetry. Nurses play significant role in detecting the signs of patient deterioration, nevertheless subtle signs of deterioration can be difficult to identify leading to a delay in seeking assistance.¹⁰

A single-parameter approach has been effective, but organization of vital signs as a score identifies at-risk patients hours before a significant vital signs change. This scoring system responds to multiple parameters at the same time and identifies at-risk patients at the first sign of a subtle change in vital signs.¹¹ Studies have shown that aggregate weighted scoring systems appear to be more effective than single parameter systems in achieving optimal care for the deteriorating patient.¹²

The single parameter system has been evaluated to assess the ability to identify patients at risk of major adverse events. This study confirmed that in combination, increased heart rate, respiratory rate, low systolic blood pressure and a decrease in the Glasgow Coma Score were specific predictors of cardiac arrest, unplanned ICU admission and unexpected death.¹³

In settings lacking resources for rapid response teams and/or intensive care facilities, scoring systems may be more appropriately used to guide overall management than to provide triggers for urgent resuscitation.¹⁴

A MEWS, which is an aggregate weighted score, is a simple and reproducible tool that could work in low resource settings and it has been validated in different subspecialties.^{6,7,15} It is a bedside tool based on regularly recording of physiological parameters. It has been developed to ensure timely identification of patients at risk of deterioration and to prevent delay in intervention or transfer of critically ill patients.⁵

Taking into consideration the high number of critical patients undergoing abdominal surgery at CHUK and the burden of abdominal surgery-related morbidity and mortality, there is a need for a suitable tool for continuous assessment in order to anticipate the treatment of patients who are likely to deteriorate. This study aims to evaluate the use of MEWS in stratifying post-operative risk in patients admitted in general surgery wards at CHUK.

1.3 Rationale

The Modified Early Warning Score is a simple, immediate and objective tool to predict patient outcomes using routinely available data. It has been validated in some Western countries but few studies have been done in developing countries.^{5,14,20} There have been no studies done in Rwanda to date to test the applicability of the MEWS. The results of this study may help to use the tool not only to predict the outcome but also to serve as a track-and-trigger system tool to identify early signs of deterioration and improvement in the quality and safety of management provided to surgical patients in CHUK. This may limit avoidable, serious adverse events such as cardiac arrest, urgent and unanticipated admission to an intensive care unit or even death.

1.4. Research question

Can the MEWS be used to accurately identify patients who are likely to have poor outcomes after abdominal surgery?

1.5. Objectives the study

a. General

To predict the prognosis of patients admitted to the surgical wards post abdominal surgery using Modified Early Warning Score.

b. Specific

- To determine the MEWS of Patients who underwent abdominal surgery at CHUK
- To identify critically ill patients and patients at risk of deterioration admitted to the surgical wards post abdominal surgery by using MEWS.
- To correlate the MEWS with in hospital morbidity and mortality in patients admitted to the general surgery wards after abdominal surgery.

CHAPTER II: LITERATURE REVIEW

2.1 Introduction

Clinical early scoring systems are designed to facilitate early recognition of imminent acute medical conditions in hospitalized patients. The Modified Early Warning Score (MEWS) was proposed by Subbe and co-workers as an evaluation tool for timely identification of patients who are at risk of deterioration and to prevent delay in intervention or transfer of critically ill patients.

2.2 The Modified Early Warning Score

A MEWS is a simple bedside tool based on regularly recording of physiological parameters: respiratory rate, temperature, blood pressure, heart rate, simple assessment of neurological status

and oxygen saturation (**table 1**)⁶, which has been developed to ensure timely identification of patients at risk of deterioration and to prevent delay in intervention or transfer of critically ill patients.⁵ MEWS is a simple and reproducible tool which can be used in low resource settings.^{6,7,15}

An increasing MEWS score was shown to be associated with worse outcome and a total score of 4 or more is considered as a ward alert.

Table 1 Modified Early Warning Score (MEWS)

Score	3	2	1	0	1	2	3
Systolic BP	<70	71-80	81-100	101-199	15% up	≥200	—
Heart rate (BPM)	<30	<40	41-50	51-100	101-110	111-130	>130
Respiratory rate (RPM)	<8	—	8-11	12-20	21-25	26-30	>30
Oxygen Saturations (%)	<85	>85	>90	>95	—	—	—
Temperature (°C)	—	<35	—	35.0-38.4	—	>38.5	—
AVPU	—	—	New Confusion	Alert	Voice	Pain	Unconscious

AVPU: A, Alert; V, Verbal; P, Pain; U, Unresponsive; BPM, beats per minute, RPM: rate per minute

Adequate stratification and scoring of risk is essential to help clinical practice. Many patients in general surgical wards have clinical and physiological deterioration which is evident for many hours prior to cardiopulmonary arrest. MEWS can predict the need for critical care admission and mortality following surgery. Identifying patients at risk of deterioration at an early stage using a simple score based on physiological parameters can decrease the number of resuscitation procedures required in surgical wards. This can potentially improve the quality of care and resulting in better outcomes. In the absence of timely and appropriate intervention, the prognosis is poor. The clue is almost always in the observations of physiological parameters that are part of the routine examination of admitted patients. A common mistake that is made is the assumption that a patient who is sitting up in bed and talking is not critically ill.¹⁷ Modified Early Warning

Score has been used in a surgical setting to monitor acute admissions in wards postoperatively for early identification of patients who may need admission in critical care unit.⁷

One way of identifying patients at risk in the ward is through physiologically based warning scores. The purpose of the EWS scores is to ensure early recognition of signs of clinical deterioration in order to initiate early and appropriate intervention and management of at-risk patients on hospital wards.¹⁷ MEWS, one of the early warning scores, can be used to identify critically ill patients and patients at risk of deterioration admitted to the hospital wards.

The MEWS is also intended to improve communication between nursing staff and junior doctors and to 'flag-up' patients who need to be given immediate priority.⁷

One of the major causes of 'suboptimal care' prior to transfer from the ward in their study included failure to appreciate clinical urgency. According to McQuillan et al. at least 39% of acute emergency patients admitted to the intensive treatment unit are referred late in the clinical course of the illness.⁷

Previous studies have shown a good correlation between the MEWS score and incidence of major complications and death. In a study of 280 patients undergoing emergent laparotomy, of 42(15%) patients who died had a deteriorating EWS or EWS which failing to improve postoperatively ($P<0.005$). Survival patients had an improving or stable EWS. In addition, both EWS on admission and EWS one hour preoperatively were found to predict critical care requirement postoperatively.⁶

In a study of 334 consecutive emergency and elective surgical patients looking at the value of using MEWS on surgical in-patients to identify early deterioration, with a MEWS used with a threshold score of four or more, 75% of patients who went to critical care had triggered the early warning system.⁷

In a study done on 1082 patients (Careggi Teaching Hospital, Florence, Italy), introduction of MEWS was associated with a significantly increase in HDU admission from 14 % to 21 % ($P=0.0008$) and a significant decrease of ICU admission from 11% to 5 % ($P=0.0010$).¹⁸

