

**A SURVEY ON OUTREACH ANAESTHESIA SERVICES IN SELECTED SURGICAL
CAMPS IN KENYA**

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I hereby declare that this dissertation is my own original work and that it has not been submitted to any university or institution for examination or any other purposes.

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DEDICATION

To my beloved parents who gave me motivation in my journey to be a doctor

To my dear wife who encouraged me throughout the whole program.

To my friend Dr Muruka who gave me the courage to pursue anesthesia.

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I sincerely thank the following:

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LIST OF ABBREVIATIONS

ECG- Electrocardiograph

KNH- Kenyatta National Hospital

SPSS- Statistical Package for the Social Sciences

U.O.N- University of Nairobi.

NGOs- Non-Governmental Organisations

ASA - American Society of Anaesthesiologists

PACU- Post Anaesthetic Care Unit

WFSA- World Federation Society of Anaesthesiologists

O.R- Operating Room

VVF- Vesicovaginal Fistula

TIVA- Total Intravenous Anaesthesia

NSAIDS- Non-Steroidal Anti-inflammatory Drugs

SPSS- Statistical Package for Social Sciences

ERC- Ethics and Research Committee

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ABSTRACT

Background: Broadly defined, medical camps are stationary or mobile short term medical interventions for target communities, generally lasting from a day to a week. Surgical outreach aims to improve access to surgical services to patients who face financial or geographic barriers to surgical care and seeks to attend to as many patients as possible within a limited period.

One way to improve access to surgical services in sub-Saharan Africa would be to promote the provision of essential services and safe anaesthesia at the District Hospitals.

Providing anaesthesia care in remote locations may be challenging, as changed and variable environments pose unique problems.

Various studies have documented a slightly greater risk of unanticipated hospital admission and intraoperative event following ambulatory surgery.

Adequate monitoring in low resource settings has shown to reduce the rate of surgical complications, dropped infection complication and nearly halved the number of hypoxic episodes.

Objectives: The study aims to evaluate anesthetic practice in outreach anaesthesia in selected surgical camps in Kenya.

Methodology: The study was an observational Cross sectional survey study. The study was conducted in Surgical Medical camps in Kenya between July and December 2016. These included surgical camps conducted by Operation Ear Drop, Help a Child Face Tomorrow, Ophthalmology Camps, VVF and Surgical Society of Kenya. Two stage sampling was utilized to recruit participants in the study. A survey tool was used for data collection concerning the patients and the facility where the camp was held.

Results: A total of five selected surgical camps were surveyed which included 363 patients. The challenges faced in outreach anaesthesia ranged from anaesthesia drug supplies to inadequate monitoring equipment. Most of the patients attended to were ASA 1 and II. Airway complication were the common complication experienced in surgical camps. Most of the surgeries were carried out under regional anaesthesia

Conclusion: The challenges faced in outreach anaesthesia range from anaesthesia drug supplies to inadequate monitoring.

Recommendation: Efforts should be made to improve access to essential anesthetic drugs, invest in monitoring equipment in all operating rooms and train more anaesthesia providers to provide safe anaesthesia.

CHAPTER ONE

1.1 INTRODUCTION

Broadly defined, medical camps are stationary or mobile short term medical interventions for target communities, generally lasting from a day to a week. Surgical outreach aims to improve access to surgical services to patients who face financial or geographic barriers to surgical care and seeks to attend to as many patients as possible within a limited period.

Equally vast are the assemblages of global institutions and groups that organize and sponsor them. These include NGOs, other development and aid institutions, volunteer programs, private hospitals, churches, branches of the ministry of health and the military.

There are many different kinds and combinations of camps such as general health camps, dental and eye camps, reproductive health and family planning camps, gynaecological fistula and specialized surgical camps.

One way of improving access to surgical services in sub-Saharan Africa would be to promote the provision of essential services and safe anaesthesia at the District Hospitals. These hospitals are the first referral hospitals for people living in rural areas and this leaves them in their general capacity to handle emergency and trauma cases. Patients receive much of their primary health care at these facilities but are referred to secondary and tertiary health care facilities for more specialized care.

1.2 PROBLEM STATEMENT

Conditions that need surgery are common in developing countries and contribute significantly to the burden of disease. Various organizations work to reduce this burden by improving emergency and essential surgical care in developing countries through medical camps in remote areas as well as those with deficient speciality care.

ASA standards for basic anaesthesia monitoring require presence of qualified anaesthesia personnel throughout the conduct of the course of anaesthesia and continuous evaluation of the patient's oxygenation, ventilation, circulation, and temperature.

Providing anaesthesia care in out of regular standard operating room situations may be challenging, as changed and variable environments pose unique problems since the conditions under which the anaesthesia care is delivered may vary greatly because of the space and equipment available in these locations.

This study will assess the quality of anaesthesia delivery and safety measures at these medical camps with the aim of improving quality of services in medical camps.

1.3 STUDY JUSTIFICATION

Level 4 hospitals in Kenya are the first referral hospitals for people in rural areas and are usually left to handle emergency surgical cases and those that need elective specialized care don't get a chance to be attended to and are referred to a tertiary center. This situation has led to a growing need for surgical camps which need anesthetic care and adequate monitoring.

These medical camps handle large numbers of patients over a short period of time and the team of anesthetist involved are usually new to the operating room and the equipment. The anesthetist may come across large number of patients who may have not been investigated appropriately before. The drug sources for the medical camps also vary widely.

The challenges faced by anesthetists in these settings in Kenya have not been assessed previously. This study, therefore, set a baseline evaluation of anesthesia facilities in outreach camps.

It is hoped that this study will help standardize the safety measures across medical camps organized by different groups. It will also help in coming up with minimal local standards to be met in spite of the challenges in our set up and this will improve the quality of services and patient safety in medical camps.

1.4 Broad objective

To evaluate anesthetic practice of outreach anaesthesia in selected surgical camps in Kenya

1.5 Specific objectives

- i. To determine challenges faced in outreach anaesthesia
- ii. To determine the ASA classification of patients attended to in outreach anaesthesia
- iii. To evaluate monitoring standards in outreach anaesthesia
- iv. To determine common complications in outreach anaesthesia

CHAPTER TWO

2.1 LITERATURE REVIEW

Every year, about 234 million surgical procedures take place globally. Of these procedures only a quarter are performed in low and middle income countries where nearly three quarter of the world population lives. Conditions that need surgery are common in developing countries and contribute significantly to the burden of disease in these countries⁸.

Various organizations are working to reduce this burden by improving emergency and essential surgical care in developing countries through medical camps in remote areas.

In a research by Galukande et al, the range of surgical procedures in district hospitals in Mozambique and Tanzania consisted mainly of essential and lifesaving emergency procedures such as caesarean sections for delivery of babies and wound related procedures. These left the level 4 facilities without capacity to handle other surgical procedures.

Anesthetists are more frequently called upon to provide care for sicker patients undergoing novel, unfamiliar procedures in non-traditional locations. As technology advances, the number of procedure areas and the need for anaesthesia services proliferates. As the outreach surgery cases continue to grow at an exponential rate and the landscape of anaesthesiology is changing; new challenges and opportunities emerge².

The Royal College of Anesthetists defines a remote site as any location at which an anesthetist is required to provide general/regional anaesthesia, or sedation away from the main theatre suite and/or anesthetic department and in which it cannot be guaranteed that the help of another anesthetist will be readily available¹.

Wherever possible, anaesthesia in remote sites should be provided by appropriately experienced consultants¹.

Providing anaesthesia care in out of operating room situations may be challenging, as changed and variable environments pose unique problems. When providing care at such locations, anaesthetists must maintain the same high standard of anesthetic care provided in the operating suite. The anaesthetizing location must be surveyed by the anaesthetist to determine whether anaesthesia care can be delivered safely in that location before delivery of that care. The requirements for anaesthesia and the patient's underlying condition do not vary merely because of location, but the conditions under which the anaesthesia care is delivered may vary greatly because of the space and equipment available in these locations³.

A complete medical history is essential, good communication skills, and a thorough understanding of Pathophysiology are required of any anaesthesia provider working in remote location because the Operating Room support network may not be readily available and the procedure may be unfamiliar or new⁵.

A prospective cohort study by Chung F, et al. on Pre-existing medical conditions as predictors of adverse events in day-case surgery, 17,638 consecutive ambulatory surgery patients, found that, compared with individuals younger than 65 years, those who were 65 years or older were 1.4 times as likely to experience an intraoperative event and 2.0 times as likely to experience an intraoperative cardiovascular event. In contrast, elderly patients had a much lower incidence of any postoperative event, postoperative pain, nausea and vomiting, and dizziness¹⁴.

Mandal et al in “Unplanned admissions following ambulatory plastic surgery: A retrospective study”, documented a slightly greater risk of unanticipated hospital admission following ambulatory surgery in older aged patients i.e., age 65 years or older¹⁵.

