UNIVERSITY OF ZAMBIA

SCHOOL OF MEDICINE

DEPARTMENT ON ANAESTHESIA AND CRITICAL CARE

VALIDATION OF RISK SCORES FOR POSTOPERATIVE NAUSEA AND VOMITING IN PATIENTS UNDERGOING GENERAL ANAESTHESIA FOR ELECTIVE SURGERY AT UNIVERSITY TEACHING HOSPITAL IN LUSAKA ZAMBIA

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A dissertation submitted in partial fulfillment of the requirement for the award of the degree of Masters of Medicine in Anaesthesia and Critical Care.

The University of Zambia

Lusaka

(2016)

DECLARATION

I hereby declare that this dissertation represents my own work and has not been presented either wholly or in part at the University of Zambia or any other university.

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APPROVAL

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Date :

Examiner 02 :

Signature :

Date :

Examiner 03 :

Signature :

Date :

DEDICATION

To my father who has always been there to encourage me to do more. To my husband who has been supporting me and to my children who I want to teach the importance of hard work.

ABBREVIATIONS

ASA. . . . . .American Society of Anaesthesiologists

ENT. . . . . .Ear Nose and Throat

PONV . . . . . .Postoperative Nausea and Vomiting

ROC. . . . . .Receiver Operating Characteristic curve

UTH. . . . . .University Teaching Hospital

UNZABREC. . . . . University of Zambia Biomedical Research and Ethics Committee

ABSTRACT

Background: Postoperative nausea and vomiting (PONV) is a common complication of general anaesthesia. There are documented risk factors associated with PONV which include female gender, non-smoker, and history of motion sickness, use of opioids and surgery duration of more than 60 minutes. Other risk factors are types of surgery such as Ear-nose-throat (ENT), gynaecological and laparotomy or laparoscopic surgeries. There are scores which have been created and are used to predict which patients are at high risk of PONV. Different risk scores are universally used to predict PONV in patients scheduled for surgery, but their validation has shown different outcomes in different settings and different ethnic populations. The objective of this study was to validate the commonly used risk score, (Apfel and Koivuranta risk scores) in the patients at the University Teaching Hospital in Lusaka, Zambia. Another objective was to determine the incidence of PONV at University Teaching Hospital.

Method: This was a prospective observational cohort study conducted at the University Teaching Hospital in Lusaka Zambia. 246 patients were sampled and comprising both male and female. Two patients had missing data hence were omitted from analysis. The age range was between 18 and 80 years old. Patients were recruited the day before surgery and were seen and interviewed at least six hours post-operatively using a structured questionnaire (Appendix A). Any episode of nausea or vomiting was taken as PONV. The data was analysed using SPSS version 22. And discrimination was done using the receiver operating characteristic curve (ROC).

Results: The overall incidence of PONV was found to be 25.4%. The receiver operating curve for Apfel for nausea was 0.63 which was lower than that in the original study which was 0.75. For Koivuranta the ROC area for nausea was 0.62 and for vomiting was 0.64. In the original study this was 0.70 and 0.72 respectively. (A value of 1 means perfect prediction and a value of 0.5 means no predictive values*).* The sensitivity was seen to be decreasing as the number of risk factors increased.

Conclusion: The PONV risk scoring systems do not accurately predict which patients are at high risk of PONV in the population studied. Also the incidence of PONV is not as high as in the derivative population. Hence there is need to develop a new or modified score which will suit our environment.

ACKNOWLEDGEMENTS

I would like to thank my supervisors for their guidance throughout the whole journey from proposal stage till the completion of the dissertation. I wish to thank the nurses from the surgical wards who assisted me with the data collection. Dr Dylan Bould for his help with the analysis of the data. And lastly but not the least the patients who made it possible.

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1.0 INTRODUCTION

Post operative nausea and vomiting (PONV) is one of the common complaints following anaesthesia and can be a serious complication of clinical concern in the post-operative period. (Mark et al. 2007). The effects on patients can be physical, metabolic, psychological as well as economical. It can cause prolonged stay in the recovery room with an increase in the cost of care on the patient as well as the hospital. Some of the adverse effects of PONV include aspiration pneumonia, electrolyte imbalance and surgical wound dehiscence.

Nausea is a subjective unpleasant sensation associated with awareness of the urge to vomit. Vomiting or emesis on the other hand is a forceful expulsion of gastric contents through the oesophagus into the mouth. It involves a powerful and sustained contraction of abdominal muscles, descent of the diaphragm and opening of the cardia. The end result of vomiting is the gastric content being thrown up into the mouth from the stomach. The act of vomiting is referred to as retching (Catherine *et al*, 2010)

There are many risk factors associated with postoperative nausea and vomiting, which can be used in the form of scores to stratify risk of PONV in patients (Keith G. *et al.* 2006). The risk factors are classified as surgical, anaesthetic and patient factors. Surgical factors include; duration of surgery, and type of surgery such as: breast surgery, ophthalmic surgery, ear, nose and throat surgeries, gynaecological surgery, laparoscopic, laparotomy and genitourinary surgeries. Anaesthetic factors include; type of anaesthesia with general anaesthesia with inhalation agents and opiates having a high risk, and total intravenous anaesthesia (TIVA) using propofol reducing the risk of postoperative nausea and vomiting. The risk is increased eleven times with general anaesthesia compared to regional anaesthesia (Keith *et al.* 2006). Intra-operative drugs such as opioids, nitrous oxide and inhalation agents increase risk, as do premedication with opioids. Patient factors include; age of patients with young age associated with an increased risk, and the risk decreasing from the age of fifty. Women are three times more at risk than males until after menopause when the risk becomes the same. This is probably due to the reduced level of progesterone in post-menopausal women. A previous history of PONV and a history of motion sickness have been noted to increase the risk, whereas smoking decreases it by a factor of about 0.6 (Keith et *al* 2006)

Patients who are at increased risk of PONV should receive prophylaxis with drugs such as dexamethasone, cyclizine, metoclopramide and ondansetron. There are also several non-pharmacological factors that can reduce PONV, including adequate hydration, adequate pain control, avoidance of tight fitting face masks and slow deep breaths to decrease the sensation of nausea (Camu *et al.* 1992). The latest guidelines on PONV management were updated in 2014 by a multidisciplinary team. The guidelines were based on the risk score developed by Apfel et.al. (Gan et al 2014).

The incidence of PONV in an unselected population is in the range of 20-30%, (Keith *et al* 2006). The risk factors that have been used in scores to assess risk of PONV have generally not included racial origin.