In a prospective cohort study conducted in Netherlands, in 572 consecutive surgical patients admitted to their level 1 trauma center hospital, for an EWS score of 3 or greater the odds ratio

for achieving the composite endpoint (death, resuscitations, unexpected ICU admissions, severe complications, and emergency Operation) was 11.3 (95% confidence interval, 5.5 - 22.9) compared with an EWS score of less than 3.¹⁹

In a study done in 100 patients admitted to critical care units at Cairo University hospitals, looking at Value of Modified Early Warning Score among critically ill patients, a high MEWS (score max ≥ 8) was associated with 33 (86.8%) cardiac arrest in a group of 41 patients. Patients with MEWS < 8, cardiac arrest occurred in 5 (13.2%) in a group of 59 patients ($P < 0.0001$).²⁰

CHAPTER III: METHODS

3.1 Study description

Patients were entered in the study at admission in general surgery wards post-operatively. Patient's age, gender, MEWS calculation (BP, SPO₂, HR, RR, level of consciousness and temperature), diagnosis, procedure and comorbidities were recorded. The MEWS was recorded 12 hourly for 72 hours. After 72 hours till to the end points, no further record of MEWS was done by the research team and all the patients were followed by the research team. The primary end point was admission to ICU, unplanned intubation, cardiopulmonary arrest and death. The secondary end point was time of discharge. The time from admission to the time of the end points was recorded.

We choose outcomes with short time frames because the ability of the score to predict longer-term clinical deterioration is not directly relevant to their utility in guiding acute care decisions.

3.2 Study design

This was a prospective observational descriptive study for 5 months duration from October 2015 to February 2016 assessing the applicability of MEWS in predicting the outcome in patients who underwent abdominal surgery admitted in general surgery wards.

3.3 Study population

All patients admitted to the general surgical wards after abdominal surgery at University Teaching Hospital of Kigali who met the inclusion criteria during the time period of the study.

3.4 Selection of study population

a. Inclusion criteria

- Patients age 12 years and above undergoing abdominal surgery.¹⁶
- Patients operated for an abdominal problem.

b. Exclusion criteria

- Heart failure
- Polytrauma patients with brain injury

3.5 Study setting

The study was conducted in the department of surgery at University Teaching Hospital of Kigali, a national referral hospital. The hospital has a capacity of 513 beds. Department of surgery account 170 beds, 6 operating rooms shared between all surgical specialties apart Gynecology and Obstetrics department which has its own 2 operating rooms; and a recovery room or Post Anesthesia Care Unit (PACU). The hospital have an Intensive Care Unit (ICU) of 7 beds shared by the patients coming from all departments, except the department of pediatrics which has a Pediatric Intensive Care Unit (PICU); this makes its accessibility not ease for all patients in need. It has also a High Dependent Units (HDU) with 4 beds.

3.6 Measurement of outcomes

Time from admission to time of adverse events like admission to ICU, unplanned intubation, reoperation, use inotropes, cardiopulmonary arrest or death and time to discharge was evaluated.

3.7 Sampling method

All patients meeting the selection criteria, during the study period, were included in the study after offering an informed consent.

3.8 Sample size calculation

The sample size was calculated based on the estimation for a single proportion, with expected prevalence of 14% of mortality rate linked to postoperative abdominal surgery at CHUK⁹, a confidence interval of 95%, and a margin error of $d=0.05$.

The sample size calculation: $n = (Z^2 \cdot p \cdot q) / d^2$

n = Sample size; CI (95%); $Z=1.96$, $p=0.5$ (Proportion); $d=0.05$ (margin error)

The sample calculated will be 185 patients.

3.9 Data collection

Data were collected using a standardized questionnaire. The following data were collected for the study:

1. Age
2. Sex
3. Emergency versus elective
4. Post-operative diagnosis
5. Procedure
6. Unplanned intubation
7. Use of inotropes
8. Cardiopulmonary arrest
9. Transfer to ICU or HDU
10. Reoperation
11. Death
12. Time to discharge
13. MEWS calculation

MEWS was calculated as shown in the table above (**table 1**). The cumulative scores were stratified into 3 categories as follow:

Table 2 Risk stratification

Risk group	MEWS Score
Low	0–3
Medium	4-6
High	7 and above

3.10 Data processing and analysis

Data were collected using a standardized questionnaire during recruitment and follow up of the patients. A data base was created using Epidata 3.1 software. STATA 13 software was used for data analysis. Means & standard deviations were used for normally distributed data and Chi-square tests for associations between groups. The relationship between MEWS and the outcome was studied using a logistic regression analysis.

3.11 Ethical considerations

As it is an observational study, there was no change about the process of care of enrolled patients.

a. Confidentiality

The information being collected were limited to only the minimum amount of data necessary to accomplish the research purposes.

All information was kept confidential; identity of patients will not be disclosed to the public. The information was kept confidential by the research team. No any patient's identification was mentioned on the data collection or questionnaire sheets. After being enrolled in the study, the patient were assigned a number that was different from his Hospital ID number. The hospital ID number has not appeared on the questionnaire and it was matched with the study number on a separate list for continued tracking of the patient during the study period.

Access to identified and identifiable data was only limited to the research team. Finally, research records were stored in locked cabinets.

b. Informed consent

An informed consent was obtained from the patient or any other legally recognized attendant at the recruitment. Participation in the study was voluntarily and patients had rights to withdraw from the study at any time during the study. The study was conducted according to the principles of good clinical practice for the best treatment.

Assent form was sought for children between 12 and 20 years of age.

c. Ethical approval

The research proposal was approved by Department of Surgery / CHUK for clearance and it was submitted to and approved by the CMHS IRB for review. Ethic and research committees of the University Teaching Hospital of Kigali (CHUK) also approved the research proposal.

3.12 Study limitation

Despite the respectable sample size, the observational nature of the study must be considered as main limitation.

CHAPTER IV: RESULTS

Over a five months period, October 2015- February 2016, 177 patients were enrolled in the study. Age varied from 12 to 91 years (SD 19.12), the majority were males 110 (62.5%) to 67(37.85%) of females.

4.1 Demographic data

4.1.1 Age:

Variable	Obs	Mean	Std. Dev.	Min	Max
Age	177	41.23164	19.12392	12	91

Table 3: Age

In our study, patients' age varied from 12 to 91 years old with a mean of 41.23 ± 19.1 years.

4.1.2 Sex:

The majority of our patients were males 110 (62.15%). Male to female ratio was 1.6:1

Sex	Freq.	Percent
Male	110	62.15
Female	67	37.85
Total	177	100.00

Table 4: Sex

4.1.3 past medical history

The majority of our population had no past medical history reported 154 (87.01%) and 5.08% were immunosuppressed.

PMH	Freq.	Percent
HIV	9	5.08
Asthma	3	1.69
Hypertension	3	1.69
Cardiomyopathy	2	1.13
Diabetes	2	1.13
Others	4	2.27
No PMH	154	87.01
Total	177	100.00

Table 5: Past medical history

4.1.4 Past Surgical History

The majority of our population had no past surgical history 109 (79%), 23 (16.6%) had previous abdominal surgery, and only 6 (4.35%) had obstetric surgery.