Provision of anaesthesia/deep sedation in remote sites presents potentially significant risks for the patient related to⁴:

1. Unfamiliarity of the anesthetist with one or more of the following:

- The isolated environment.
- The available unfamiliar/outdated equipment.
- The assistance being provided.
- The procedure being undertaken.

2. Difficulties with communication and the immediate availability of senior assistance.

3. Difficult or limited access to patients.

4. Untrained personnel

Guidelines for anesthetic care delivered outside the Operating Room, American Society of Anaesthesiologists (ASA) 2013 Guidelines for Non–Operating Room Anaesthetizing Locations include recommendations for:

(1) A reliable oxygen source with backup as required.

(2) A working suction source with all proper connections & suction catheters.

(3) Waste gas scavenging system.

(4) Adequate monitoring equipment to meet the standards for basic anaesthesia monitoring and, in addition, a self-inflating hand resuscitator bag/ transport ventilator.

- (5) Sufficient safe electrical outlets.
- (6) Adequate illumination of the patient and anaesthesia machine with battery-powered backup.
- (7) Sufficient space for the anaesthesia care team.
- (8) An emergency cart with a defibrillator, emergency drugs, and other emergency equipment.
- (9) A means of reliable two-way communication to request assistance.
- (10) Compliance of the facility with all applicable safety and building codes.
- (11) Available post-operative care in a post-anaesthesia care unit (PACU) setting with the oversight of anesthesiologist/intensivist and a dedicated nursing staff.

It is the responsibility of the anesthesiologist providing care to ensure that the anaesthetizing location in which that care is delivered meets all applicable standards.

ASA standards for basic anaesthesia monitoring require presence of qualified anaesthesia personnel throughout the conduct of anaesthesia and continuous evaluation of the patient's oxygenation, ventilation, circulation, and temperature.

Provision is made for the absence of anaesthesia personnel from the immediate vicinity of the patient if required for safety (i.e., in the presence of radiation hazards), provided that adequate patient monitoring is continued despite the physical separation of the anesthesiologist from the patient. Oxygen concentrations of inspired gas should be monitored with the use of a low-concentration alarm, blood oxygenation should be monitored with pulse oximetry, and ventilation should be monitored by observation of the patient. When present, the position of the endotracheal tube must be verified by observation and by detection of end-tidal carbon dioxide. Continuous end-tidal carbon dioxide analysis should be performed. When mechanical ventilation

is used, a disconnect alarm with an audible signal must be present. Circulation is monitored by continuous display of the electrocardiogram, as well as by measurement of arterial blood pressure at a minimal interval of 5 minutes, in addition to other assessments such as auscultation, palpation of pulse, invasive blood pressure monitoring, or oximetry. When changes in body temperature are anticipated or suspected, patient temperature should be assessed. There should be no hesitation to use invasive monitoring if the patient's condition warrants so during a procedure.

The Association of Anaesthetists of Great Britain and Ireland in recommendations for standards of monitoring during anaesthesia and recovery recommend that the following monitoring devices are essential to the safe conduct of anaesthesia.

A - Induction and Maintenance of Anaesthesia

1. Pulse oximeter
2. Noninvasive blood pressure monitor
3. Electrocardiograph
4. Airway gases: oxygen, carbon dioxide and vapor
5. Airway pressure

The following must also be available

- A nerve stimulator whenever a muscle relaxant is used
- A means of measuring the patient's temperature

During induction of anaesthesia in children and in unco-operative adults it may not be possible to attach all monitoring before induction. In these circumstances monitoring must be attached as soon as possible and the reasons for delay recorded in the patient's notes.

B- Recovery from Anaesthesia

A high standard of monitoring should be maintained until the patient is fully recovered from anaesthesia. Clinical observations must be supplemented by the following monitoring devices.

1. Pulse oximeter
2. Non-invasive blood pressure monitor

The following must also be immediately available

- Electrocardiograph
- Nerve stimulator
- Means of measuring temperature
- Capnograph

If the recovery area is not immediately adjacent to the operating theatre, or if the patient's general condition is poor, adequate mobile monitoring of the above parameters will be needed during transfer. The anaesthetist is responsible for ensuring that this transfer is accomplished safely.

Mijumbi et al defined some minimal requirements for the provision of safe general anaesthesia for an adult or child, for spinal anaesthesia and for obstetric anaesthesia using either spinal or general anaesthesia. Essential requirements as shown in Table 1 below were similar to those described by the WFSA as 'basic' equipment requirements, with the addition of the pulse oximeter (defined in 1992 as an intermediate requirement), and drugs required for obstetric anaesthesia (not included in the WFSA standards)⁹.

Table 1. Definitions of minimal requirements for safe anaesthesia

A	B	C	D
Adult general anaesthesia	Paediatric general anaesthesia	Spinal anaesthesia	Obstetric anaesthesia
Oxygen supply Face mask Laryngoscope Tracheal tube Suction apparatus Pulse oximeter Tilting table	As for A plus Paediatric: mask laryngoscope tracheal tube oropharyngeal airway breathing circuit intravenous cannulae	As for A plus Local anesthetic drugs Spinal needle Sterile syringes Disinfectant to clean skin Sterile gloves Blood pressure monitor	A and C plus Access to blood transfusion Oxytocin or ergometrine Hydralazine or labetalol Magnesium sulphate

A recent analysis of closed anaesthesia claims demonstrated greater injury severity and more substandard care in outside OR procedures than seen with operating room closed claims. Drug interactions were the most common associated factors, followed by drug overdose, inadequate monitoring, inadequate skills for cardiopulmonary resuscitation, inadequate evaluation before sedation and premature discharge from medical supervision were other incidents noted as contributory to the events in outside OR procedures³.

Bull et al in; “anaesthesia during the Falklands conflict” reports that some of the main challenges in the provision of anaesthesia were rudimentary monitoring, the location, equipment, the nature of the patients and shortage of staff⁶.

In a study by Mijumbi et al in Uganda on; “Anaesthesia services in developing countries: defining the problems”, only 23% of anaesthetists had the minimum requirements for the safe provision of anaesthesia to an adult. The items most frequently unavailable were a pulse

oximeter (74% of anaesthetists), a tilting operating table (23%), an oxygen source (22%) and appropriately sized tracheal tubes (21%). Other findings were that running water was not always present for 44% of respondents, electricity was not always present for 80%, and intravenous fluids were not always available for 30%. Electricity supplies were unreliable. General facilities for infection control were poor, inadequate disinfectants with reuse of tracheal tubes. Sixteen per cent of government hospitals and 50% of mission hospitals were able to deliver safe anaesthesia for adults. Access to bedside or laboratory investigations was poor. In general there were shortages of personnel, drugs, equipment and training⁹

In a study by Fisher Q. et al in; “Assessing pediatric anaesthesia practices for volunteer medical services abroad”, airway complications were the most frequent difficulty in the operating room followed by cardiovascular complications.

Significant Negative Events also occurred with urgent return to the operating room because of bleeding, unplanned extubations, cancellation of surgery after anaesthesia induction and transfer to an intensive care unit following respiratory failure¹⁰.

A new WHO study confirms that adequate monitoring alongside use of pulse-oximeters in low resource settings reduces the rate of surgical complications from 21.5% to 8.8%, dropped infection complication by more than 10% and nearly halved the number of hypoxic episodes⁷.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Study Design

Observational Cross sectional survey study. A cross-sectional study is an observational study in which exposure and outcome are determined simultaneously for each subject presenting a snapshot of a group of individuals at a specific time by direct observing them in their natural setting¹⁶. This study sought to describe anesthetic practice in outreach anaesthesia in selected surgical camps in Kenya without the intervention of the researcher but by observing the practices.

3.2 Study Site

The study was conducted in selected Surgical camps in Kenya between July and December 2016. These included surgical camps conducted by Operation Ear Drop, Help a Child Face Tomorrow, Ophthalmology Camps, VVF and Surgical Society of Kenya.

3.3 Study population

Consenting patients undergoing surgery in surgical camps in Kenya within the study period.

3.4 Sample size

The number of camps and subsequent number of patients were determined by the Yamane, (1967) formula given by:

$$n = \frac{N}{1+N(e)^2}$$

Where n is the sample size, N is the population size i.e. the total number of camps (40) or patients to be attended to (3975); e is the level of precision, 0.05 for this study

$$n_{camps} = \frac{40}{1+40 \times 0.05^2} = 36.4 \approx 36 \text{ camps}$$

$$n_{patients} = \frac{3975}{1 + 3975 \times 0.05^2} = 363.4 \approx 363 \text{ patients}$$

Therefore 363 patients in 36 camps were involved in the study.

3.5 Sampling procedure

Two stage sampling was utilized to recruit participants in the study. At stage one patients were proportionately stratified according to number of camps and number of patients attended to per camp while at stage two, patients attending a specific camp were randomly sampled according to the number of patients accorded to the camp in the sample.