Some studies have shown that ethnicity and environmental factors have some influence on postoperative nausea and vomiting (Camu *et al.* 1992).

The risk factors identified by Koivuranta *et al* (1999) and Apfel *et al* (2002) have been validated at a different hospital (Eberhart et al, 2000) and the result was found to be similar. However, studies done in black South Africans showed that the incidence of PONV was not similar to what was found in the original studies. (Rodseth *et al* 2010).

2.0 LITERATURE REVIEW

The predictive scores by Apfel *et al* (1999), Koivuranta *et al* (1997) and Palazzo and Evans (1993) are widely used to predict the risk of PONV. These three studies used logistic regression analysis to identify and create scores to predict postoperative nausea and vomiting. Risk factors identified included; sex, history of previous PONV, history of motion sickness, duration of anaesthesia and use of opioids as analgesia intra and postoperatively (Eberhart *et al.* 2000). The Apfel and Koivuranta scores assign a point for each risk variable, where the total score is associated with a predicted risk of PONV (Tables 1 and 2). Eberhart *et al.*2000) evaluated and attempted to validate the above scores using 1,444 patients. They concluded that by using these scores the occurrence of PONV could be predicted with moderate accuracy (Eberhart et al. 2000).

Characteristics	Points
Female sex	1
History of motion sickness or postoperative nausea and vomiting	1
None smoker	1
Postoperative opioids treatment planned	1
Total	4

Table 1: Apfel score to predict Postoperative nausea and vomiting. (Apfel C C et al 1999)

Score	Percentage (%) PONV
0	10
1	21
2	39
3	61
4	78

Table 1.1: Probability of Postoperative nausea and vomiting

Characteristics	Score
Duration of surgery greater than 60 minutes	1
Female sex	1
History of motion sickness	1
History of PONV	1
None smoker	1
Total	5

Table 2: Koivuranta score to predict PONV (Kouvuranta et al 1997)

Score	Percentage (%) PONV
0	17
1	18
2	42
3	54
4	74
5	87

Table 2.1: Probability of PONV

Sinclair *et al.* (1999) showed that in addition to the risk factors mentioned above, age, type of surgery and type of anaesthesia also increased the risk of PONV. They found that for every 10 year increase in age the risk of postoperative nausea and vomiting decreased by thirteen percent. Orthopaedic and plastic surgery patients had a six fold increase in postoperative nausea and vomiting (Sinclair *et al.* 1999). Evidence suggests that PONV in children carries similar risk factors as that found by Sinclair, but also that a history of PONV in the relative of the child increases the risk (Eberhart *et al.* 2004).

Although several other risk factors have been described in the literature, such as a history of migraine, ASA physical status, pre-operative anxiety, inadequate peri-operative fluids and type of fluid used (crystalloid versus colloid) (Gan 2006), these have not been validated.

However, ethnicity as an independent risk factor has attracted some attention. In a study conducted in South Africa (Rodseth et *al.* 2010) the incidence of PONV was compared between Black and Non-Black South Africans. When all other variables were controlled for, Black South Africans demonstrated a lower incidence of PONV as compared to the comparison group. The Black South Africans showed an overall incidence of 27%, compared with 45% in the comparison group (Rodseth et *al.* 2010). Besides ethnicity, the other known risk factors of sex, history of motion sickness and PONV were also found to be independent variables (Rodseth et al. 2010). A study done in Malawi by Mndolo *et al 2014* showed a similar incidence of postoperative nausea and vomiting of 29.6%. This was similar to the incidence of PONV in black South Africans (Rodseth *et al.* 2010.) Rodseth et al in their study

recommended that the inclusion of ethnicity as a risk factor for postoperative nausea and vomiting should be explored. (Rodseth et *al*, 2010)

A Nigerian study in women undergoing obstetric and gynaecological procedures found the incidence of PONV to be low, at about 4% (Ugo et *al*). These are patients who had three of the four risk factors, and the percentage of postoperative nausea and vomiting was expected to be above 50% using either the scoring system by Apfel et al or Koivuranta et al. However, less than ten percent experienced PONV (Ugo et al. 2010). The risk factors were female sex, general anaesthesia and gynaecological surgery. A West Indies study looking at patients who underwent tonsillectomy found an incidence of thirteen percent, which is significantly lower than predicted for patients undergoing ENT surgery under general anaesthesia (Scarlet et al. 2005). For example, a study to compare antiemetic drugs after tonsillectomy surgery in patients (Letchti et al. 2007) found an overall incidence of 38.9% (Letcht et al. 2007). The population of the West Indies is mostly Black this can explain this low incidence.

These studies that specifically look at racial groups as a risk factor demonstrate that the scoring systems may be inaccurate in Black populations. The differences may be attributed to many factors, such as ethnicity or diet. Ethnic differences in response to drugs are well demonstrated and can probably be attributed to genetic propensity. For example, differences in opioids sensitivity have been shown between Caucasian and African-American children, where the latter group had a higher incidence of opioids related adverse effects (Senthilkumar et al. 2012).

Zambians are ethnically similar to black South Africans hence a study to validate the scoring systems which were developed in European countries is needed so that it can be determined whether the scores apply in the Zambian population or not. In addition, there is need to determine the incidence of postoperative nausea and vomiting at the University Teaching hospital. Watcha et al in 1994 found that the incidence of PONV at which prophylaxis was more cost-effective than was for teaching was 30% for ondansetron and 13% for droperidol. (Watcha et al. 1994). Both of these drugs are not even stocked in University teaching hospital. Like Mehernoor stated, as anaesthesiologist we can serve our patients better in resource limited places if choices are made based on the evidence of drug effectiveness, side effect profile and reduced cost. (Mehernoor. 2000).

3.0 STATEMENT OF THE PROBLEM

Postoperative nausea and vomiting is ranked as one of the major undesirable surgical outcomes in the immediate postoperative period (Macario et al.1999). A survey showed that 78 percent of surgeons consider PONV as problematic (Simanski et al. 2001). There are risk scores which are used to predict which patients are at risk of PONV. However, studies conducted in black Africans (Alli 2014) (black South Africans in particular) showed that the risk scores were not as accurate as they were in non-black South Africans. Zambians have a similar ethnicity to South Africans hence there is need to see if the risk scores can be

validated in the Zambian setting. A scoring system that has been tested in diverse settings and found accurate is more likely to be accurate in new settings. (Bosch et al. 2005). In this case the two risk scores have not been tested in many settings which are different from the original settings and the few places in which that had been done, the scores were not accurate. There is need to test the scoring systems in Zambians as there is no such data to show if they apply.