PSH	Freq.	Percent
Abdominal Surgery	29	16.38
Obstetric	8	4.52
No PSH	140	79.10
Total	177	100.00

Table 6: Past Surgical History**4.1.5 Elective versus Emergency**

Nature of the procedure	Freq.	Percent
Emergency	130	73.45
Elective	47	26.55
Total	177	100.00

Table 7: Elective versus Emergency

The majority of procedures were performed as emergency 130 (73.45%). Electives counted for 47 (26.55%).

4.1.6 Post operative diagnosis

Post operative diagnosis	Freq.	Percent
Intestinal obstruction	66	37.29
Intestinal obstruction/volvulus	21	11.86
Intestinal obstruction/hernia	19	10.73
Intestinal obstruction/adhesions	17	9.60
Intestinal obstruction/intussusception	6	3.39
Intestinal obstruction/tumor	2	1.13
Intestinal obstruction/paralytic ileus	1	0.56
Peritonitis	40	22.6
appendicular	13	7.34
typhoid perforation	10	5.65
gastric perforation	8	4.52
PID	4	2.26
Bowel perforation	3	1.69
Primary	2	1.13
Blunt abdominal trauma	14	7.91
Cholelithiasis	13	7.34
Hernia	10	5.65
Colostomy	6	3.39
Gyn-Obs	4	2.26
Rectal prolapse	4	2.26
Gastric cancer	4	2.26
Liver abscess	3	1.69

Penetrating abdominal trauma	3	1.69
Other	10	5.65
Total	177	100.00

Table 8: Post operative diagnosis

Intestinal obstruction 66 (37.29%) and peritonitis for 40 (22.6%) were top of to the list of post-operative diagnosis in this study.

4.1.6 Post abdominal surgery major complications

Table 11: Post abdominal surgery major complications

Complications	Freq.	Percent
No	150	84.75
Yes	27	15.25
Total	177	100.00

We recorded 24 (14.69%) patients who developed major complications.

Types of complication	Freq.	Percent
None	150	84.75
Respiratory failure	13	7.34
Intraabdominal abscess	6	3.39
Septic shock	5	2.82
Fascia dehiscence	2	1.13
Surgical site infection	1	0.56
Total	177	100.00

Tables 9: Post abdominal surgery major complications and Types of complication

The main complication was respiratory failure with 7.34% followed by intraabdominal sepsis which accounted for 3.39%.

4.1.7 The Modified Early Warning Score

MEWS day 1 group risk	Freq.	Percent
Low	113	63.84
Moderate	41	23.16
High	23	12.99
Total	177	100.00

Table 10: The Modified Early Warning Score day 1 postoperative

MEWS day 2 group risk	Freq.	Percent
Low	118	67.82
Moderate	37	21.26
High	19	10.92
Total	174	100.00

Table 11: The Modified Early Warning Score day 2 postoperative

MEWS day 3 group risk	Freq.	Percent
Low	124	79.49
Moderate	22	14.10
High	10	6.41
Total	156	100.00

Table 12: The Modified Early Warning Score day 3 postoperative

MEWS on day one postoperative ranged from 0 to 14 with a median of 3(SD 2.6). (*Table 11*)

On day two postoperative MEWS ranged from 0 to 10with a median of 3(SD 2.6), (*Table 12*)

On day three postoperative MEWS ranged from 0 to 10 with a median of 2 (SD 2.3), (*Table 13*)

4.1.8 Post laparotomy in hospital mortality

Outcome	Freq.	Percent
Discharge	166	93.79
Dead	11	6.21
Total	177	100.00

Table 13: Post laparotomy in hospital mortality

In hospital post abdominal surgery mortality rate in surgical wards was 6.21%.

4.1.9 Unplanned intubation

Unplanned intubation	Freq.	Percent
Yes	3	1.69
No	174	98.31
Total	177	100.00

Table 14: Post laparotomy unplanned intubation

Post abdominal surgery unplanned intubation from patients in surgical wards was 1.69%.

4.1.10 Admission to ICU/HDU

Admission to ICU/HDU	Freq.	Percent
Yes	18	10.17
No	159	89.83
Total	177	100.00

Table 15: Post laparotomy admission to ICU/HDU

18 (10.17%) patients were admitted in ICU/HDU from surgical wards.

4.2 Cross tables

4.2.1 Rate of outcome by MEWS

4.2.1.1 MEWS day 1

	MEWS day 1 group risk			
Outcome	Low	Moderate	High	Total
Discharge	110	40	16	166
Dead	3	1	7	11
Total	113	41	23	177

Pearson chi2(2) = 26.6083 Pr = 0.000

Table 16: Rate of outcome by MEWS day 1.

In low, moderate and high-risk group MEWS day one, patients who died were 2.65%, 2.44%, and 30.43 % respectively.

4.2.1.2 MEWS day 2

Outcome	MEWS day 2 group risk			Total
	Low	Moderate	High	
Discharge	117	34	14	165
Dead	1	3	5	9
Total	118	37	19	174

Pearson chi2(2) = 22.4672 Pr = 0.000

Table 17: Rate of outcome by MEWS day 2

In low, moderate and high risk group MEWS day two, patients who died were 0.85%, 8.11%, and 26.32 % respectively.

4.2.1.3 MEWS day 3

Outcome	MEWS day 3 group risk			
	Low	Moderate	High	Total
Discharge	123	20	6	149
Dead	1	2	4	7
Total	124	22	10	156

Pearson chi2(2) = 34.4339 Pr = 0.000

Table 18: Rate of outcome by MEWS day 3

By MEWS on day three, 0.81% died in low risk group against 40% in high risk group.

4.2.2 Rate of Complication by MEWS

4.2.2.1 MEWS day 1

Complications	MEWS day 1 group risk			
	Low	Moderate	High	Total
No	105	36	10	151
Yes	8	5	13	26
Total	113	41	23	177

Pearson chi2(2) = 37.5433 Pr = 0.000

Table 19: Rate of Complications by MEWS day one.

In low, moderate and high-risk group MEWS day one, complications accounted for 7.08%, 14.63%, and 56.52% respectively.

4.2.2.2 MEWS day 2

Complications	MEWS day 2 group risk			
	Low	Moderate	High	Total
No	113	29	9	151
Yes	5	8	10	23
Total	118	37	19	174

Pearson chi2(2) = 36.3044 Pr = 0.000

Table 20: Rate of Complications by MEWS day two.

In low, moderate and high-risk group MEWS day two, complications accounted for 5.08%, 21.62%, and 52.63% respectively.

4.2.3 Rate of Admission to ICU/HDU by MEWS

	MEWS day 1 group risk			
Admission to ICU/HDU	Low	Moderate	High	Total
Yes	4	4	10	18
No	109	37	13	159
Total	113	41	23	177

Pearson chi2(2) = 33.3777 Pr = 0.000

Table 21: Rate of Admission to ICU/HDU by MEWS day one

In low, moderate and high risk group MEWS day one, admission in ICU/HDU was 3.54%, 9.76%, and 43.48 % respectively.