Medical Camp	Number of camps	patients per camp	Total patients	camps Proportion	patients Proportion	camps to be sampled	patients to be sampled	patients to be sampled per camp
Help A Child Face Tomorrow	3	25	75	0.0750	0.0189	3	7	2
Operation Ear Drop	20	60	1200	0.5000	0.3019	18	110	7
Ophthalmology Camps	14	150	2100	0.3500	0.5283	12	192	16
VVF	2	200	400	0.0500	0.1006	2	37	19
Surgical Society of Kenya	1	200	200	0.0250	0.0503	1	18	18
Total	40	635	3975			36	363	

3.6 Inclusion/exclusion criteria

3.6.1 Inclusion criteria;

Patients undergoing surgeries other than emergency surgeries in organized surgical camps in Kenya who consented to the study.

3.6.2 Exclusion criteria;

Patients undergoing surgery other than organized by surgical camp

Patients undergoing surgery as an Emergency

Patients who declined to consent for the study

Patients found unfit for surgery: (Fever, anaemia, diarrhoea, respiratory tract infection, recent oral intake)

3.7 Data management

3.7.1 Data collection procedure

The eligible patients or their next of kin for those unable to give consent were required to give informed consent and complete a consent form before being involved in the study. The consenting process involved explaining to the patients or their next of kin the aim of the study, confidentiality and the use of the results. A questionnaire was available for data collection during perioperative management of these patients. Anesthetists providing anaesthesia were recruited to aid in the data collection perioperatively. Some part of the questionnaire was completed by the anesthetist.

3.7.2 Data Quality Assurance

Quality assurance was enhanced continuously throughout the study period to maximize on the validity and reliability of the findings.

Pre-testing of study instrument was carried out in a non-study surgical camp to correct it for bias, misinterpretation of the questions and ambiguity. The validity of the study was ascertained by ensuring that the data collection instruments reflect the objectives of the study. The research findings were validated by review with other similar literature.

During data collection process trained research assistant was deployed in the guidance of the researcher to ensure questionnaires completeness and relevant information is collected. EpiData software was used during data entry so as to get rid of inconsistencies and to ease data cleaning process. The reliability of the questionnaire, the degree to which the research data yield the same results after repeated trials, was established through split half technique whereby the data collected is randomly split in to two datasets and

Cronbach alpha coefficient evaluated with an alpha (α) score of 0.70 or higher considered satisfactory and ascertains reliability.

3.7.3 Data Analysis

At the end of each data collection period the filled checklists were cross checked for completeness and any missing entries corrected. The quantitative data collected was coded, processed and cleaned any present inconsistencies and outliers. Data entry was done using EpiData. Data was then analyzed by the use of SPSS (Statistical Package for the Social Sciences) version 20 as per the specific research questions using frequencies and percentages. Findings were presented in the form of text, charts and tables.

3.8 Ethical Considerations

Permission to conduct the research was sought from the relevant authorities at surgical camps. Ethical approval was sought from the KNH/UON ethics committee ref no P222/03/2016. Consent was sought from the study participants. The research assistants/researcher gave full information about what the research entails and ensured participants are competent to give their consent. All concerns causing any sort of discomfort to respondents were resolved immediately and mitigation strategies put in place. Codes were used to refer to participants' privacy to ensure their privacy. The research data was kept under key and lock to ensure its confidentiality and used only for research purposes.

3.9 Study findings dissemination.

The findings of this study will be disseminated through; presentation to members of anaesthesia department of the University of Nairobi, manuscripts, presentation in conferences organised by Kenya society of anaesthesiologists (KSA), feedback to the theatre team and a report to UON/KNH ERC

CHAPTER FOUR

STUDY FINDINGS

4.1 Preliminary information

The survey was conducted in five selected surgical camps over a period of six months. The camps included: operation ear drop (OED), help a child face tomorrow (HCFT), ophthalmology, vesico- vaginal fistula (VVF), and surgical society of Kenya (SSK). The camps were carried out in level 4 to level 6 hospitals. The timing of the camps range from monthly to annually and sometimes when need arose to have them.

The frequency of the camps varied from time to time depending on the availability of volunteers, sponsorship, and when the hospital location where the camps are to take place were ready.

This study used a sample of 363 respondents from different camps as illustrated in Figure 1 below. The distribution of number of respondents from each camp varied ($p\text{-value}<0.01$).

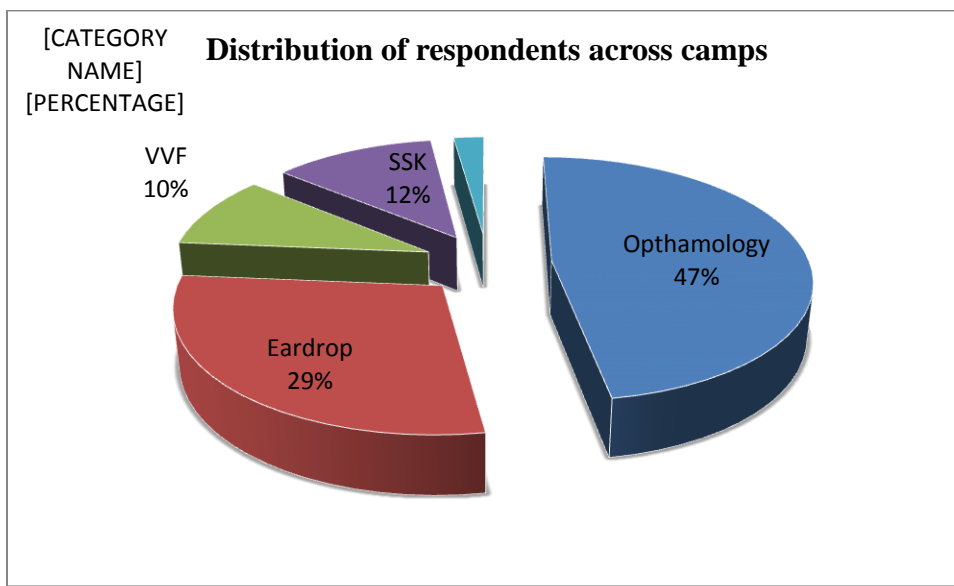


Figure 1: Distribution of respondents across camps

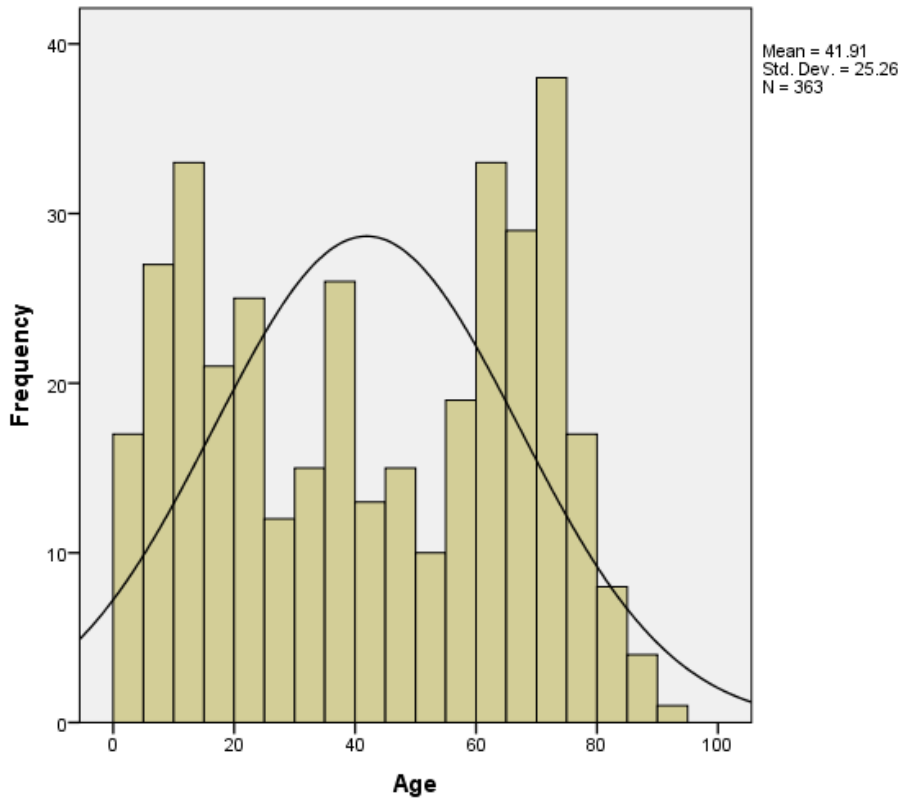
The sample comprised of (50.1%) male and (49.9%) female respondents. The distribution of gender was similar (p-value=0.874) between male and female respondents. 33.1% respondents aged 58-77 years and 26.9% were aged below 18 years, see Table 1.