4.0 STUDY JUSTIFICATION

Although there are many predictive scores, the ones that are commonly used are by Apfel et al. 2002 and Koivuranta et al. 1997. These scores are the basis on which prophylactic antiemetic medication is administered in those patients predicted to be at high risk of PONV. However, these scores do not confer the same predictions in Black patients in general, and may not be appropriate for use in the Zambian surgical population in particular (Rodseth et al. 2010, Ugo et al. 2010).

The use of antiemetic prophylaxis has been shown to reduce the incidence of PONV in patients at risk, with those predicted to have a high risk requiring more than one type of drug for prevention or treatment. However, these drugs come at a cost to the health system, and an estimation of the size of the problem would help guide decision-making on purchase of these drugs and possibly averting unnecessary expenditure. Also, administration of any additional drug carries added risk of side effects to the patient, and should be avoided whenever possible. Although the risk-prediction scores in common use are validated and accepted Internationally, it is accepted that they may perform poorly in specific settings, including African countries where the population may display different propensities related to their pharmacogenetics profiles. For this reason, it is important to try to evaluate these scores to see if they are suitable for the Zambian setting.

5.0 RESEARCH QUESTION

Are the Apfel and Koivuranta scoring systems for PONV valid for the adult patients undergoing anaesthesia for elective surgery at the University Teaching Hospital?

6.0 OBJECTIVES

1. Determine the incidence of PONV at the university teaching hospital.
2. To validate the Apfel and koivuranta scoring systems for PONV

7.0 METHODOLOGY

This was a prospective observational cohort study conducted at the University Teaching hospital in Lusaka, Zambia. The sample composed of male and female adult patients who underwent general anaesthesia for elective surgery. All study participants had risk scores recorded according to the Apfel and Koivuranta scoring systems.

The Apfel and Koivuranta scoring systems were then compared with the findings of the study. The variables which were used are the risk factors identified in the two systems namely; sex of the patient, history of motion sickness or postoperative nausea and vomiting, history of smoking, use of opioids intraoperatively and postoperatively and duration of surgery.

7.1 INCLUSION CRITERIA

Male and female adults (from 18 years of age)

Patients undergoing general anaesthesia for elective surgery of any type

Written consent

7.2 EXCLUSION CRITERIA

Those patients who have been vomiting prior to surgery

All patients under the age of eighteen years old.

All emergency surgeries.

Inability to communicate (e.g. reduced conscious level)

7.3 DATA COLLECTION

The data was collected by use of a structured questionnaire (appendix A) administered by the principle investigator with the help of trained research assistants.

The participants were identified the day before the surgery. The principal investigator with the research assistants visited the patients and obtained consent. The patients were first seen at least six hours after surgery on the ward then 24 hours later. The data collected was from July 2015 to October 2015

7.4 STUDY SITE

The study was conducted in all the surgical wards of the University Teaching Hospital of Lusaka, Zambia namely; G block wards for general surgery, some orthopaedic patients,

urological patients and plastic and neurosurgery patients. Patients for gynaecology, other orthopaedic patients and maxillofacial and ear, nose and throat patients are nursed in C block. Data was collected during week days when elective surgeries are conducted

7.5 DATA MANAGEMENT

Data was kept and recorded by the principle investigator in accordance with best practice research governance. A second data set prior to analysis was created on SSPS version 22. The information was obtained from the questionnaires.

7.6 SAMPLE SIZE

Sample was calculated using the prevalence formula, marginal of error of 5%, confidence level of 95%, and an estimated population incidence of 20%.

SS = Z2 x P x (1-P) /C2

SS: sample size

Z: Z value (I, E 1.96 for a 95% confidence level

P: estimated population incidence of PONV, expressed as a decimal, 0.2 in this case. C: confidence interval, expressed as decimal, 0.05 in this case.

From the formula the sample size for the study was estimated at 246. However, two patients were lost out hence the samples size reduced to 244.

7.7 DATA ANALYSIS

The formula used to come up with the risk scores was developed using multivariable logistic regression analysis (Bosch J. E et al.2005). In the Apfel et al scoring system the equation used was;

Risk of PONV = 1/1+exp [-2.28+1.27 x female gender

+0.65 x history of PONV or motion sickness

+0.72 x non-smoking

+0.78 x postoperative opioid use] (Bosch J. E et al, 2005).

The expression-2.28 +1.27 x female gender + 0.65 x history of PONV or motion sickness + 0.72 x non-smoking +0.78 x postoperative opioid use is called the linear predictor. (Bosch et al. For the Koivuranta et al. system again using multivariable logistic regression analysis, the formula was developed. Bosch et al. 2005

Risk of PONV = 1/1+exp. [-2.21+0.93 x female gender

+0.82 x history of PONV

+ 0.59 x history of motion sickness

+ 0.61 x non-smoking

+0.75 x duration of surgery over 60 minutes.] (Bosch et al, 2005)

To validate the two risk scores, the predictors present for each patient were counted and then compared with the known percentage for postoperative nausea and vomiting for patients with similar score in the risk scores. Then the predictive accuracy was quantified using discrimination.

The predictive accuracy of the original scoring systems and their simplified versions was quantified using measures of discrimination (Macario et al. 1998).

Discrimination is the ability of a risk score or scoring system to distinguish between patients with and without PONV. This is estimated using the area under the Receiver Operating Characteristic curve (ROC area). ROC area theoretically may range from 0.5 (discrimination equivalent to that of chance) to 1.0 (perfect discrimination) (Simanski et al. 2001).

In this study discrimination was used to validate the two scores.

The clinical applicability of the risk scores was evaluated using sensitivity and specificity.

Analysis of the data was performed with **SPSS version 22.**

7.8 MEASUREMENT VARIABLES

The dependent variables were nausea, retching and vomiting

Independent variables were; age, sex, history of PONV or motion sickness, duration of the operation and type of surgery were independent variables.

Patients were considered to have had PONV if they experienced at least one episode of postoperative nausea, retching or vomiting or any combination of these in the first 24 hour after surgery. The patients were first seen after 6 hours post operatively.

Vomiting was recorded as either being present or absent.