	MEWS day2 group risk			
Admission to ICU/HDU	Low	Moderate	High	Total
Yes	2	7	6	15
No	116	30	13	159
Total	118	37	19	174

Pearson chi2(2) = 24.8791 Pr = 0.000

Table 22: Rate of Admission to ICU/HDU by MEWS day two

In low, moderate and high risk group MEWS day two admission in ICU/HDU was 1.69 %, 18.92 %, and 31.58% respectively.

4.2.3 Hospital stay by MEWS

The average hospital stay was 7.7 days (SD 8.7) with a range from 1 to 61 days.

Post-operative hospital stay	Freq.	Percent
0-7	124	70.06
Above 7	53	29.94
Total	177	100.00

Table 23: Hospital stay

Post-operative hospital stay	MEWS day 1 group risk			Total
	Low	Moderate	High	
0-7	91	22	11	124
Above 7	22	19	12	53
Total	113	41	23	177

Pearson chi2(2) = 16.5840 Pr = 0.000

Table 24: Hospital stay by MEWS

For patients with hospital stay above 7 days, 19.47% were in low risk group against 52.17% in high risk group.

4.3 Logistic regression analysis

4.3.1 MEWS in predicting complication

Complications	Odds Ratio	Std. Err.	z	P>z	[95% Conf.	Interval]
Age	1.005279	.0154616	0.34	0.732	.9754273	1.036045
Oxygen	.2832624	.2114411	-1.69	0.091	.0655858	1.223398
EMER						
Elective	.3450073	.3915674	-0.94	0.348	.0373038	3.190824
MEWSd1						
Moderate	.4550693	.3703018	-0.97	0.333	.0923491	2.242448
High	1.689941	1.508016	0.59	0.557	.2939703	9.714935
MEWSd2						
Moderate	1.553992	1.234853	0.55	0.579	.3273829	7.376347
High	1.920988	2.063596	0.61	0.543	.2339552	15.77308
MEWSd3						
Moderate	4.349675	3.013274	2.12	0.034	1.11887	16.90962
High	12.06107	12.4726	2.41	0.016	1.589061	91.54422
_cons	.1288448	.1500328	-1.76	0.078	.0131489	1.26254

Table 25: MEWS in predicting complications

When the rate of complications was adjusted for age, oxygen supplement, MEWS day one, MEWS day two and MEWS day three only the MEWS one day three was the best predictor of complications, with being in moderate and high risk group increases 4.3 and 12 times the risk of complications respectively.

4.3.2 ROC curve MEWS complication predictor

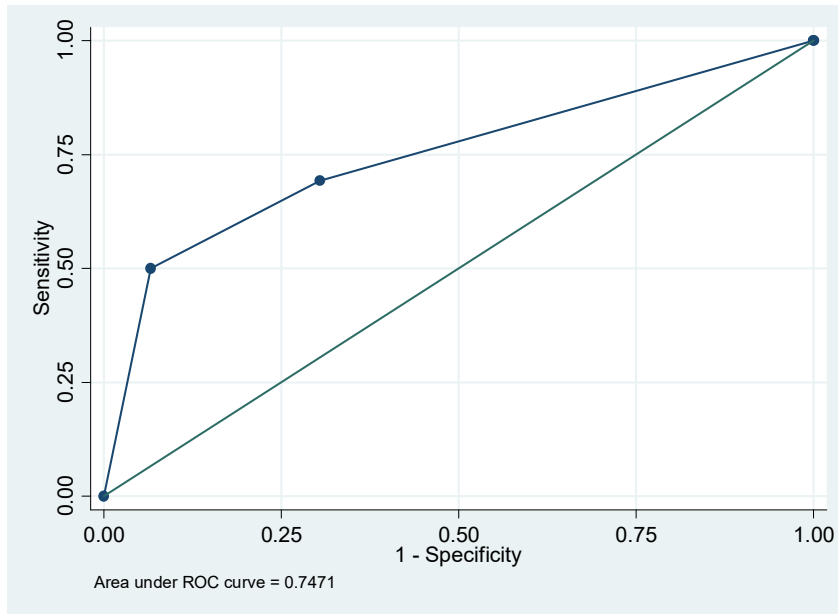


Figure1: ROC curve MEWS complication predictor

We found the MEWS can predict complication at 74.71%

4.3.3 ROC curve MEWS predicting admission to ICU/HDU

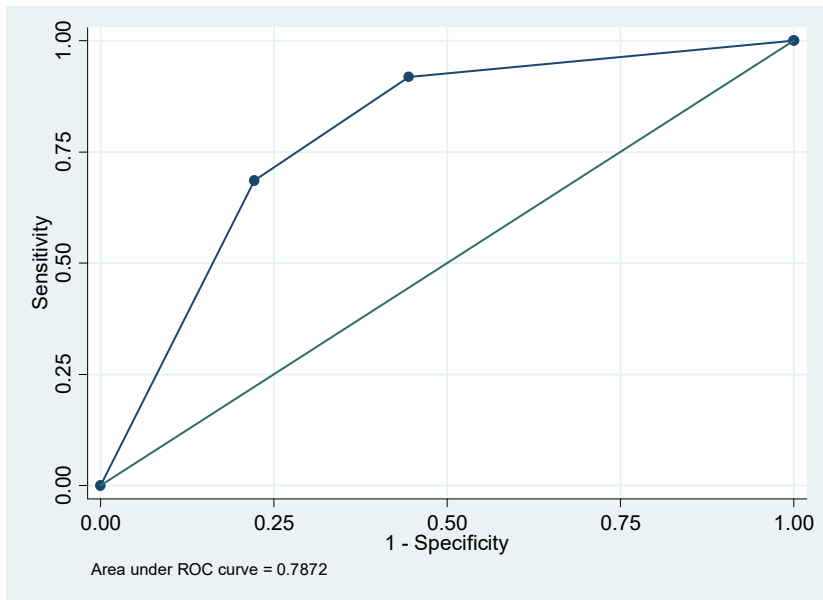


Figure2: ROC curve MEWS predicting admission to ICU/HDU

We found the MEWS could predict admission in critical care unit at 78.72%

4.3.4 MEWS in predicting outcome

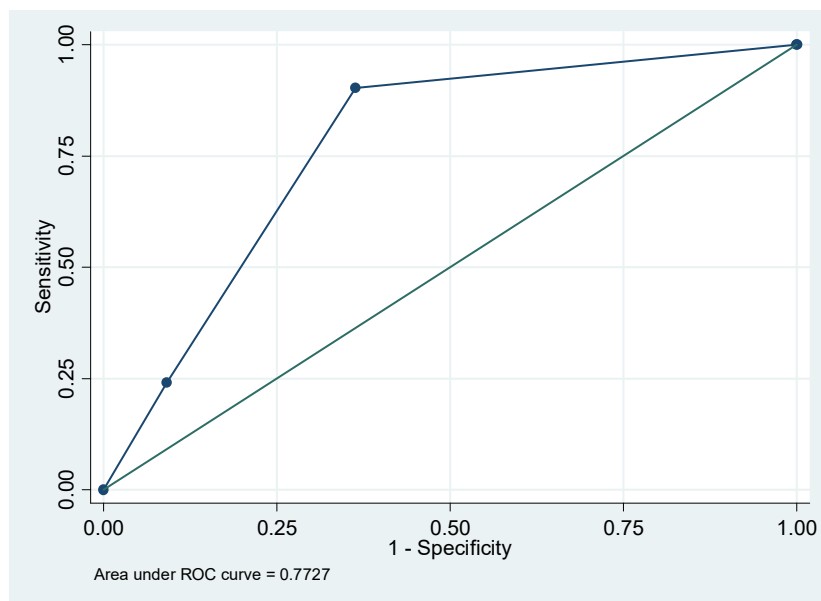


Figure3: *MEWS in predicting outcome*

We found the MEWS can predict the mortality at 77.27%

CHAPTER V: DISCUSSION

During the study period, 177 patients who underwent abdominal surgery were enrolled. 110 (62.15%) were male patients and 67 (37.85%) were female. The age ranged between 12-91 years with a mean age of 41.23 years and standard deviation of 19.12.