Table 1: Gender and age of respondents

Variables	Category	Frequency	Percent	P- value
Gender	Female	182	50.1	0.874
	Male	181	49.9	
Age	<18	96	26.9	<0.001
	18-27	32	9	
	28-37	35	9.8	
	38-47	37	10.4	
	48-57	25	7	
	58-67	56	15.7	
	68-77	62	17.4	
	78-87	9	2.5	
	>87	5	1.4	

The mean age was 41.9 (SD 25.3) within the range of 7 months to 94 years (Figure 2).

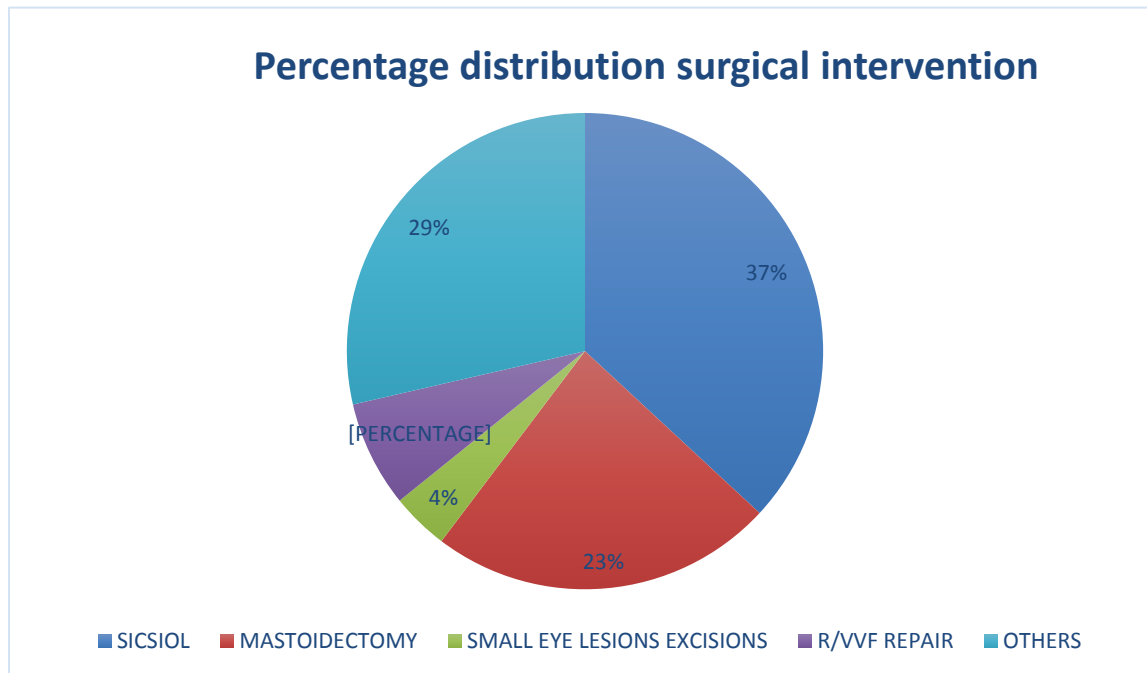
Figure 2: The distribution of age (years)



4.2 Planned surgical interventions

On the surgical interventions carried out during the period of study July to Dec 2016, Small incision cataract surgery and intraocular lens (SICS+IOL) (37%), Mastoidectomy (23%), RVF/VVF repair (7%) and others including thyroidectomy, contracture release, herniotomy, herniorrhaphy (29%).The distribution of planned surgical interventions varied (p-value<0.01) (figure 3).

Figure 3: Distribution of surgical interventions



4.3 ASA Classification

Majority (73.6%) of the respondents attended were ASA classification 1 and 26.4% were ASA class II.

The Mode of anaesthesia that was mostly used was Local anaesthesia (47.4%), followed by General anaesthesia (38.3%); the least used was regional anaesthesia (14.3%). The distribution of the proportions of mode of anaesthesia was different across the respondents (p -value <0.01) as shown in Table 2 and Figure 4.

Table 2: ASA Classification and Mode of Anaesthesia used

Variables	Category	Frequency	Percent	P-value
ASA Classification	I	267	73.6	<0.01
	II	96	26.4	
Mode of Anaesthesia	Local	172	47.4	<0.01
	Regional	52	14.3	
	General	139	38.3	

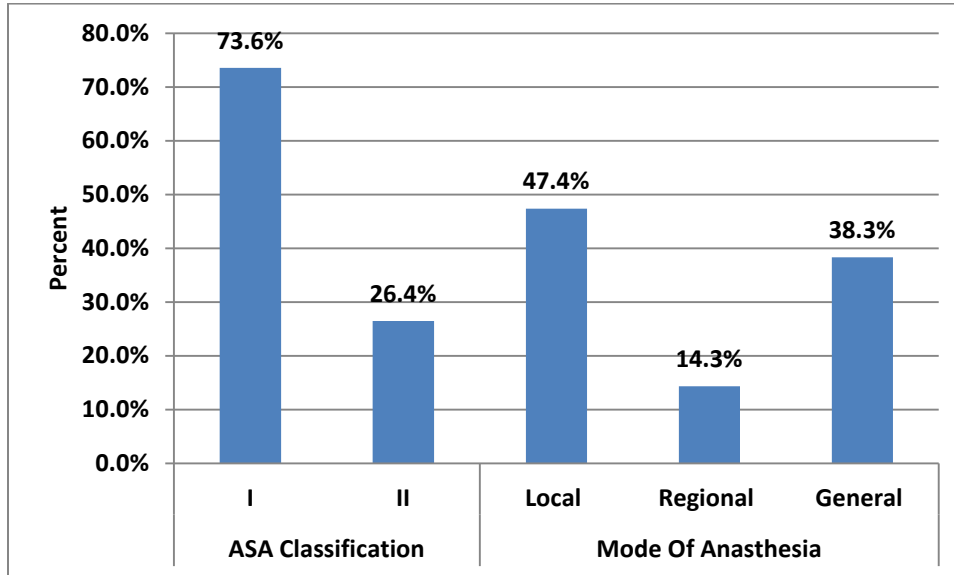


Figure 4: ASA Classification and Mode of Anaesthesia

4.4 Anesthetic Complications

4.4.1 Respiratory complications

For patients undergoing procedures under general anaesthesia, laryngospasm was the most common respiratory complication experienced by 4.4% of the respondents followed by endotracheal tube difficulties (2.8%). None of the respondents had complications with upper airway obstruction.

On laryngospasm complications (58%) occurred in operation eardrop camp (table 3).most of the respiratory complications (90%) occurred under general anesthesia.

Table 3: Respiratory complications type of camp

Respiratory complications		Camp				
		Ophthalmology	Eardrop	VVF	SSK	HEFT
Intraop	Laryngospasm	3	10	0	3	1
	Bronchospasm	0	1	0	1	1
	Endotracheal Tube Difficulties	2	3	0	4	2
	Others	0	1	0	1	1
Pacu	Upper airway obstruction	0	0	0	0	0
	Bronchospasm	0	0	0	1	0
	Others	2	3	0	1	0

Table 4: respiratory complication and mode of anaesthesia

Respiratory complications		Mode of Anaesthesia		
		Local	Regional	General
Intraop	Laryngospasm	0	0	17
	Bronchospasm	0	0	3
	Endotracheal Tube Difficulties	0	0	11
	Others	0	0	3
Pacu	Broncospasm Pacu	0	0	1
	OthersPacu	3	1	2

4.4.2 Cardiovascular complications

Hypertension was the most common cardiovascular complication experienced by 23 (6.3%) of the respondents with 82% of these occurring in ophthalmology and SSK camps (table5)

Post-operative nausea was the most common negative event experienced by 26 (7.2%) respondents. Post-operative vomiting was the least experienced complication with only 7(1.9%) respondents experiencing it (Table 5).