Nausea was graded as absent, mild, moderate and severe using a four-point verbal numeric rating scale (VNRS) (Apfel et al, 2002);

0 - No nausea

1 - mild

2 - moderate

3 – severe

8.0 ETHICAL CONSIDERATIONS

Approval was sought from University of Zambia Biomedical Research Committee (UNZABREC). A standardised questionnaire was used to recruit participants considering that the study was observational there were no anticipated adverse events to the participants.

Informed consent was obtained from all participants and they were informed that they could withdraw from the study at any time. The consent was explained in the language the patient was familiar with. All patients were treated with respect. The data findings were kept confidential for all patients and no name was used in the data set only numbers which each patient was assigned.

9.0 RESULTS

A total number of 408 patients were seen and recruited for the study a day before surgery and 244 were successfully included in the study. Though the calculated sample size was 246, 2 patients had missing data hence they were not included in the analysis. Most of the patients fail out due to their surgeries being cancelled. Data was collected from July 2015 to October 2015.

9.1 DISTRIBUTION OF PATIENTS CHARACTERISTICS, PREDICTORS AND OUTCOMES.

Predictors	**Validation dataset**	**Apfel et al**	**Koivuranta et** al
n	244	1040	1107
Female gender	173(71%)	593(57%)	731(60%)
Age in years	38(18-80)	49(36-61)	46(4-86)
History of motion sickness	2(0.8%)	-	266(24%)
History of PONV	12(4.9%)	-	476(43%)
None smoker	220(90%)	759(73%)	863(78%)
Duration of surgery (Min)	85(10-315)	117(73-170)	72(42-105)
Use of Opioid	224(92%)	478(46%)	786(71%)
Outcome			
Overall Incidence	62(26%)	478(46%)	786(71%)

Table 3. Shows the distribution of patient's characteristics, predictors of PONV and outcomes for the study and the two derivation studies.

(*Values are numbers [proportions, median {interquartile range or median range}*]

9.2 RECEIVER OPERATING CHARECTERISTIC CURVE (ROC)

	Nausea	Vomiting	Nausea +/- Vomiting
Apfel et al	-	-	0.75(0.71-0.79)
Validation study	0.62(0.53-0.70)	0.67(0.51-0.81)	0.63(0.55-0.71)
Koivuranta et al	0.72	0.70	#
Validation study	0.62(0.54-0.71)	0.64(0.49-0.80)	0.63(0.55-0.71)

Table 4: Receiver operating characteristic curve (ROC) areas. Comparing those of the study and the two derivation studies.

[#ROC area for nausea is assumed equal to that of PONV (Van de Bosch et al 2005)