Most of our patients had no past surgical history 140(79.1%). Abdominal and obstetric surgery accounted for 16.38% and 4.52% respectively. 154 (87.01%) had no past medical history. Findings comparable to those reported by Ngarambe (2015)²¹ with the majority of population with no past medical history 188 (86%), and no past surgical history 193 (88.53%).

The majority of operations were done as emergency at a rate of 73.45% and elective operations accounted for 26.55%, features comparable with those found by Gardner-Thorpe in UK (2006)⁷ with 123 (37%) elective and 211 (63%) emergency.

Among our diagnosis, intestinal obstruction (37.29%) and peritonitis (22.6%) were top to the list of postoperative diagnosis in this study.

In patients admitted in surgical wards, complications were recorded in 26 (14.69%) of patients.

Patients admitted to ICU/HDU from surgical wards were 18 (10.17%) and unplanned intubation were performed in 1.69% of patients.

MEWS on the day one postoperative ranged from 0 to 14 with a median of 3 (SD 2.6), high risk group (MEWS 7-above) counted 12.99% of the patients, moderate (4-6) and low risk (0-3) groups 23.16% and 63.84% respectively. On the day two postoperative MEWS ranged from 0 to 10 with a median of 2.85 (SD 2.6), high risk group (MEWS 7-above) counted 10.9% of the patients, moderate (4-6) and low risk (0-3) groups 21.26% and 67.82% respectively. On the day three postoperative MEWS ranged from 0 to 10 with a median of 2 (SD 2.3), high risk group (MEWS 7-above) counted 6.41% of the patients, moderate (4-6) and low risk (0-3) groups 14% and 79.49% respectively. Subbe found that a MEWS on admission ranging from 0 to 9 with a median of 1.²² In a study done by Ashraf, MEWS at admission ranged from 0 to 11 with a median of 6.²⁰

MEWS was associated with post-operative admission in ICU/HDU, with overall admission in ICU/HDU of 10.17% ($P = 0.000$). In low, moderate and high risk group MEWS day one, admission in ICU/HDU was 3.54%, 9.76%, and 43.48 % respectively.

On day two, the overall admission in ICU/HDU was 8.62% and in low, moderate and high-risk group MEWS day two, admission in ICU/HDU was 1.69 %, 18.92 %, and 31.58% respectively ($P = 0.000$). Subbe found that a MEWS with a scoreMax of 5 or more was associated with an increased risk of death (OR 5.4, 95%CI 2.8-10.7), ICU admission (OR 10.9, 95%CI 2.2-55.6) and HDU admission (OR 3.3, 95%CI 1.-9.2).²²

MEWS was associated with in-hospital postoperative complications, with overall complication rate of 15.25% ($P = 0.000$) where in low, moderate and high-risk group MEWS day two, complications accounted for 5.08%, 21.62%, and 52.63% respectively.

Daniel M. Keller found that Early Warning Score can predict adverse outcomes after surgery. With a score of at least 3, EWS was associated with a greater than 10-fold risk of a patient reaching a composite endpoint defined as death, resuscitation, unexpected admission to the intensive care unit, emergency surgery, and severe complications.¹⁹

MEWS was associated with in-hospital postoperative mortality in patients admitted in surgical wards, with overall mortality rate of 6.21% ($P = 0.000$) where in low, moderate and high-risk group MEWS day two, mortality rate was 0.85%, 8.11%, and 26.32 %respectively.

In a study done by Giuseppe⁶ EWS was significantly greater in the mortality group when compared to the survivors. Paterson (2006)¹ found a significant linear relationship between in-hospital mortality and admission SEWS score (chi 34.3, $P < 0.001$). Mortality rose more than eightfold for a score of ≥ 4 compared with 0–3 (difference in proportions 15.3%; 95% confidence interval 3.7–26.9; $P < 0.01$). One systematic review reported that the early warning system scores appeared to have a strong predictive ability with higher scores corresponding to higher rates of adverse outcomes.²³

In a study by T Cooksley et al, MEWS was statistically significant in predicting Critical Care Unity (CCU) admission ($P = 0.037$) and 30 day mortality ($P = 0.004$). In addition, the median MEWS of patients admitted to CCU was 5 as compared to a value of 4 for patients not admitted.²⁴

The average hospital stay was 7.7 days (SD 8.7) with a range from 1 to 61 days. Hospital stay extended significantly in relation to increasing MEWS ($P = 0.000$). For Paterson (2006)¹ length of stay increased significantly in relation SEWS score ($P = 0.001$). A score of ≥ 4 as opposed to 0–3 equated with more than a doubling of length of stay.

Using c-statistic, we generate ROC curve to predict complication, admission in critical care unit and mortality; and we found that MEWS could predict complication at 74.71%, admission in critical care unit at 78.72% and mortality at 77.27%. Giuseppe found EWS as second best predictors of mortality with AUC values of around 0.70 and indeed, by day 2 postoperatively EWS was the best overall predictor of mortality with an AUC value of 0.83.⁶

Ashraf found that MEWS with a score max grade of 8 or more was associated with the highest efficacy at which the sensitivity was 78.9%, specificity was 93.5%, positive predictive value was 88.2%, Negative predictive value was 87.9%, with area under curve (AUC) = 0.928.¹⁹ Gardner-Thorpe in their study, the sensitivity of the MEWS used with a threshold score of four was 75% for critical care admission. The specificity was 83%.⁷

In their study, Le Onn Ho and colleagues²⁵ found a poor performance of the MEWS for predicting mortality in critically ill patients presenting to an emergency department. A MEWS score of <4 had a sensitivity of 47% and a specificity of 27.92% in predicting patient mortality. This corresponded to a 6.66% positive predictive value (PPV), 82.96% negative predictive value and an area under the receiver operating characteristic (ROC) curve of 0.68.

When predicting admission to ICU, HDU or the ICA, a MEWS score of <4 had a sensitivity of 74.16% and a specificity of 33.91% with a corresponding PPV of 46.7%, a NPV of 62.7% and an area under the ROC curve of 0.49..