Table 5: Cardiovascular complications and type of camp

Cardiovascular Complications		Ophthalmology	Eardrop	VVF	SSK	HEFT
Cardiovascular	Hypertension	10	1	3	10	0
	Hypotension	1	5	12	4	1
Negative Events	Post-Operative Nausea	5	7	7	6	0
	Post-Operative Vomiting	0	3	4	0	0

Table 6: cardiovascular complication and mode of anaesthesia

Cardiovascular Complications		Mode Of Anaesthesia			Total
		Local	Regional	General	
Cardiovascular	Hypertension	10	8	6	24
	Hypotension	3	15	5	23
Negative Events	PostOperative Nausea	5	8	12	25
	PostOperative Vomiting	0	4	3	7

4.5 Facility Survey

4.5.1 Type of facility

Majority (54%) of the respondents were from Level 4 hospitals and (25.6%) from Level 6 hospitals. The distribution of type of hospital was different (p-value<0.01) (Table 5)

Table 7: Distribution of respondents per level of hospital

Type of Hospital	Frequency	Percent
Level 6 hospital	93	25.6
Level 5 hospital	74	20.4
Level 4 hospital	196	54.0

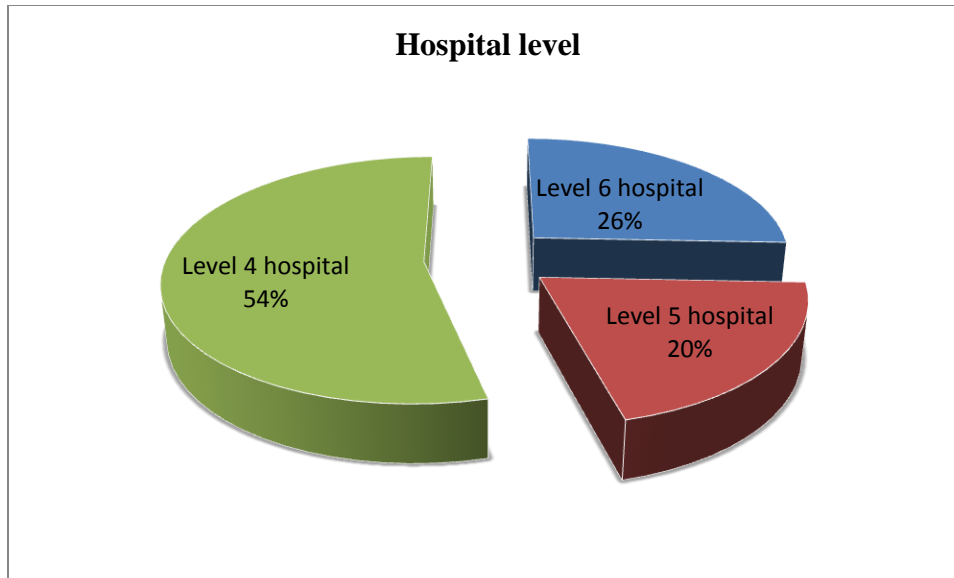


Figure 5: Distribution of respondents per level of hospital

4.5.2 Total number of operating tables

Level 4 hospitals had the higher average number of tables 2.7 (SD=0.66) compared to level 5 and level 6 whose averages were 2.09 (SD=1.13) and 1.68 (SD=0.47) respectively (Table 6).

Table 8: Mean Number of operating tables

Type of Hospital	Mean number of tables	Std. Deviation
Level 4 hospital	2.70	.660
Level 6 hospital	1.68	.467
Level 5 hospital	2.09	1.125

4.5.3 Monitoring equipment

Capnographs were more available in Level 6 hospital. Pulse Oximeter, Thermometer, Suction Machine were readily available at Level 6 and 5 hospitals. Blood Pressure Machines, ECG Monitors and Defibrillator were more available at all levels of hospitals (Table 7).

Table 9: Monitoring equipment

Monitoring equipment	Level 6		Level 5		Level 4	
	Mean	SD	Mean	SD	Mean	SD
Blood Pressure Machine	1.66	.475	1.77	1.054	2.16	.690
Pulse Oximeter	1.66	.475	1.82	1.307	1.23	.631
ECG Monitors	1.66	.475	1.77	1.117	2.13	.681
Capnograph	1.47	.702	.03	.163	.01	.073
Thermometer	.30	.607	1.15	.753	1.05	1.181
Suction Machine	1.50	.655	1.68	1.148	1.26	.612
Defibrillator	.25	.604	.49	.503	.90	.318

4.5.4 Oxygen Supply

Piped oxygen was more available in Level 6 hospitals. Oxygen Concentrators were very few and more common in level 5 hospitals. Oxygen cylinders were more available in level 4 hospitals (Table 8).

Table 10: Oxygen Supply

Oxygen Supply	Level 6		Level 5		Level 4	
	Mean	SD	Mean	SD	Mean	SD
Piped Oxygen	1.62	0.626	0.2	1.193	0.23	0.631
Oxygen Concentrator	0	0	0.38	0.716	0.12	0.321
Oxygen Cylinders	1.43	0.843	2.72	1.66	6.13	2.153

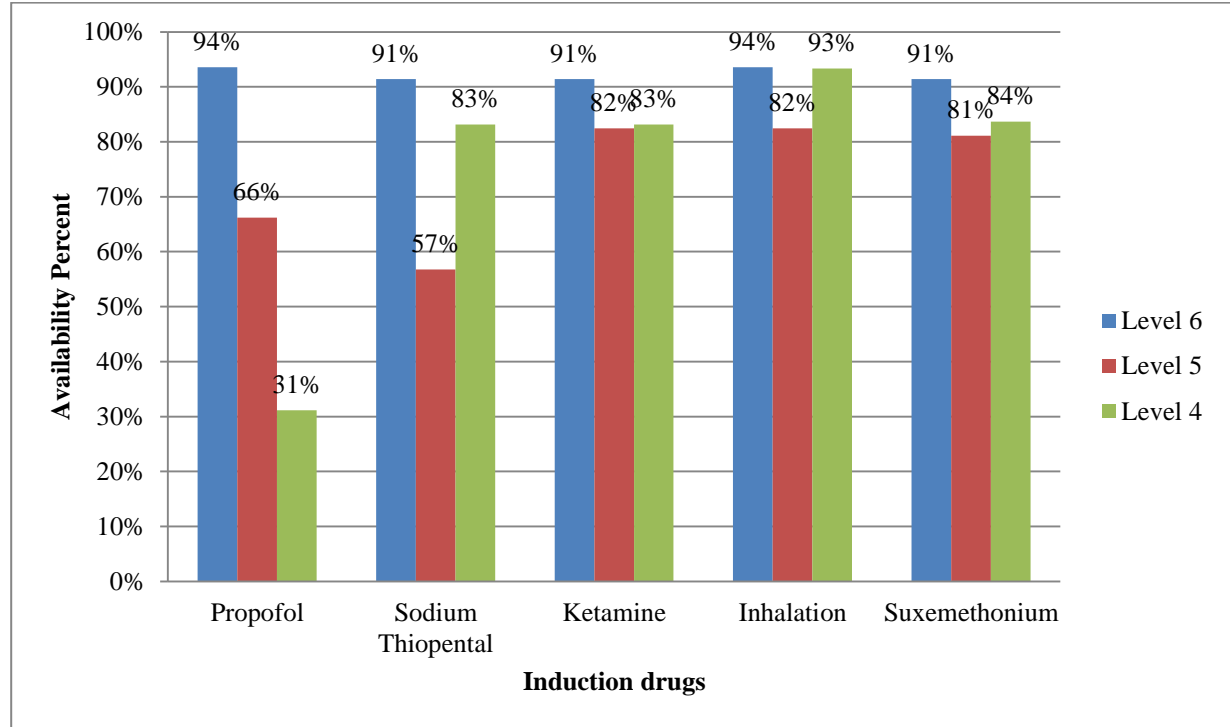
4.6 Equipment and drug availability during the medical camp

4.6.1 Induction Drugs

All types of induction drugs were not readily available in different levels of hospitals.

Most induction agents were readily available in level 6 hospital. Propofol was least available for use in level 4 hospitals at (31%). Suxamethonium was readily available at all levels at (91%), (81%), (84%) for level 6, 5, 4 respectively. Inhalational induction was readily available across level 6, 5, 4 hospitals at (94%), (82%), (93%) respectively.

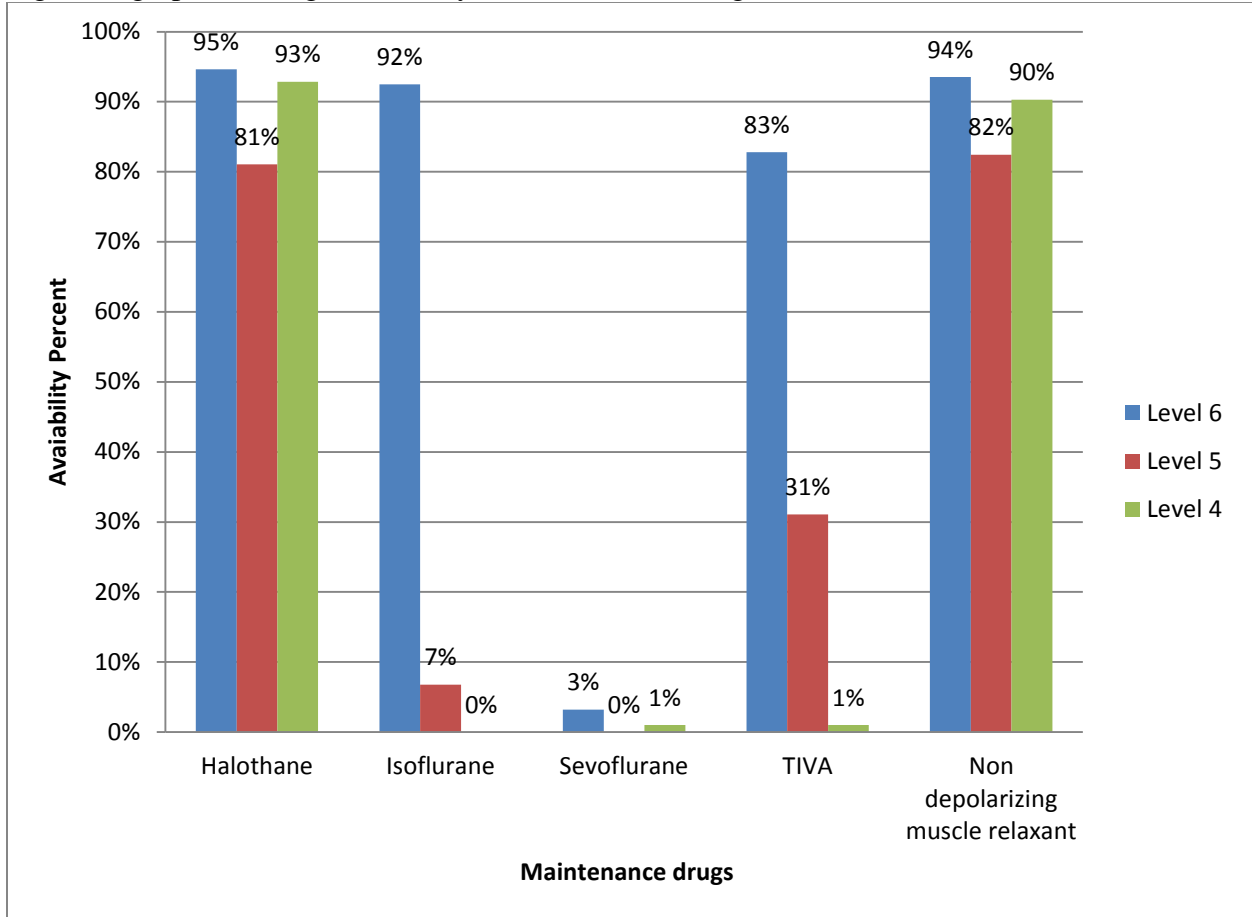
Figure 6: graph showing availability of Induction drugs