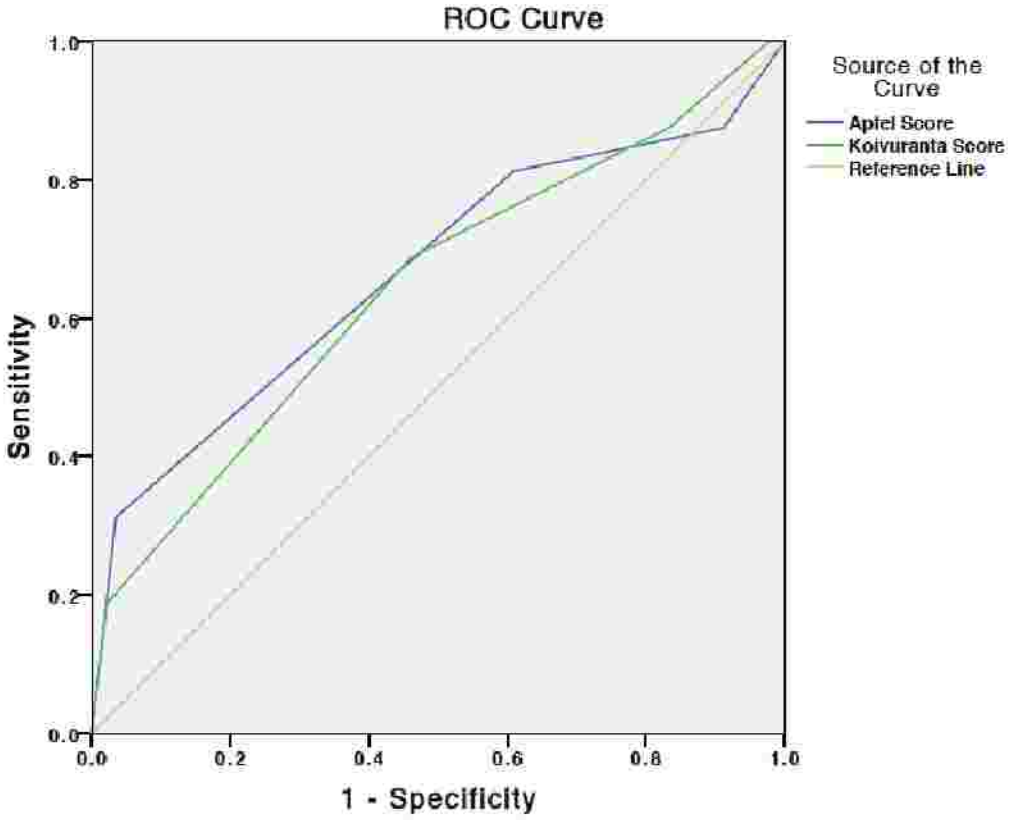

Figure 1a Receiver operating characteristics curve for PONV

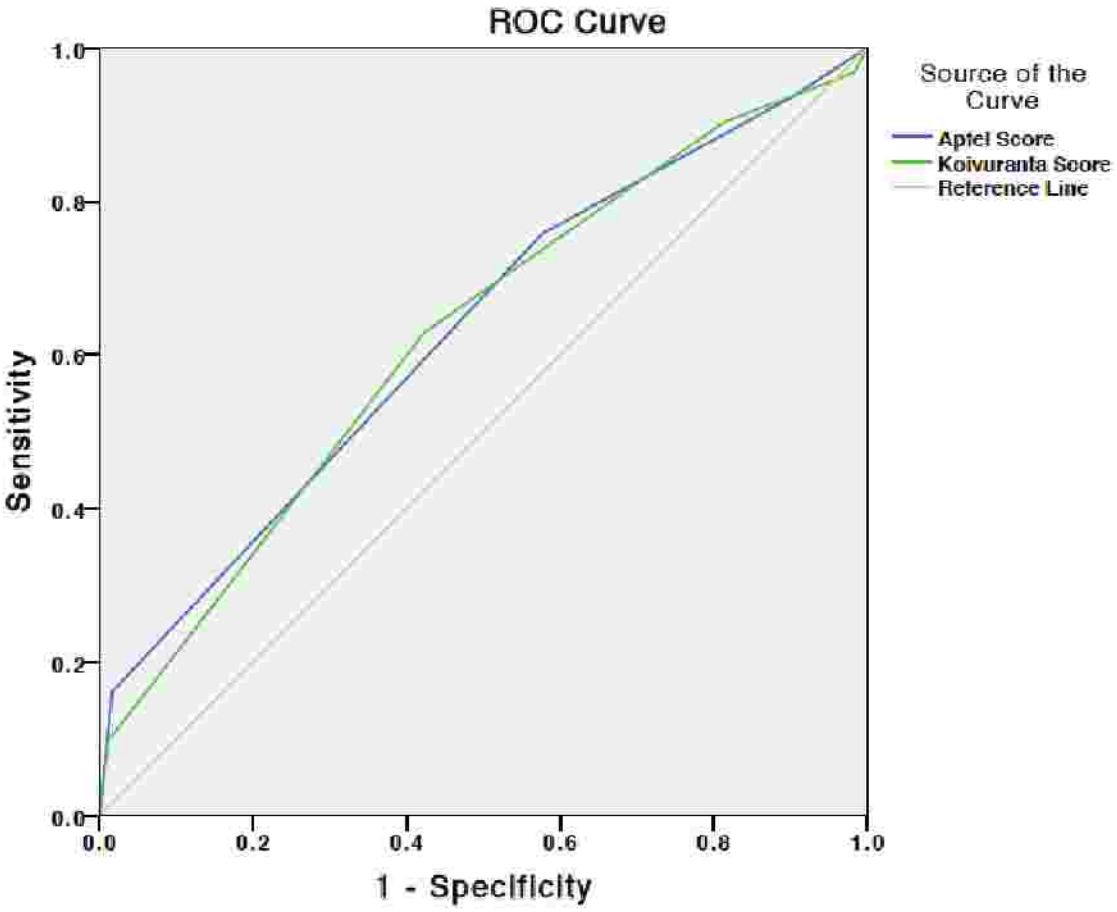

Figure 1b: receiver operating characteristic curve for Nausea

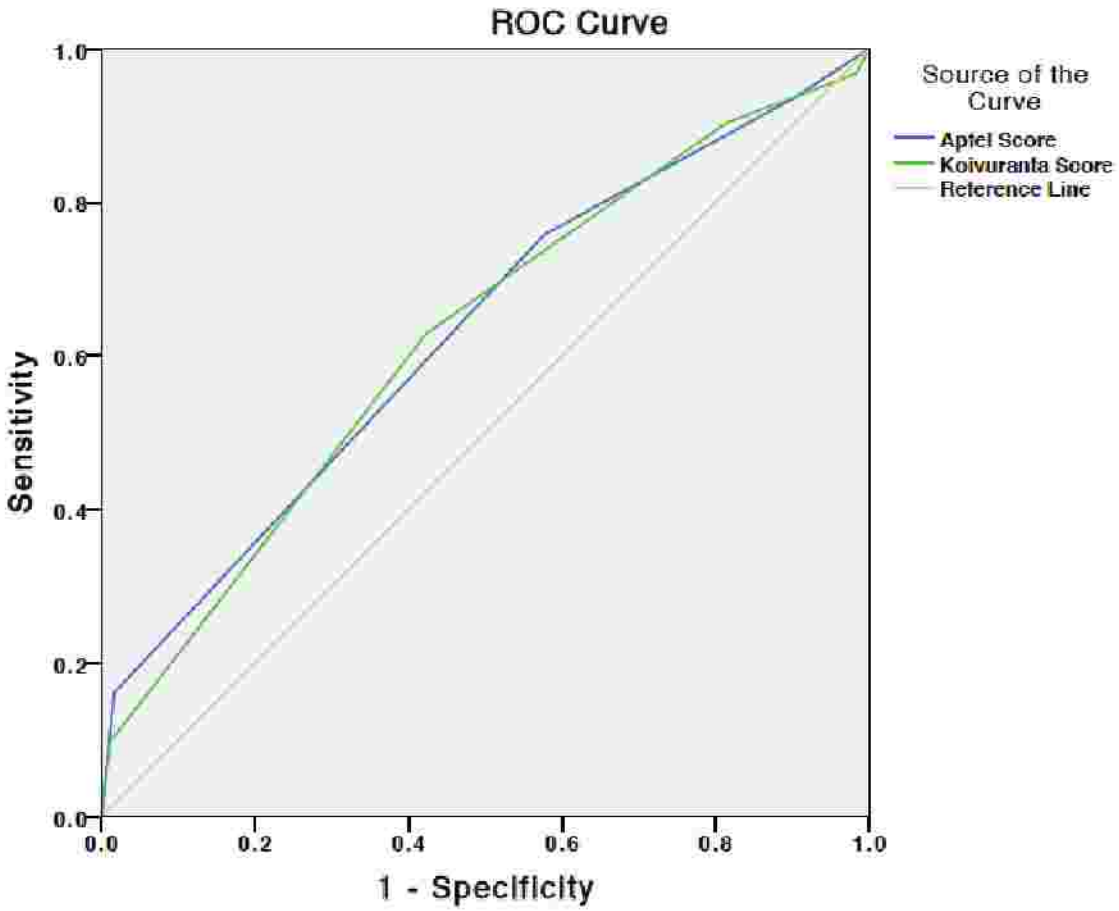

Figure 1c: Receiver operating characteristic curve for nausea

Figures 1 a, b and c are showing the area under the ROC curve for vomiting, PONV and nausea as was found in this study. As stated by Bosch et al, the curves for nausea and PONV were very similar. This is because any patient who experienced nausea was considered to have had PONV as stated above.