CHAPTER VI: CONCLUSION AND RECOMMENDATIONS

The MEWS can be effectively used in patients admitted in surgical wards in a low-resource setting hospitals as an important risk management tool to ensure timely identification of patients at risk of deterioration and to prevent delay in intervention or transfer of critically ill patients. The MEWS can also predict major post-operative complications and outcome, therefore a good tool for surgical team that can be used as a track-and-trigger system to early identification and plan for early close follow up and management of surgical patients. It would be interesting to use the score instead as an observational tool but to use it as interventional and then assess the patient outcome.

REFERENCES

1. Paterson R, Macleod DC, Thetford D, Beattie A, Graham C, Lam S, et al. Prediction of in-hospital mortality and length of stay using an early warning scoring system : clinical audit. 2006;281–4.
2. Hogan H, Healey F, Neale G, Thomson R, Vincent C, Black N. Preventable deaths due to problems in care in English acute hospitals: a retrospective case record review study. *BMJ Qual Saf* (2012).
3. McQuillan P, Pilkington S, Allan A, et al. Confidential inquiry into quality of care before admission to intensive care. *BMJ* 1998;316:1853–7
4. Krause et al. (2004) A comparison of antecedents to cardiac arrests, deaths and emergency intensive care admissions in Australia and New Zealand, and the United Kingdom the ACADEMIA study. *Resuscitation* 62: 275-82
5. Kyriacos U, Jelsma J, James M, Jordan S (2014) Monitoring Vital Signs: Development of a Modified Early Warning Scoring (Mews) System for General Wards in a Developing Country. *PLoS ONE* 9(1): e87073. doi:10.1371/journal.pone.0087073
6. Giuseppe Garcea, Ramarao Ganga, Christopher P. Neal, Seok L. Ong, Ashley R. Dennison, David P. Berry. Preoperative Early Warning Scores Can Predict In-Hospital Mortality and Critical Care Admission Following Emergency Surgery. *Journal of Surgical Research* 159, 729–734 (2010). <http://dx.doi.org/10.1016/j.jss.2008.08.013>
7. J Gardner-Thorpe, N Love, J Wrightson, S Walsh, N Keeling. The value of Modified Early Warning Score (MEWS) in surgical in-patients : a prospective observational study. *Ann R Coll Surg Engl* 2006; 88: 571–575.
8. Nyundo M,:Emergency abdominal surgery at Kigali University Teaching hospital, A Dissertation submitted for partial fulfillment of the award of M.Med general surgery University of Rwanda 2009.
9. Chuk surgical data base 2013
10. Flanagan EM. The Implementation of an Early Warning System to a Sub-Acute Unit [Masters dissertation]. Dublin: Royal College of Surgeons in Ireland; 2013.
11. National Institute for Health and Clinical Excellence. Acutely ill patients in hospital: Recognition of and response to acute illness in adults in hospital. Clinical guideline: National Institute for Health and Clinical Excellence; July 2007.

12. Mathukia C, Fan W, Vadyak K, Biege C, Krishnamurthy M. Modified Early Warning System improves patient safety and clinical outcomes in an academic community hospital. *Journal of Community Hospital Internal Medicine Perspectives* 2015, 5: 26716 - <http://dx.doi.org/10.3402/jchimp.v5.26716>
13. Massey D, Aitken LM, Chaboyer W; A literature Review: Do Rapid Response Systems reduce the incidence of major adverse events in the deteriorating ward patient? *J Clin Nurs*. 2010 Dec;19(23-24):3260-73. Doi:10.1111/j.1365-2702.2010.03394.x.
14. Olson D, Davis NL, Milazi R, Lufesi N, Miller WC, Preidis G a., et al. Development of a severity of illness scoring system (inpatient triage, assessment and treatment) for resource-constrained hospitals in developing countries. *Trop Med Int Heal*. 2013;18(7):871–8.
15. Groarke JD, Gallagher J, Stack J, Aftab A, Dwyer C, MCGovern R, et al. Use of an admission early warning score to predict patient morbidity and mortality and treatment success. *Emerg Med J* 2008;25:803–806.
16. R.M. Kliegman, B.F. Stanton, J.W. St Geme III, N.F. Schor, R E. Behrman. Nelson text book of paediatrics 20thed. Philadelphia: Elsevier, Inc 2016
17. Dk Naidoo. An evaluation of the Triage Early Warning Score in an urban accident and emergency department in KwaZulu-Natal. *S Afr Fam Pract* 2014;56(1):69–73.
18. Peris A., Zagli G, MacCarrone N, Batacchi S, Cammelli R, Cecchi A., The use of Modified Early Warning Score may help anesthesists in postoperative level of care selection in emergency abdominal surgery. *Minerva Anesthesiol*. 2012;78(9):1034–8.
19. Daniel M. Keller. Early Warning Score Predicts Adverse Outcomes After Surgery. *Br J Surg*. 2012;99:192-197.
20. Ashraf H. Abd Al Mohsen & Mohamed A. Shehata. Value of Modified Early Warning Score Among Critically Ill Patients. *Med. J. Cairo Univ.*, Vol. 78, No. 1, December: 1-7, 2010 www.medicaljournalofcairouniversity.com
21. C Ngarambe, Applying the Surgical Apgar Score in predicting post-operative outcome of patients undergoing laparotomy at UTH-K. Thesis for Master of Medicine in General Surgery, University of Rwanda 2015
22. Subbe CP, Kruger M, Rutherford P, Gemmel L. Validation of a modified Early Warning Score in medical admissions. *QJM*. 2001;94(10):521–6.

23. Smith MEB, Chiovaro J, O'Neil M, Kansagara D, Quinones A, Freeman M, Motu'apuaka M, Slatore CG. Early Warning Scoring Systems: A Systematic Review. VA-ESP Project #05-225; 2013
24. T Cooksley, E Kitlowski, P Haji-Michael; Effectiveness of Modified Early Warning Score in predicting outcomes in oncology patients; Q J Med 2012; 105:1083–1088
<http://doi:10.1093/qjmed/hcs138>
25. Ho LO, Li H, Shahidah N, Koh ZX, Sultana P, Eng M, et al. Poor performance of the modified early warning score for predicting mortality in critically ill patients presenting to an emergency department. 2013;4(4):273–7.

APPENDIX 1: QUESTIONNAIRE

APPLICABILITY OF THE MODIFIED EARLY WARNING SCORE (MEWS) IN PREDICTING POST-OPERATIVE OUTCOME OF PATIENTS UNDERGOING ABDOMINAL SURGERY AT CHUK.

A) To be filled by a nurse or resident

NO:

Date...../...../201..

1. Patient hospital number

2. Sex: Male Female

3.1 Age:

3.2 PSH

3.3 PMH

4. Nature of the procedure: Emergency Elective

5. Post operative diagnosis

6. Procedure:

7. Oxygen supplement

8. Modified Early Warning Score

a) Systolic BP

Score

b) Respiratory rate	<input type="text"/>	Score	
c) Oxygen saturation	<input type="text"/>	Score	<input type="text"/>
d) Pulse rate	<input type="text"/>	Score	<input type="text"/>
e) Temperature (°C)	<input type="text"/>	Score	<input type="text"/>
f) Conscious level	<input type="text"/>	Score	<input type="text"/>
g) urine output	<input type="text"/>	Score	<input type="text"/>

MEWS:

B) To be filled by Dr URIMUBABO J Christian only

9. Complications

a) Absent	<input type="text"/>		
b) Present	<input type="text"/>		
i. Unplanned intubation	<input type="text"/>	Post op day	<input type="text"/>
ii. Use of inotropes	<input type="text"/>	Post op day	<input type="text"/>
iii. Septic shock	<input type="text"/>	Post op day	<input type="text"/>
iv. Ventilator use	<input type="text"/>	Post op day	<input type="text"/>
v. Cardiopulmonary arrest	<input type="text"/>	Post op day	<input type="text"/>
vi. Transfer to ICU or HDU	<input type="text"/>	Post op day	<input type="text"/>
vii. Reoperation	<input type="text"/>	Post op day	<input type="text"/>

viii. Death

Post op day

ix. Other:.....

11. Time to discharge

APPENDIX 2: CONSENT FORM

Study no:

Hospital ID:

Purpose of the study

The purpose of this study is to evaluate the usefulness of the Modified Early Warning Score in patients undergoing laparotomy at CHUK. The MEWS is measured from patient's physiologic parameters in postoperative period. The information collected will be useful in improving post-laparotomy care of patients.

Study description

Patients will entry in the study at admission in general surgery wards post-operatively. Patient's age, gender, MEWS calculation (Blood Pressure, Oxygen saturation, Heart Rate, Respiratory Rate, level of consciousness, temperature and urine output), diagnosis, procedure and comorbidities will be recoded. The MEWS will be recorded 12 hourly for 72 hours. After 72 hours till to the end points, no further record of MEWS will be done by the research team and all the patients will be followed by the research team.

Risk and benefits

There is no harm or risk to you for participating in this study. No additional tests outside the usual done pre and post operatively and there will be no extra cost to you for participating in this study.

You will not benefit directly from participating in this study, you will make a major contribution to the information known about the MEWS score. In the future, others may benefit from the information collected in improving post-laparotomy care of patients.

Voluntary participation

Participation in this study is out of your free will. You will not be denied medical care in case you refuse to participate in the study. You may stop participating at any time with no consequences whatsoever.

Confidentiality

All information will be kept confidential; your identity will not be disclosed to the public.

I have read the abovementioned information/ The abovementioned information has been read to me. I have had time to ask questions and got satisfactory answers. I consent voluntarily to participate in this study.

Name of the participant.....

Signature

Date (day/month/year).....

Enquiries

For any enquiries or further clarification, please contact the following persons:

Dr URIMUBABO J Christian: Principle researcher **Tel: +250 788 628 421**

Dr NTAKIYIRUTA George: Supervisor **Tel: +250 788 433 638**

Prof Kato J NJUNWA, Chairperson of CMHS IRB **Tel: +250 788 490 522**

Prof Jean Bosco GAHUTU, Deputy Chairperson CMHS IRB **Tel: +250 783 340 040**

AMASEZERANO YO KWEMERA KUJYA MU BUSHAKASHATSI

Nimero y’uwinjiye mu bushakashatsi:

Nimero y’ibitaro:

Icyo ubushakashatsi bugamije

Ubu bushakashatsi bugamije kureba akamaro k’ igipimo “Modified Early Warning Score” mu barwayi babagwa mu nda mu bitaro bikuru bya CHUK. Igipimo “Modified Early Warning Score” kiboneka hifashishijwe ibipimo by’umuvuduko w’amaraso, uko umutima utera, uko umuntu ahumeka. Ayo makuru azadufasha mu kunoza uburyo bwo kwita ku barwayi babazwe munda.

Ingaruka kuri ubu bushakashatsi

Nta ngaruka nimwe k’umuntu ujya muri ubu bushakashatsi. Nta kizamini na kimwe kiziyongera ku bizamini bisanzwe bizaba byasabiwe umurwayi ugiye kubagwa cyangwa amaze kubagwa bityo nta mafaranga y’umurwayi azatangwa muri ubu bushakashatsi.

Ubushake bw’umuryayi

Kwinjira muri ubu bushakashatsi ntabwo ari agahato. Ntabwo uzamburwa uburenganzira bwawe k’ubuvuzi wagombaga guhabwa nuramuka wanze. Wemerewe guhagarika kuba muri ubu bushakashatsi igihe ushakiye nta ngaruka nimwe bizakugiraho.

Ibanga

Amakuru yose azava muri ubu bushakashatsi azakoreshwa mw’ibanga; amazina y’umurwayi ntazigera atanganzwa mu ruhame.

Nyuma yo gusoma/gusomerwa ibikubiye muri aya masezerano, maze guhabwa umwanya wo kubaza ibibazo nari mfite bigasubizwa neza, nemeye nta gahato kujya muri ubu bushakashatsi.

Amazina y’umurwayi.....

Umukono

Italiki (umunsi/ukwezi/umwaka).....

Ibisobanuro/kurenganurwa

Mugihe wakenera ibisobanuro birenzeho cyangwa kurenganurwa, wahamagara:

Dr URIMUBABO J Christian: uyoboye ubushakashatsi **Tel: +250 788 628 421**

Dr NTAKIYIRUTA George: ukurikirana ubushakashatsi **Tel: +250 788 433 638**

Prof Kato J NJUNWA, Chairperson of CMHS IRB **Tel: +250 788 490 522**

Prof Jean Bosco GAHUTU, Deputy Chairperson CMHS IRB **Tel: +250 783 340 040**

APPENDIX 3: ASSENT FORM

FOR CHILDREN 12-20 years old

Study no:

Hospital ID:

Why are they doing this study?

The purpose of this study is to evaluate the usefulness of the Modified Early Warning Score in patients undergoing laparotomy at CHUK. The MEWS is measured from patient's physiologic parameters in postoperative period. The information collected will be useful in improving post-laparotomy care of patients.

What will happen to you? Will the study hurt? Will you get better if you are in the study?

Your temperature, breathing and heartbeat, oxygen saturation, level of consciousness and urine output will be checked. There is no harm or risk to you for participating in this study. This study won't make you feel better or get well. But the results from this study will be useful in improving post-laparotomy care of other patients like you later.

What if you have any questions?

You can ask questions any time, now or later

Who will know what I did in the study?

Any information you give to the study staff will be kept private (or secret). Your name will not be on any study paper and no one but the study staff only will know that it was you who was in the study.

Do you have to be in the study?

You do not have to be in the study. No one will be mad at you if you don't want to do this. We will also ask your parents if they would like you to be in the study. Even if your parents want you to be in the study you can still say no. You will not be denied medical care. Even if you say yes now you can change your mind later.

The abovementioned information has been read to me. I have had time to ask questions and got satisfactory answers. I consent voluntarily to participate in this study.

I want to take part in this study. I know I can change my mind at any time.

_____ Verbal assent given Yes

Name of child

Signature of Child

Age

Date

I confirm that I have explained the study to the participant to the extent compatible with the participants understanding, and that the participant has agreed to be in the study.

Name of

Person obtaining assent

Signature of

Person obtaining assent

Date

Enquiries

For any enquiries or further clarification, please contact the following persons:

Dr URIMUBABO J Christian: Principle researcher **Tel: +250 788 628 421**

Dr NTAKIYIRUTA George: Supervisor **Tel: +250 788 433 638**

Prof Kato J NJUNWA, Chairperson of CMHS IRB **Tel: +250 788 490 522**

Prof Jean Bosco GAHUTU, Deputy Chairperson CMHS IRB **Tel: +250 783 340 040**

UBURENGANZIRA BUTANZWE N’UMWANA K’ UBUSHAKASHATSI

Abana bari hagati y’ imyaka 12 na20.

Nimero y’uwinjiye mu bushakashatsi:

Nimero y’ibitaro:

Icyo ubushakashatsi bugamije

Ubu bushakashatsi bugamije kureba akamaro k’ igipimo “Modified Early Warning Score” mu barwayi babagwa mu nda mu bitaro bikuru bya CHUK. Igipimo “Modified Early Warning Score” kiboneka hifashishijwe ibipimo by’umuvuduko w’amaraso, uko umutima utera, uko umuntu ahumeka. Ayo makuru azadufasha mu kunoza uburyo bwo kwita ku barwayi babazwe munda.

Ingaruka kuri ubu bushakashatsi

Nta ngaruka nimwe, mbi cyangwa nziza, k’umuntu ujya muri ubu bushakashatsi. Nta kizamini na kimwe kiziyongera ku bizamini bisanzwe bizaba byasabiwe umurwayi ugiye kubagwa cyangwa amaze kubagwa bityo nta mafaranga y’umurwayi azatangwa muri ubu bushakashatsi.

Ubushake bw’umuryayi

Kwinjira muri ubu bushakashatsi ntabwo ari agahato. Ntabwo uzamburwa uburenganzira bwawe k’ubuvuzi wagombaga guhabwa nuramuka wanze. Wemerewe guhagarika kuba muri ubu bushakashatsi igihe ushakiye nta ngaruka nimwe bizakugiraho. Tuzabaza ababyeyi bawe niba bemerako ujya mu bushakashatsi. Nubwo ababyeyi baba bifuzako ujya mu bushakashatsi, wowe ushobora kubyanga.

Ibanga

Amakuru yose azava muri ubu bushakashatsi azakoreshwa mw’ibanga; amazina y’umurwayi ntazigera atanganzwa mu ruhame. Nta muntu numwe uri hanze y’ ubu bushakashatsi uzamenyako wagiye.

Nyuma yo gusoma/gusomerwa ibikubiye muri aya masezerano, maze guhabwa umwanya wo kubaza ibibazo nari mfite bigasubizwa neza, nemeye nta gahato kujya muri ubu bushakashatsi.

Uburenganzira

Nemeye kujya muri ubu bushakashatsi. Nzi neza ko nshobora kuva muri ubu bushakashatsi igihe icyo ari cyo cyose.

Amazina y’umwana:

Abyemeye mu magambo: yego ...

Nemeje ko nasobanuriye uyu mwana ubu bushakashatsi mu magambo asobanuye neza ku rwego rw’imyumvire ye kandi umwana yemeye kujya muri ubu bushakashatsi.

Amazina y’ubonye uburenganzira bw’umwana n’umukono:

.....

Itariki: .../.../.....

Ibisobanuro/kurenganurwa

Mugihe wakenera ibisobanuro birenzeho cyangwa kurenganurwa, wahamagara:

Dr URIMUBABO J Christian: uyoboye ubushakashatsi **Tel: 0788628421**

Dr NTAKIYIRUTA George: ukurikirana ubushakashatsi **Tel: 078833638**

Prof Kato J NJUNWA, Chairperson of CMHS IRB **Tel: +250 788 490 522**

Prof Jean Bosco GAHUTU, Deputy Chairperson CMHS IRB **Tel: +250 783 340 040**

APPENDIX 4: ETHICAL APPROVALS



COLLEGE OF MEDICINE AND HEALTH SCIENCES

CMHS INSTITUTIONAL REVIEW BOARD (IRB)

Kigali, 02/10/2015
Ref: CMHS/IRB/305/2015

Dr URIMUBABO Jean Christian
School of Medicine and Pharmacy, CMH, UR

Dear Dr URIMUBABO Jean Christian

RE: ETHICAL CLEARANCE

Reference is made to your application for ethical clearance of the revised protocol of the study entitled “**Applicability of the Modified Early Warning Score (Mews) In Predicting Post-Operative Outcome of Patients Undergoing Abdominal Surgery at CHUK.**”

Having reviewed your application and been satisfied with your revised version incorporating the comments from the IRB, your study is hereby granted ethical clearance. The ethical clearance shall last for one year from the date it is issued and it is renewable on request upon submission of the progress report in accordance with the guidelines of the Institutional Review Board (IRB) of the College of medicine and Health Sciences. In addition, at the end, the IRB shall need to be given the final report of your study.

We wish you success in this important study.

 A blue ink signature of Professor Kato J. NJUNWA is written over a circular official seal of the Institutional Review Board. The seal contains the text 'INSTITUTIONAL REVIEW BOARD' and 'COLLEGE OF MEDICINE AND HEALTH SCIENCES'.

Professor Kato J. NJUNWA
Chairperson Institutional Review Board,
College of Medicine and Health Sciences, UR

Cc:

- Principal, College of Medicine and Health Sciences, UR
- University Director of Research and Postgraduate studies, UR

EMAIL: researchcenter@ur.ac.rw P.O. Box: 3286, Kigali, Rwanda WEBSITE: <http://cmhs.ur.ac.rw/> www.ur.ac.rw



**CENTRE HOSPITALIER UNIVERSITAIRE
UNIVERSITY TEACHING HOSPITAL**

Ethics Committee / Comité d'éthique

November 09, 2015

Ref.: EC/CHUK/181/2015

Review Approval Notice

Dear Jean Christian Urimubabo,

Your research project: "Applicability of the modified early warning score (MEWS) in predicting post-operative outcome of patients undergoing abdominal surgery at University Teaching Hospital of Kigali."

During the meeting of the Ethics Committee of University Teaching Hospital of Kigali (CHUK) that was held on 09/11/2015 to evaluate your protocol of the above mentioned research project, we are pleased to inform you that the Ethics Committee/CHUK has approved your protocol.

You are required to present the results of your study to CHUK Ethics Committee before publication.

PS: Please note that the present approval is valid for 12 months.

Yours sincerely,

Dr. Georges Ntakiyiruta
The Vice President, Ethics Committee,
Kigali University Teaching Hospital

<<University teaching hospital of Kigali Ethics committee operates according to standard operating procedures (Sops) which are updated on an annual basis and in compliance with GCP and Ethics guidelines and regulations>>.

B.P. :655 Kigali- RWANDA www.chk.org.rw Tél. Fax : 00 (250) 576638 E-mail : hospital.chuk@gmail.com