4.6.2 Maintenance drugs

All types of maintenance drugs were not fully available in all levels of hospitals with Isoflurane, Sevoflurane, and TIVA being the least available maintenance drugs

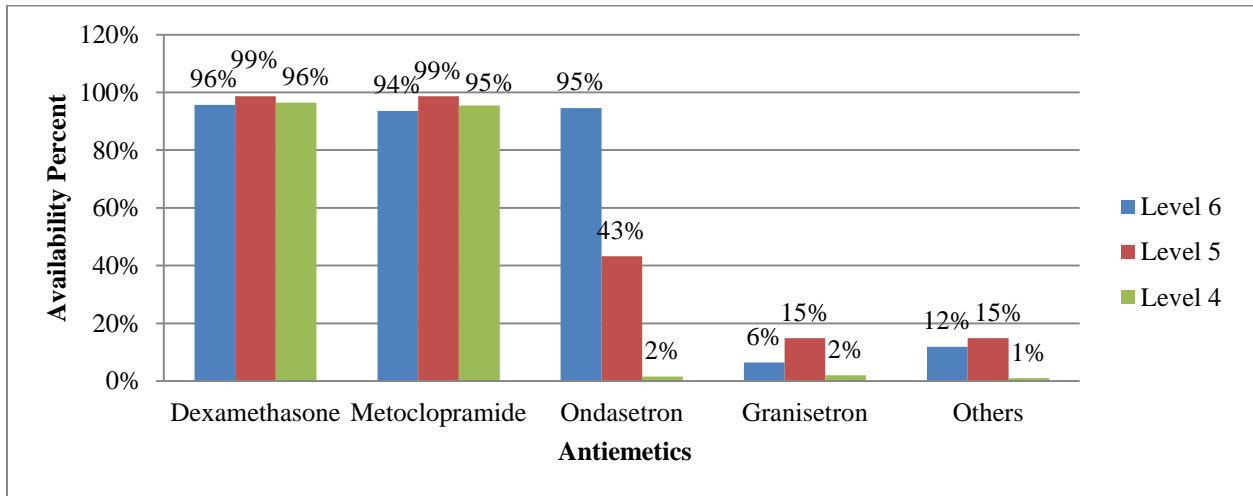
Figure 7: graph showing availability of Maintenance drugs



4.6.3 Antiemetics

All types of Antiemetics were not fully available in different levels of hospitals with Ondasetron and Granisetron being the least available Antiemetics.

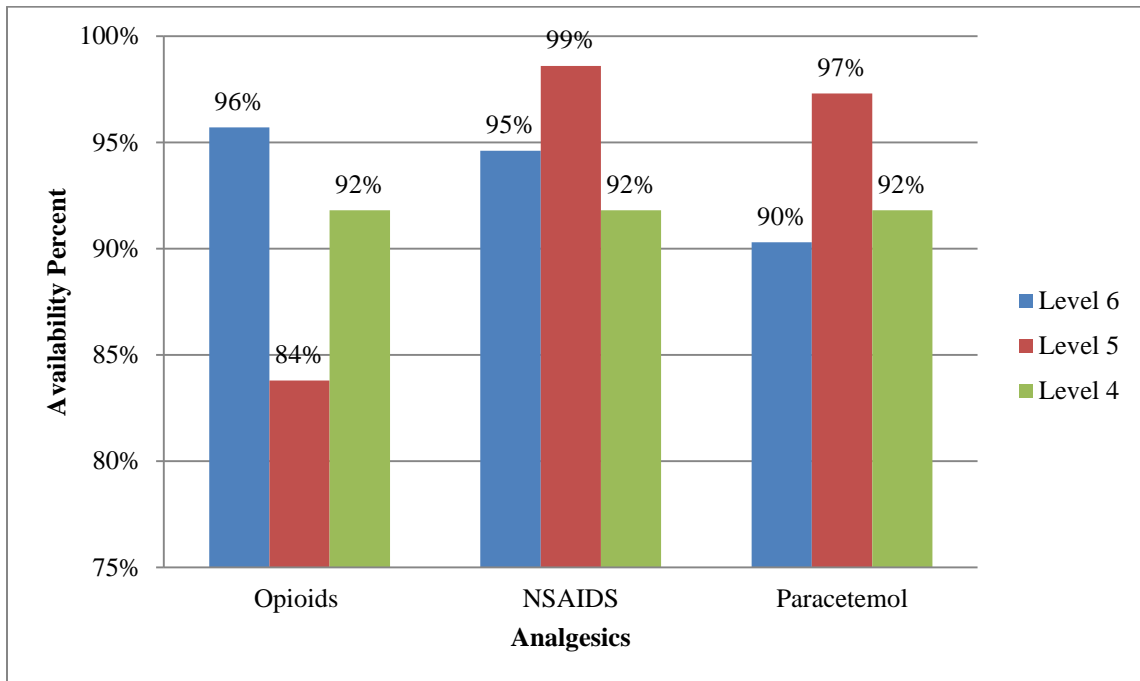
Figure 8: graph showing availability of Antiemetics



4.6.4 Analgesics

Most analgesics were missing in different levels of hospitals with NSAIDS being the most available for used as analgesia.

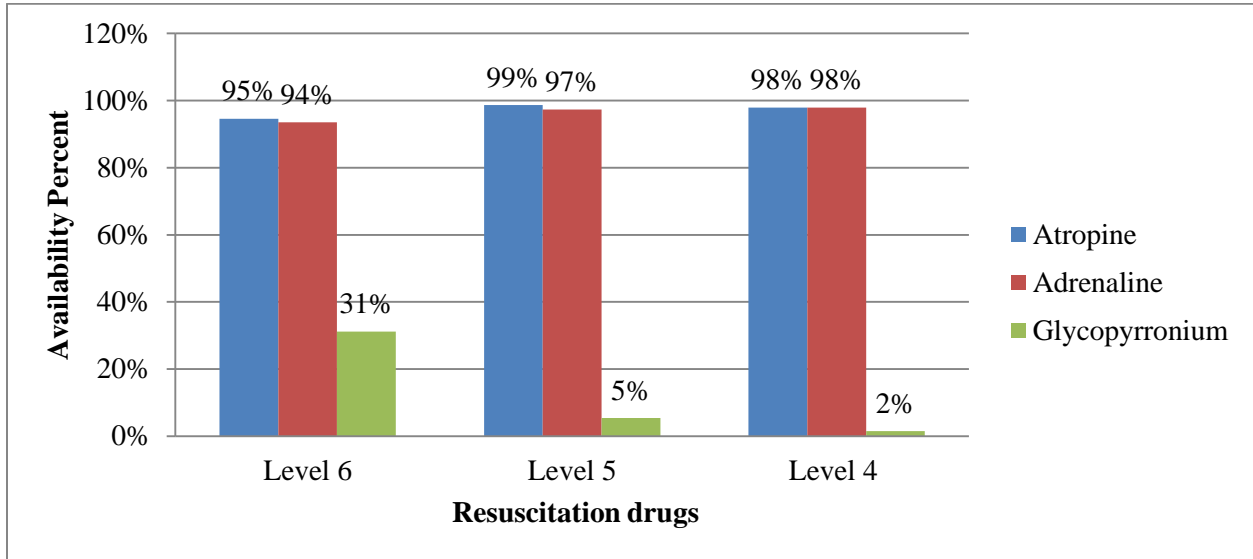
Figure 9: graph showing Analgesics use and availability



4.6.5 Resuscitation drugs

Various resuscitation drugs were missing in different levels of hospitals with Glycopyrronium being the least available.

Figure 10: bar graph showing Resuscitation drugs availability



4.6.6 Manning operating tables

In level 6 hospitals, one anesthetist runs one operating table. In level 5 hospitals majority (77%) of anesthetist run one operating table; while in level 4 hospitals one anesthetist runs more than one operating table.

Table 11: Operating tables Run by an anesthetist

Hospital	Tables run by one anesthetist			
	One		More than one	
	Frequency	Percent	Frequency	Percent
Level 6	92	98.9	1	1.1
Level 5	57	77	17	23
Level 4	36	18.4	160	81.6

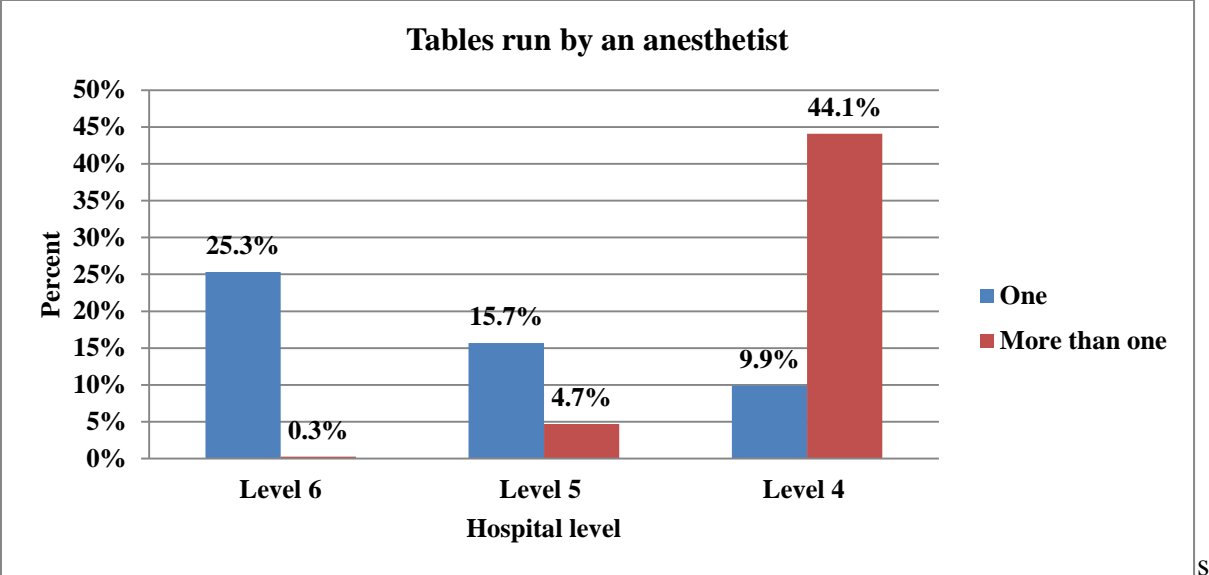


Figure 11: Tables run by an anesthetist

CHAPTER FIVE

DISCUSSION

The findings in this study demonstrate the status of anesthetic practice in outreach anaesthesia services in selected surgical camps in Kenya.

ASA standards for basic anaesthesia monitoring require presence of qualified anaesthesia personnel throughout the conduct of anaesthesia and continuous evaluation of the patient's oxygenation, ventilation, circulation, and temperature.

In this study, most of the equipment's and drugs were primarily the ones available in the host hospital facility and was not able to ascertain whether camp organisers carried anesthesia equipment and drugs.

Various types of induction drugs were not readily available in different levels of hospitals with Propofol least available for use in level 4 hospitals at (31%). Ketamine and inhalation induction was most readily available. Propofol use was limited due to its cost, availability and storage conditions. This means that the anaesthetists used the drug which was available and didn't have the liberty to choose from a variety.

In this study it was noted that various types of maintenance drugs were not fully available in all levels of hospitals with Isoflurane, Sevoflurane, and the use of TIVA being the least available maintenance drugs across the board. Use of TIVA was low since propofol as one of the drugs used for total intravenous anaesthesia was not readily available across all the levels of hospitals. Its use was more in level six where it was more readily available. The use of TIVA was limited since its use needs infusion pumps which were not readily available at all levels of hospitals. In a study by Ilori on Anaesthesia for Surgical Outreach in a Rural Nigerian Hospital, some of the

Anaesthetic Challenges included non-availability of medical gases and breathing circuits including face masks¹⁸.

Antiemetics i.e. Ondasetron and Granisetron were the least available for the prevention and management of post-operative nausea and vomiting which could lead to unplanned admissions from nausea and vomiting. Metoclopramide and Ondasetron are among the drugs in the essential drug list 2016 which should be available at all levels of hospitals. This was not the case. In a study by Zulfiquer et al on evaluation of unplanned admission following day surgery in a surgical center in London, 11% of the admissions were due to postoperative nausea and vomiting hence the need to avail antiemetics.

Resuscitation drugs were not readily available at all levels hospital yet this are part of the drugs needed in the basic and advanced life support algorithms.

On the number of operating tables each anesthetist runs, in most of the level 4 hospitals, one anesthetist runs more than one operating table while the ratio becomes better as move towards level 6 hospital and was as a result of most of the local anesthetic procedures being undertaken at the level four hospitals where the anesthetist provided monitored anaesthesia care for the patients under local anaesthesia on more than one table in the operating room. In a study by Mijumbi et al in Uganda on; “Anaesthesia services in developing countries: defining the problems”, personnel and drug shortages were among the challenges faced⁹.

Majority (73.6%) of the respondents attended were ASA classification 1. This was due to the choice of patients without comorbidities to avoid complications as small incision cataract surgery and Mastoidectomy were the most planned surgical interventions (30.3%) and (23.4%) respectively which were carried out as short stay procedures. This is in line with a study by Chung F, et al. on Pre-existing medical conditions as predictors of adverse events in day-case

surgery patients. They found that, compared with individuals younger than 65 years, those who were 65 years or older and with comorbid conditions were 1.4 times as likely to experience an intraoperative event and 2.0 times as likely to experience an intraoperative cardiovascular event¹⁴.

Local and regional anaesthesia was the anesthetic used on majority of patients who were ASA1 and II hence this allowed for early discharge and avoided negative events associated with general anaesthesia and longer stay in the hospital.

On anaesthetic complications, Laryngospasm was the most common respiratory complication experienced by 4.4% of the respondents. Majority of these patients were from OED camps where it occurred at (58%) and this involve involved ear nose throat surgeries. This was followed by airway difficulties.

Hypertension was the most common cardiovascular complications experienced by (6.6%) of the respondents and occurred mostly on patients undergoing procedures in ophthalmology camps. This is because most of the patients in ophthalmology camps underwent small incision cataract surgeries among the elderly who had hypertension as a comorbidity.

In a study by Fisher Q. et al in; “Assessing paediatric anaesthesia practices for volunteer medical services abroad”, airway complications were the most frequent difficulties in the operating room followed by cardiovascular complications.

Significant negative events experienced in this study were Post-operative nausea and vomiting at (6.9%). This incidence was lower than findings in another study done by Onyando on the effect of preoperative volume loading on the incidence of postoperative nausea and vomiting at Kenyatta national hospital where the overall incidence of PONV was found to be 36.67%. This

could be explained by the fact that most surgeries in this study were done under regional and local anaesthesia and took short duration. Longer and more invasive surgeries are associated with higher incidence of PONV.

On the survey of the facilities used for the camps, majority of the camps (54%) were carried out in Level 4 hospitals. Level 4 hospitals in Kenya are the first referral hospitals for people in rural areas and are usually left to handle emergency surgical cases and those that need elective specialized surgical care don't get a chance to be attended to and are referred to a tertiary center hence the growing need for surgical camps which need specialised surgical care not readily available at the level 4 hospitals. Majority of the camps were carried out at Level 4 hospitals since there was less interruption of the normal routine functions during the camps hence more acceptance.

Availability of monitoring equipment in the operating room was another challenge during the outreach camps. In most level 4 and 5 hospitals, most of the operating rooms didn't have Capnography for monitoring. In most level 4 hospitals, most of the monitoring equipment were shared across the operating tables i.e. defibrillator, thermometer and suction machine. This does not conform to the ASA 2013 guidelines which state that the equipment mentioned above should be functional and readily available.