9.4 INCIDENCE OF PONV

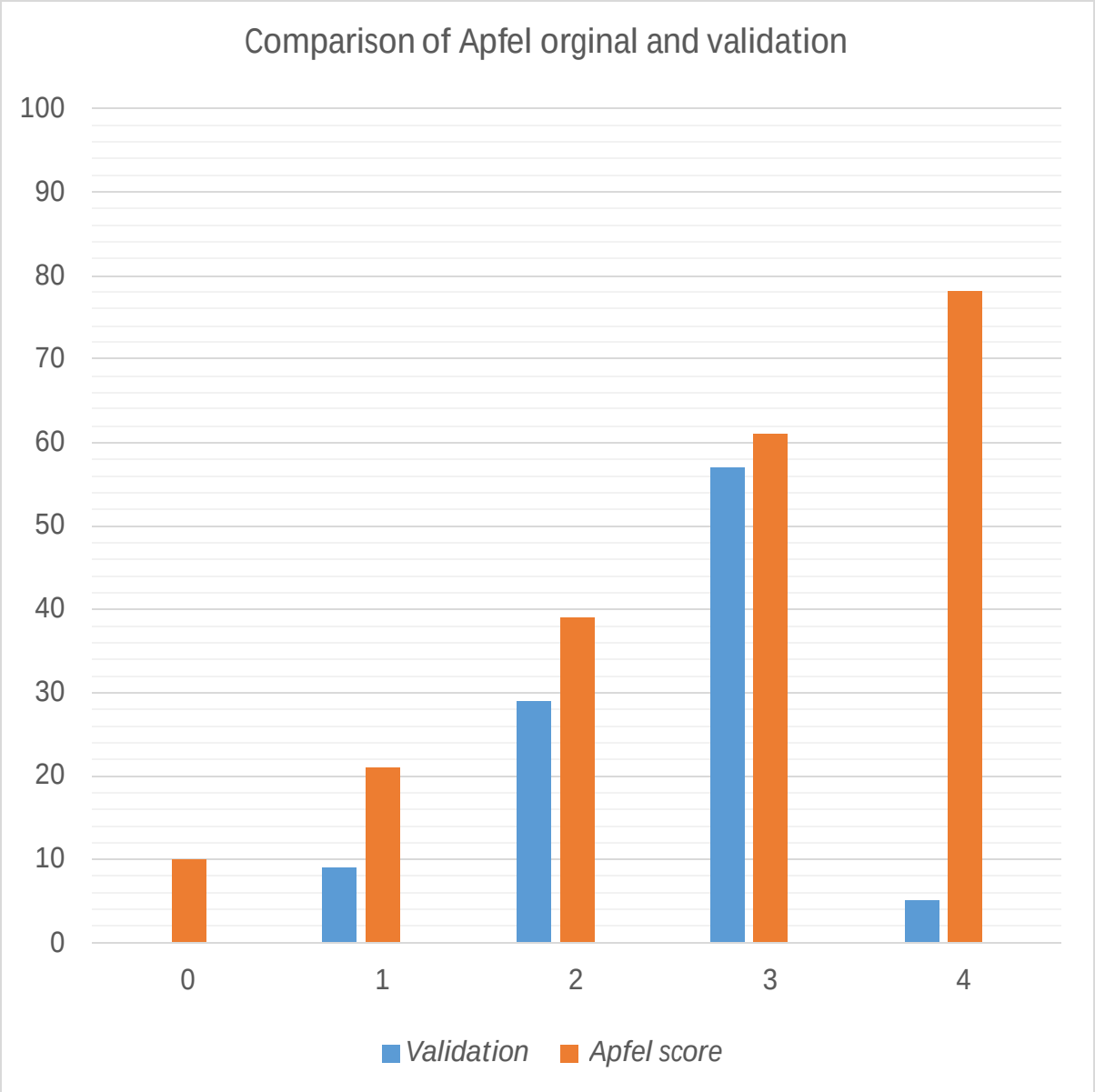

Figure 2. Percentage of patients with PONV per risk score as found in the derivative Apfel et al (orange) and this study (blue)

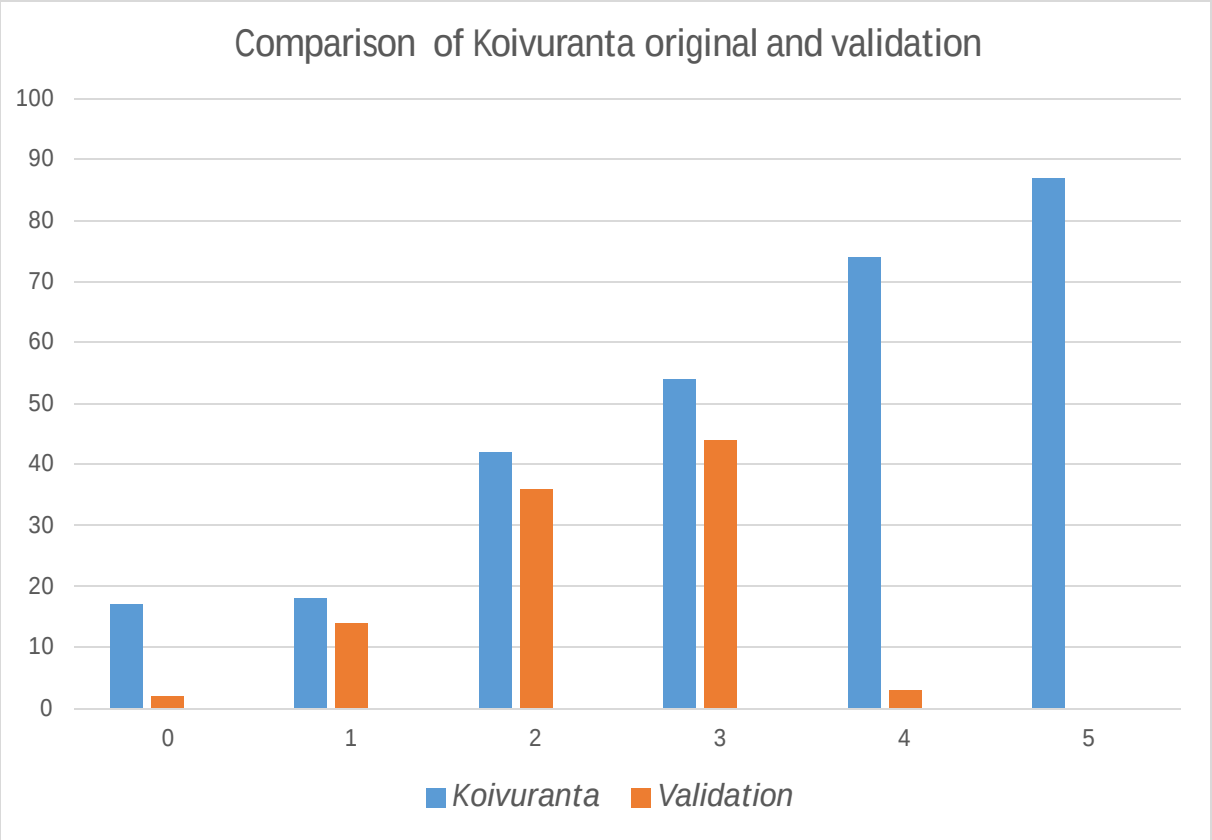

Figure 3. Percentage of patients with PONV per risk score as found in the derivative Koivuranta score (blue) and this validation study (orange)