On oxygen supply to the operating rooms, all operating rooms in level 6 hospital had access to piped oxygen. Use of oxygen cylinders was the main source of oxygen in level 4 and five hospitals. In level 6 hospitals, the cylinders were only used for backup or for patient transport from one unit to another. The Association of Anaesthetists of Great Britain and Ireland

recommend that among others, a reliable oxygen source with backup is required for safe conduct of anaesthesia.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Conclusions

There are challenges faced in outreach anaesthesia ranging from anaesthesia drug supplies to inadequate monitoring

Most of the patients attended to were ASA 1 and 11 which is line with ASA classification for most ambulatory surgery cases.

The monitoring standards are not up to ASA recommendation

Airway complications were the most common complications experienced in surgical camps; and most of the surgeries were carried out under regional anaesthesia

6.2 recommendations

Efforts should be made to improve access to essential anesthetic drugs, invest in monitoring equipment in all operating rooms and train more anaesthesia providers to provide safe anaesthesia.

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APPENDICES

APPENDIX 1-SURVEY TOOL

TOPIC; A SURVEY ON OUTREACH ANAESTHESIA SERVICES IN MEDICAL CAMPS IN KENYA

Camp Name:.....

PATIENT SURVEY

BIODATA

- 1. Serial no.....
- 2. Age:.....
- 3. Gender; (Tick one)Female Male
- 4. Planned surgical intervention:.....
- 5. ASA Classification.....
- 6. Mode of anaesthesia
 - a. Local anaesthesia
 - b. Regional anaesthesia
 - c. General Anaesthesia

Anesthetic Complications

7. Respiratory complications

Respiratory complications		Yes	No
Intraop	Laryngospasm		
	Bronchospasm		
	Endotracheal tube difficulties		
	Others		
Pacu	Upper airway obstruction		
	Bronchospasm		
	Others		

8. Cardiovascular complications

		Yes	No
Cardiovascular	Hypertension		
	Hypotension		
Negative Events	Post-Operative Nausea		
	Post-Operative Vomiting		

FACILITY SURVEY

1. Camp name:
2. Type of hospital
 - a) Level 6 hospital
 - b) Level 5 hospital
 - c) Level 4 hospital
 - d) Mission hospital
 - e) Level 3 hospital
 - f) Private hospital
3. Total number of operating tables
4. Monitoring equipment

Equipment	Total number available
Blood pressure machine	
Pulse oximeter	
ECG Monitors	
Capnograph	
Thermometer	
Suction machine	
Defibrillator	

5. Oxygen supply

Equipment	Total number available
Piped Oxygen	
Oxygen Concentrator	
Oxygen Cylinders	

Challenges faced during the medical camp

6. Drugs

a. Induction Drugs

Induction drug	Yes	No
Propofol		
Sodium Thiopental		
Ketamine		
Inhalational		
Suxamethonium		

b. Maintenance drugs

Maintenance drug	Yes	No
Halothane		
Isoflurane		
Sevoflurane		
TIVA		
Non depolarizing muscle relaxant		

c. Antiemetics

Antiemetics	Yes	No
Dexamethasone		
Metoclopramide		
Ondasetron		
Granisetron		
Others		

d. Analgesics

Analgesics	Yes	No
Opioids		
Ketamine		
NSAIDS		
Paracetamol		

e. Resuscitation drugs

Resuscitation drugs	Yes	No
Atropine		
Adrenaline		
Glycopyrronium		

7. How many operating tables does one anesthetist run?

f. One

g. More than one

APPENDIX II

CONSENT EXPLANATION

Title: A Survey on Outreach Anaesthesia Services in selected surgical Camps in Kenya

Institution: Department Of Anaesthesia, University Of Nairobi

Investigator: Dr Charana Ondigo Evans

Supervisors: Dr.Chokwe T.M, Dr. Olang' P.R, Dr. Muriithi J.

Explanation

Permission is requested from you for enrolment in a medical research study. You should understand the following general principles, which apply to all participants in medical research:

- 1) Your decision to enrol in the study is entirely voluntary.
- 2) You may withdraw from the study any time.
- 3) Refusal to participate will invoke no penalties or loss of benefits to which you are otherwise entitled.
- 4) Feel free to ask any questions regarding the study or your participation.

The purpose of this study is to evaluate current anesthetic practice in outreach anaesthesia in medical camps in our Kenyan republic. The findings of the study after evaluation can address any deficits or challenges that are faced by hospitals and anesthetists. This creates room for future improvement of anesthetic care services in our country hence improve quality health care. Absolute confidentiality regarding participation is ensured. No names will be used in any documents. All information will be treated with utmost confidentiality.

IDHINI MAELEZO

Mada: Utafiti Wa Huduma za Kuwafikia Anaesthesia Katika Makambi Matibabu

Nchini Kenya

Taasisi: Idara ya Anaesthesia, Chuo Kikuu cha Nairobi

Mpelelezi: Dkt. Charana Ondigo Evans

Msimamizi: Dkt. Chokwe T.M, Dkt. Olang' P.R, Dkt. Muriithi J.

Maelezo

Ruhusa ni ombi kutoka kwako kwa ya uandikishaji wako katika utafiti wa matibabu. Unapaswa kuelewa kanuni za jumla zifuatazo, ambazo zinahusu washiriki wote katika utafiti wa matibabu:

- 1) Uamuzi wako kujiandikisha katika utafiti ni hiari kabisa.
- 2) Unaweza kuondoka kutoka utafiti wakati wowote.
- 3) Kukata kushiriki hutaleta adhabu yoyote wala hasara ya faida ambazo ungezipata.
- 4) Jisikie huru kuuliza maswali yoyote kuhusu utafiti au ushiriki wako.

Madhumuni ya utafiti huu ni kutathmini hali ya sasa Huduma za Kuwafikia Anaesthesia Katika Makambi Matibabu Nchini mwetu Kenya. Matokeo ya utafiti baada ya tathmini yanaweza kushughulikia pungufuzozote au changamoto zinazokabiliwa na hospitali.

Usiri kabisa kuhusu ushiriki umehakikishwa. Hakuna majina zitatumika katika nyaraka zozote.

Habari yote itakayopatikana itawekwa kwa usiri mkubwa.

APPENDIX III

INFORMED CONSENT FORM

Participants Consent Form

I (Facility In-charge),(initials), do hereby give consent to participate in the study titled ‘**A SURVEY ON OUTREACH ANAESTHESIA SERVICES IN SELECTED SURGICAL CAMPS IN KENYA**’ whose nature and relevance have been explained to me. I have neither been coerced nor enticed to participate. I fully understand the right of withdrawal from the study at any time.

Signature.....

Investigator’s declaration

I declare that I have explained to the participant about this study titled ‘**A SURVEY ON OUTREACH ANAESTHESIA SERVICES IN SELECTED SURGICAL CAMPS IN KENYA**’ and have understood the purpose, objectives, benefits, risks and their rights of the study and have agreed to consent to participate in the study.

Name.....Date.....Sign

For further information, issues or clarification you may contact:

Dr. Charana Telephone number – 0725135103

Supervisor Dr. Chokwe T.M--- 0722528237

KNH/UON – Ethics & Research Committee. Telephone number – 2726300-9

FOMU YA IDHINI

SEHEMU YA MSHIRIKI

Mimi (Mkuu wa Hospitali), nakubali kwa hiari kushiriki katika utafiti huu wenye kichwa **‘A SURVEY ON OUTREACH ANAESTHESIA SERVICES IN SELECTED SURGICAL CAMPS IN KENYA’** ambao umuhimu wake nimeelezwa kwa kina. Sijalazimishwa wala kuhongwa kushiriki katika utafiti huu. Naelewa pia kwamba naweza kujiondoa kwa utafiti huu wakati wowote.

SEHEMU YA MPELELEZI

Natangaza kwamba nimeelezea mshiriki kuhusu utafiti huu wenye kichwa **‘A SURVEY ON OUTREACH ANAESTHESIA SERVICES IN SELECTED SURGICAL CAMPS IN KENYA’** na amelewa malengo, faida, athari na haki zao za utafiti na amekubaliana ridhaa kushiriki katika utafiti.

MajinaTarehe.....Sahii.....

Kwa maelezo Zaidi

Dkt.Charana Evans Nambari ya simu - 0725135103

APPENDIX IV

RESEARCH BUDGET IN KENYA SHILLINGS (KSH)

ITEM	COST(KSH)
Statistician	20000
Printing & photocopying	9600
Binding	1800
KNH/UON ethics & research processing fee	2000
Stationery (pens, note books, pencils)	5000
Travelling	15000
Accommodation	30000
Contingency	8340
Total	91740

APPENDIX V

WORK PLAN

ACTIVITY	PERIOD
Proposal writing	Jan-March 2015
Proposal Discussion with supervisors	March –May 2015
Proposal Presentation to the department	Sept-Dec 2015
Seeking Ethical approval	Dec-May 2016
Data collection	July-Dec 2016
Data analysis and report writing	Jan 2017
Discussion of results with supervisors	Feb 2017
Presentation of study findings to the department	March 2017