9.5 POSITIVE AND NEGATIVE PREDICTIVE VALUE, SENSITIVITY AND SPECIFICITY

APFEL SCORE

Score	0	1	2	3	4	Total
Number of patients with PONV	0	4	10	37	8	59
Number of patients without PONV	0	18	60	102	5	185
Total	0	22	70	139	13	244
Positive predictive value (%)		24	33	30	67	
Negative predictive value (%)		0	82	85	78	
Sensitivity (%)		100	93	83	14	
Specificity (%)		0	10	42	98	

Table 5, shows number of patients with and without PONV, Positive Predictive Value (PPV) Negative Predictive Value (NPV), Sensitivity and Specificity for each possible number of risk scores according to the Apfel.

The percentages refer to positive predictive value (PPV), negative predictive value (NPV), sensitivity and specificity at various pre-defined cut-off values of the Apfel scores. For example, an Apfel score of one or greater than one will give a PPV of 24%, NPV of zero, and sensitivity of 100% and specificity of zero.

KOIVURANTA SCORE

Score	0	1	2	3	4	5	Total
Patients with PONV	2	34	4	10	5	0	59
Patients without PONV	3	35	18	60	3	0	185
Total	5		22	70	8	0	244
Positive predictive value (%)		24	24	33	63		
Negative predictive value (%)		60	85	81	75		
Sensitivity (%)		97	90	64	8		
Specificity (%)		2	18	53	98		

Table 6 shows patients with and without PONV, PPV, NPV, Sensitivity and Specificity for each number of risk scores according to Koivuranta et al.

These percentages refer to positive predictive value (PPV), negative predictive value (NPV), sensitivity and specificity at various pre-defined cut-off values of the Koivuranta scores. For example, a Koivuranta score of 1or greater than 1 will give a PPV of 24%, NPV of 60%, and sensitivity of 97% and specificity of 2%.

10.0 DISCUSSION

10.1 DISCRIMINATION USING RECIEVER OPERATING CURVE AREA UNDER THE GRAGH

The result of this study showed that the two predictive scores; Apfel et al. 1999 and Koivuranta et al. 1997 are not very accurate at predicting predict PONV in the patients studied in this study.

In this validation study comparing the original Apfel et al. 1999 study the ROC area was 0.63 as compared to the original score which had the ROC area of 0.75. Thus concluding that the discrimination was poor. However, the ROC area of this study was similar to a validation done by Bosch J E et al. 2005 whose ROC area was also 0.63 even though 24 hours was used. Another validation study conducted at the same hospital as the original study showed a ROC area of 0.68 (Apfel et al. 2002. This loss in discrimination ability is said to occur when a scoring system is noted to be too optimistic. The estimated risks are either too high than expected or too low. (Harrell FE et al. 1996.) The loss can also be due to differences in the distribution of predictor values. In table 5 above all the predictors have different distribution between the original scores and this study. Though in all the study the proportion of females were high, in this study the proportion was above 70% as compared to Apfel et al 57% and Koivuranta et al 60%. This could have been expected to probably sway the score towards the original score as female sex is a predictive score but that did not come out in this study. History of motion sickness was extremely low less than 1 % compared to 24 % seen in the Koivuranta score this could also have led to the current result. Another reason could be due to the time at which PONV was assessed in the original study the patients was assessed after 24 hours but in this study the average time was 6 hours postoperatively. This was because some patients under went day case surgeries and were discharge before 24 hours elapsed.

In the Koivuranta et al. study the ROC area for nausea was 0.72 that of vomiting was 0.70. In this study however the ROC areas were lower than that; 0.62 and 0.64 for nausea and vomiting, respectively. The same reason as above can be used to explain differences in the ROC area. In the Koivuranta study the ROC area for the overall PONV was not given but was assumed to be the same as that of nausea. However, in this study the ROC area for PONV was 0.63 were as that of nausea was 0.62. The validation study by Bosch et al 2006 had ROC areas of 0.66(nausea), 0.65(vomiting) and 0.66 for PONV. These are a bit similar to the ones found in this study as compared to the original study. And these are said to be similar to a validation study of Koivuranta et al. (Apfel C C et al. 2002). In the study by

Eberhart L H J et al. ROC areas were similar to that of the original study. (0.71 for PONV and 0.73 for vomiting.

10.2 POSTOPERATIVE NAUSEA AND VOMITING INCIDENCE

The overall incidence of PONV in this study (25.4%) was lower than that in the original studies. (44% for the Apfel *et al.* study and 52% for the Koivuranta original study). However, this incidence was similar to that found in black South Africans (Rodseth *et al* 2010 were all the parameters were the same for both groups of patients.and a study conducted in Malawi to determine the incidence of PONV in Malawi [Mndolo S et al, 2014 also found the incidence of 25. Even when comparing the incidence for each risk score the same trend was observed except for zero risk score for Koivuranta which showed a very high incidence for someone with no risk compared to those with risks. Most of the people of Malawi and Zambia originated from South Africa hence there could be similarity in their genetic makeup. Their diets are also similar maybe diet could also be attributed to this difference in PONV as compared to Europeans.

10.3 SENSITIVITY AND SPECIFICITY OF THE TWO SCORING SYSTEMS

Using each risk score to predict high risk of a patient experiencing PONV and excluding a score of zero (0), in the Apfel scoring system, a patient with a risk score of 1 or greater than 1, the sensitivity would be 100% and specificity of zero. However, when the threshold is 2 the sensitivity was 93% and specificity of 10%. For 3 this was 83% against 42% respectively and for a score of 4 as the highest risk only 14% sensitivity and 98% specificity. This means that using the Apfel score 98% of patients with a risk score of 4 will be given anti-emetic drugs unnecessarily, were as a patient with a score of 1 all the patients will be treated appropriately. This means that using the Apfel score it is assumed that a patient with a high score in this case with a score of 4 is presumed to be at very high risk of PONV and will be given ant-emetic prophylactically usually more than one drug when in actual sense this score only has a sensitivity of 14 % at this score.

Using the Koivuranta score; a risk score of 1 was giving a sensitivity of 97% and specificity of 2%. For sore of 2; 90%; 18%, 3; 64%; 53% and score of 4 was giving 8% and 98% respectively. The same explanation applies as the Apfel even though this later score even has a lower sensitivity.

11.0 CONCLUSION

The two PONV predictive scores are not accurate for the adult patients undergoing general anaesthesia at UTH.

The incidence of PONV in this study population was 25.4 percent much lower than that found in the studies used to derive the predictive scores.

12.0 RECOMMENDATIONS

It is important that the correct patients at risk are treated prophylactically for PONV as these drugs are costly - especially in a country like Zambia were the resources are limited. These drugs also have undesirable side effects. (Sung Y F. Drug safety. 1996 and Domino et al1998.) In reality predictive scores are said to predict poorly in new populations. (Bosch et al 2005). It is therefore recommended that clinicians consider one of the three options. (Steyerberg et al, 2004). These are;

1. Use the scoring system as it is but bearing in mind that the predictors may not be ideal for the population.
2. Make some adjustments to the published scoring systems.
3. Revise the existing scoring systems by re-estimating individual regression coefficients and including new predictors.

In our environment the third option may will be the best as not only are the patient's ethnicity different from those used to derive the scoring systems, the drugs used for conducting anaesthesia are a bit different as we never use Nitrous oxide as an inhalation agent which is one of the drugs thought to cause PONV.

It is important to determine the factors which will predispose the patients to PONV seeing that 25% patients did experience PONV. The existing scoring systems are clearly inadequately predictive in the local population and their use and therefore recommend that a study be conducted to establish a more reliable scoring system as the local PONV incidence percentage is quite high.

At the moment there is need to continue providing prophylactic anti-emetics to the patient as the incidence found though not as high as in the original studies was high enough to have a good number of patients suffering postoperatively.

From this study it was noted that patients are not given anti-emetic prophylactically as none of the charts reviewed indicated the drug having been given even though other drugs were charted on the anaesthetic form. So we recommend that all patients at risk should be given prophylaxis.

13.0 LIMITATION

1. . As this was a hospital based study the findings could not be applicable to the general population.
2. Due to the differences in the time of observation for postoperative nausea and vomiting this could be the reason why the incidence was low in this study.
3. Also the sample size was much smaller than the original studies hence this could have had some effect on the result.
4. The duration it took to collect the data was long due to high rate of cancellation of cases which were booked. There are many factors which led to that which are not part of this study.

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15.0 APPENDIX

A. DATA COLLECTION SHEET

1. Date……/……/…… (DD/MM/YYYY).

2. Gender……M F

3. Age……

4. Do you suffer from motion sickness? (a) yes (b) no

5. Have you ever had surgery before? (a) yes (b) no

6. If yes did you experience PONV? (a) yes (b) no

7. Do you smoke? (a) Yes (b) no

8. Time after surgery…….

9. Duration of the surgery.....

10. Type of operation……..…

1. Did you feel nauseous after surgery (a) yes (b) no

2. If yes, can you rate the nausea on scale of 0-3, with 0 being none?

3. Have you vomited after surgery? (a) yes (b) no

B. INFORMATION SHEET

VALIDATION OF RISK SCORES OF POSTOPERATIVE NAUSEA AND VOMITING IN PATIENTS UNDERGOING GENERAL ANAESTHESIA AT THE UNIVERSITY TEACHING HOSPITAL IN LUSAKA

1. WHY ARE WE GIVING YOU THIS FORM?

We are giving you this form so as to give you information about the named study and also to give you a chance to ask questions.

2. WHO IS CARRYING OUT THE STUDY?

Dr. Tuma Kasole as part of specialist training at the University of Zambia School of Medicine.

3. BACKROUND INFORMATION

You are being asked to take part in the above named study, were we are going to validate the risk scores for postoperative nausea and vomiting. The scoring systems which are used to predict patients at risk of postoperative nausea and vomiting were developed in the western countries Europe to be specific. These scores after being used in some African countries don't seem to be very accurate at predicting postoperative nausea and vomiting. The environment in which the study was done is quite different when compared to our setting in addition the drugs which are given to patients who are said to be at high risk of postoperative nausea and vomiting Have severe side effects hence we are trying to see if these scoring systems apply to the Zambian setting. By you agreeing to take part in this study you are going to enable the investigator to know the incidence of postoperative nausea and vomiting and also to know whether these scores should be adhered to at this hospital.

4. WHAT HAPPENS IN THIS STUDY?

After the operation you will be asked if you had experienced any nausea and/or vomiting. This will be done two hours, six hours and twenty-four hours after the operation.

5. POSSIBLE PROBLEMS

We are not anticipating any problems due to this study as we are only going to observe you after the operation.

6. BENEFITS.

It is hoped the study will enable the anaesthetists identify which patients are at risk of postoperative nausea so that they can be given drugs which will reduce nausea and vomiting after general anaesthesia.

7. CONFIDENTIALITY

Your name will never be made public by the investigators. The medical records will be treated as all medical records at health centres. A code number that identify you will be used. This number will make it difficult for anyone to identify you. All information will be stored in a secure place. Information from this study may be used for research purposes and may be published; however, your name will never be published.

Should you wish to withdraw from the study, you can do so free and this won't affect how you will be treated at the hospital. You also are free to deny taking part in this study.

You are also free not to answer any questions you may deem personal or otherwise.

8. FURTHER INFORMATION.

In case you have any more questions or clarifications you can contact

DR TUMA KASOLE

DEPARTMENT OF ANAESTHESIA AND CRITICAL CARE

UNIVERSITY TEACHING HOSPITAL

0976455325

In case you have any questions on ethical issues you can contact the chairperson of the University of Zambia,

THE CHAIRMAN

BIOMEDICAL RESEARCH ETHICS COMMITTEE

RIDGEWAY CAMPUS

PO BOX 50110

LUSAKA

TEL 0211256062

C CONSENT FORM

VALIDATION OF RISK SCORES FOR POSTOPERATIVE NAUSEA AND VOMITING IN PATIENTS UNDERGOING GENERAL ANAESTHESIA FOR ELECTIVE SURGERY AT THE UNIVERSITY TEACHING HOSPITAL OF LUSAKA

Participant,

I..... (Participants name) have been told about the study and I have freely and willingly agreed to participate in the study. I have been explained to that my refusal or withdrawal from the study won't affect the way I will be treated at the hospital and also that I am free to refuse to answer questions I deem personal. A copy of this form signed by me and the investigator has been given to me.

Signature/thumb prints.....

DATE:

Interviewer's signature.....

DATE: