ADDIS ABABA UNIVERSITY

SCHOOL OF MEDICINE

DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE

KNOWLEDGE AND PRACTICE OF ANAESTHESIA PROVIDERS ON EXPOSURE TO INHALATIONAL ANAESTHETIC AGENTS AT TIKUR ANBESA SPECIALIZED TEACHING HOSPITAL, ADDIS ABABA, ETHIOPIA

A RESEARCH THESIS SUMMITED TO THE SCHOOL OF GRADUATE STUDIES OF ADDISABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE SPECIALITY OF ANESTHESIOLOGY

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NOVEMBER 2020

ADDIS ABABA UNIVERSITY

ADDIS ABABA UNIVERSITY

SCHOOL OF MEDICINE

DEPARTMENT OF ANESTHESIOLOGY, CRITICAL CARE AND PAIN MEDICINE

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Full title of THESIS	Knowledge and practice of anesthesia providers on exposure to inhalational anesthetic agents in TikurAnbesa Specialized Hospital, Addis Ababa, Ethiopia, 2020.
Study area	TikurAnbesa Specialized Hospital, Addis Ababa, Ethiopia,
Total cost of the study	26,180 birr
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APPROVED BY THE BOARD OF EXAMINATION

The thesis here, entitled "Knowledge and practice of anesthesia providers on exposure to inhalational anesthetic agents in TikurAnbesa Specialized Hospital, Addis Ababa, Ethiopia, 2020 " is accepted in its present form by the board of examiners as Partial Fulfillment Of The Requirement For Specialty Certificate In Anesthesiology Critical Care and Pain Medicine.

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ACKNOWLEDGEMENTS

First I would like to thank TASH department of anesthesiology for giving me this golden opportunity. I would also like to thank my advisor Dr. Fetiya Alferid for all her supports, expert advice, suggestions and assistance in all aspects of this study. My gratitude also extends to all my instructors who helped me a lot. Finally, I would like to thank my family (especialy my beautiful wife) and my friend Mr. Abadi Hailay for his all rounded support.

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ABBREVIATIONS AND ACRONYMS

AAU	Addis Ababa University
ICU	Intensive Critical Unit
NIOSH	National Institute of Occupational Safety and Health
OR	Operating Room
PONV	Post-Operative Nausea and Vomiting
TASH	TikurAnbesa Specialized teaching Hospital
TIVA	Total Intravenous Anaesthesia
AC	Air Conditioning system

Abstract

Background: Inhalational exposure is common among the different health care providers, especially in anesthesia care providers. Anesthesia providers have failed to identify personal protective equipments.Knowledge related to occupational hazard prevention among these providers was also low.

Objective: To assess the Knowledge and practice of Anesthesia Providers on Exposure to Inhalational Anesthetic Agents in Tikur Anbessa Specialized Hospital.

Methods: A hospital based cross-sectional quantitative study was conducted among 114 available anesthesia providers in TASH, from 1 to 30 September 2020. Data was collected using a structured self-administered questioner. Collected data was analyzed using spss version 26 and presented with frequencies and percentages. For association between categorical variables Pearson chi square and logistic regression was used.

Result: Out of 132 anesthesia care providers we were able to collect data in 114(86.36 % of the total population) participants. Although all feel exposed to inhalational anesthetics, Only 64(56.1%) of the participants scored above the mean for knowledge on exposure to inhalational anesthetics. Being female anesthesia care provider was strongly associated with good knowledge score on the risks of inhalational anesthetics. Only 63(55.3%) of the anesthesia care providers have good practice in applying strategies to reduce exposure to inhalational anesthetic agents. There was no strongly associated factor with practice of the anesthesia provider.

Conclusion: The knowledge on exposure to inhalational anesthetics agents and the practice in applying the strategies to minimize exposure to inhalational agents in the Operating theatre is good. Being female anesthesia care provider was associated with better knowledge on the risks of exposure to inhalation anesthetics. Standard procedures of prevention of inhalational anesthetics should be implemented by TASH.The standards can be given as a form of training for anesthesia care providers and also put as a protocol by the department.

Keywords: Inhalational Anaesthetic Agents, Anesthesiologist, Knowledge, Perception, Exposure

CHAPTER 1 INTRODUCTION

1.1.Background

Chronic exposure to high concentrations of inhalational anaesthetic agents has been reported to affect the health of OR staffs especially anesthesia providers(1–3). Globally, the knowledge on inhalational anesthesia exposure of anesthesia providers is not determined yet. However, a study conducted in Ghana indicated that majority (90.1%) thought, they are exposed to inhalational anesthesia agents during procedures in their work environment(1).

The potential hazards of inhalational anesthetics to the anesthesia provider and patient was hypothesized since late 1960s, after studies showed a higher incidence of fatigue, headache, irritability and adverse reproductive effects in anesthesia providers(4).so, technology support must plan preventive maintenance measures, regular inspections for leaks and defective equipment, and early amendment of these problems. This should be supported by a commitment to training so that all concerned stakeholders understand the preventive measures required.

Study showed that the knowledge of anesthesia providers on the forms of occupational health hazards prevention is low(5).In this study, anesthesia providers failed to identify the personal protective equipment and have poor observance of preventive measures. Anesthesia providers didn't get enough training on safe anesthesia delivery and successful management of waste anesthetics gases. In addition, they reported that as they don't have any hospital standard procedures of precaution(6).

1.2. Statement of the problem

There are several evidences that inhalational agents are significantly associated with nausea, vomiting, headache, fatigue, immunosuppression(1,7). The reasons for increased exposure to inhalational anesthesia include an absence of automatic ventilation or scavenging system, poor conditioning system of OR, leakages, disconnections, use of pediatric Ayres' T-piece, high flow anesthesia, leakage from anesthesia machine, and sleeping over the lip of the users' mask(1,8).
A study demonstrated that there are some trials and strategies to build the knowledge of anesthesia providers on inhalational agents to prevent the effects on the health of exposed groups

and the environment. There are different standard procedures available at the hands of employers to minimize the exposure to inhalational agents. Moreover, there are limited numbers of training for health professionals(6). The same study showed that many health professionals don't know even the availability of standard procedures of prevention. Therefore, there is no practical implication of the standard procedures and lack of commitment in creating awareness and building capacity to increase knowledge and skills of anesthesia providers and other health professionals (6).

To date, there is one study done in Ghana that assesses the knowledge of anesthesia providers on the exposure of inhalational anesthetics. However, up to our knowledge and searches, there is no study done on the knowledge of inhalational agent exposure to anesthesia providers in Ethiopia (1). Therefore, this study is sought to find out the knowledge of anesthesia providers on exposure to inhalational anesthetics, evaluate their knowledge on the effects of exposure and strategies to reduce chronic exposure to the operating room, inhalational anesthetic agents. So that to bring solutions for the aforementioned issues.

1.3. Rationale of the study

There is significant evidence that Inhalational anesthetics are associated with high incidence of headache, nausea, irritability, fatigue, and adverse reproductive effects among anesthesia providers(1). Knowledge of anesthesia providers on the forms of occupational health hazard is low although there are no studies to date. In developing countries with poor health care and infrastructure, it is even expected to be worse. The present study is intended to contribute to bridge the information gap, among these Anesthesia providers and subsequently creating awareness and minimizing the effects of the inhalational anesthetics.

1.4. Significance of the study

Even though there are some trials by other institutions to prevent the chronic exposure of inhalational anesthesia, it is not a local and context-based intervention which is difficult to solve the problems in our set up appropriately and timely. So assessing the knowledge and practice gap would be the first step to address this issue. Since we live in a system with less developed infrastructure to healthcare, it is even more important for the anesthesia provider to be aware of the occupational hazards. Thus it is paramount to conduct the study to come up with evidence-

based, context, and local-based solutions. It can also be used as baseline data for further studies. In addition, it will provide a piece of context-based information about misconceptions to design context-based policies, programs, and strategies of interventions by the department of anesthesiology. This study is therefore sought to find out the knowledge of anaesthesia providers on exposure to inhalational anesthetics, evaluate their practice on applying the strategies to reduce chronic exposure to operating room inhalational anesthetics agents(1).

CHAPTER 2 LITERATURE REVIEW

2.1. Overview and Knowledge of anesthesia providers exposure to inhalational anesthesia worldwide

Chronic exposure to inhalational anesthetic agents can result in an occupational hazard in anesthesia providers(1,7). There is no study globally that assesses the knowledge of anesthesia providers on risks of inhalational anesthetics. A study conducted in Ghana revealed that only 1.4% of the anesthesia providers didn't use an inhalational agent which means that 98.6% of health care providers used inhalational anesthesia in their practices. In addition, the anesthesia providers assumed to be prone to inhalational agents' exposure are 90.1%. However, only 40.8% of the anesthesia providers knew the recommended and allowable limit of concentration of inhalational agents in their working places. Majority of the inhalational anesthesia providers use a poorly functioning scavenging system (28.2%) and pediatric Ayres' T-shape (28.2%)(1).

About 10% of the anesthesia didn't feel exposed to inhalational anesthesia because they are using a properly functioning scavenging system or are performing only regional anesthesia. Majority of anesthesia providers know the effect of inhalational agent exposure. They identified tiredness (87.3%), headache (70.4%), irritability (35.2%), nausea (26.8%), and memory disorder (19.7%) as symptoms of chronic exposure to inhalational anesthesia. In addition, significant numbers of anesthesia providers identified the organ effect and reasons for the exposure of inhalational anesthesia(1).

2.2. Factors and reasons triggering inhalational anesthesia exposure

There are different reasons for exposure to inhalational anesthetic agents in the operating rooms and other working places. Poorly functioning scavenging system, utilization of pediatric Ayres' T-piece, leakage from breathing circuit, lack of scavenging system, improper fitting of facemask, high flow of anesthesia, operating rooms without automatic ventilation, operating rooms where the systems are in poor conditions, and recovery rooms where gases exhaled by recovering patients are not appropriately vented are the main reason to the exposure of inhalational anesthesia(1,8).

2.3.Health effects of inhalational anesthesia

Inhalational anesthesia has clinical and environmental health effects.(1–3) Inhalational anesthesia health problem is one of the occupational hazards(5,9,10). Reproductive women who are exposed in their workplace while providing inhalational anesthetic agents are at increased risk of miscarriage (7,8). according to different kinds of literature, clinical effects of inhalational anesthesia include tiredness, headache, irritability, nausea, memory disorder, spinal cord neurotoxicity, teratogenicity, (1,11–13). There were similar results in a study done late in Britain in which half the personal samples from anesthetists exceeded an average concentration of nitrous oxide of 100 ppm during the period monitored. So, the alert from the National Institute of Occupational Safety and Health (NIOSH) concludes that an adequate ventilation system and scavenging system may still not be enough(14). Inhalational anesthesia has both clinical and environmental effects. Occupational air pollution, atmospheric pollution, and greenhouse gas effects. Some inhalational anesthesia has a greenhouse effect in which the greenhouse gases are leading the world to global warming. (10,11,15).

2.4. Precautions of inhalational anesthesia

Volatile inhalational anesthesia needs careful administration to minimize the health effects on health professionals. According to various studies, there are different prevention mechanisms to protect from exposure to inhalational anesthetics. Unscavenged operating room exposure status to the inhalational anesthetics is above the recommended international limit of concentration(9). There are some guidelines developed to prevent the exposure of inhalational agents(16). A continuous flow of fresh air ventilation system to prevent waste gas accumulation, checking and maintenance of all anesthetic equipment including scavenging system and reducing gas flow during mask induction. In addition careful filling of vaporizers, judicious checking of all connections along the anesthesia circuit and at the machine, using properly fitting face mask, is mandatory for prevention of exposure towards inhalational anesthesia(15,16).

2.5.Strategies to reduce inhalational anesthesia effects

According to the study in Ghana, all anesthesia providers did not admit to the routine monitoring of inhalational anesthesia in their working environment(1). However, all anesthesia providers

believed they are making efforts to minimize their inhalational agents' exposure(1). Ensuring appropriately working air fresh ventilation was mentioned by all anesthesia providers as a strategy to minimize inhalational anesthesia's exposure. Use of regional anesthesia, use of total intravenous anesthesia (TIVA), use of circle system, ensuring appropriately working air conditioner in the operation theatre, use of tight-fitting facemask, avoiding uses of pediatric Ayres' T-piece, and use of low fresh gas flow during anesthesia are the listed and suggested strategies to reduce the level of exposure to inhalational anesthesia(1).

Training like hazard awareness training, and gases waste management, availing standard procedures, regular inspection anesthesia machine and other equipment for leaking, periodic air and exposure monitoring, prompt eliminations of spills and leaks, medical surveillance and other capacity-building programs and strategies are very important to reduce the inhalational anesthesia's exposures toward the human beings and environment(6).

CHAPTER 3 OBJECTIVES

3.1.General objective

- To assess Knowledge and Practice of Anesthesia Providers on Exposure to Inhalational Anesthetic Agents in TASH

3.2.Specific objectives

- To determine the knowledge of anesthesia Providers on Exposure to Inhalational anesthetic agents in TASH
- To assess the practice of anesthesia providers to reduce Exposure to Inhaled Anesthetics among anesthesia Providers in TASH

CHAPTER 4 METHODS AND MATERIALS

4.1. Study Setting and period

Tikur-anbessa comprehensive specialized hospital is the largest tertiary teaching hospital in the country, Ethiopia(17). It has around 700 beds with over 700 beds 200 physicians 379 nurses and 115 other health professionals who are committed to providing health care service. In addition, TASH has 950 permanent and contract administrative staff that helps to facilitate the activities of the hospital. Most regional and federal hospitals are affiliated and strongly linked to TASH. (17). The study will be held from 1 to 30 September 2020. It has 15 operating tables: 9 major, 4 orthopedic and two obstetric. There are two schools of anesthesiology in TASH. The first one is run by the department of anesthesiology, solely run by physician anesthesiologists. It is run by 14 anesthesiologists and 51 residents. The second one is run by nurse anesthetists who have 67 BSC and MSC anesthetists.

4.2. Study design

A Hospital- based cross-sectional study will be conducted.

4.3. Source population

Anesthesia providers in TASH will be considered as a source population

4.4. Study population

All Anesthesia providers in TASH will be considered as a study population

4.5. Sample size determination

The sample size is calculated using a single proportion formula by Epi-info version 7.2, considering the assumptions of the prevalence of 50% ($p = 0.5$) because no study was conducted in Ethiopia to assess the knowledge and practice of anesthesia providers on exposure to inhalational anesthetics.95% confidence interval ($\alpha=0.05$), marginal of sampling error tolerated (d) 5% and 10% non-response rate.

$$n = \left(Z\frac{a}{2}\right) 2\ \frac{p(1-p)}{d2}$$

n= (1.96)^2(0.5(1-0.5)/ (0.05)^2

n= 384

Since the study population is less than 10,000, which is 384 therefore correction formula will used.

nf = n/ (1+n/N) = where nf=final sample size ni=initial sample size,N=total number of study population

nf= 384

1+384/132 =98

10 percent is added as a contingency rate for the non-response rate. This makes the sample size approximately 108. The plan was to study all the anesthesia providers but only 114 anesthesia providers were available and respondent during the study period.

4.6.Sampling procedure and technique

All available anaesthesia providers (114) were used in the study

4.7.Data collection procedures instrument

Data was collected through a structured questionnaire that was adopted from a previous study. The Data collection instrument was developed in English. (1)

4.8. Inclusion and exclusion criteria

- Inclusion criteria
  - All anesthesia providers working in TASH operating rooms during the study period
- Exclusion criteria
  - Those anesthesia providers who are on leave

- Those anesthesia providers who are working elsewhere during the study period

4.9. Study variables

Dependent variables

- ✓ Knowledge (good vs. poor knowledge)
- ✓ Practice(good vs. poor practice)

Independent variables

- Age
- Sex
- Years of Experience
- Level of anesthesia provider
  - ✓ Physician anesthesia care provider
  - ✓ Non-physician anesthesia provider

4.10. Operational definition

- **Knowledge:** It is the awareness of the anesthesia providers about the risks of exposure to inhalational anesthesia. It is measured by calculating the mean score of all the items and categorized as good knowledge or poor knowledge (mean=7.12).
- **Practice:** the anesthesia provides practice in applying the strategies to decrease exposures to inhalational anesthetics will be scored. If it is above the mean it will be labeled as good practice if not it will be labeled as poor practice (mean=4.77).

4.11. Data analysis and processing

The data was analyzed using SPSS version 26.

4.12. Ethical Consideration

Ethical clearance was obtained from ethical review committee of AAU department of anesthesiology. Confidentiality will be maintained at all levels of the study by avoiding the use of names and any identifiers.

4.13. Dissemination and Utilization of Results

The final result of the research will be submitted to AAU. The findings of the study will be presented at appropriate seminars, conferences, and workshops. Furthermore publishing in a scientific journal will be considered.

CHAPTER 5 Result

5.1. Socio-demography of the anesthesia providers

The study involved 114 respondents out of 118 available anesthesia providers (96.6%) who fill the self-administered questioner. Two senior anesthesiologists, 1 MSC, and 1 BSC were non-respondents. The analysis of the socio-demographic profile of the anesthesia providers shows 70.2% of them were male and a majority of them were residents (40.2%). And most of the anesthesia providers (64.9%) were in the age group between 24-30 and a majority of them (65.8%) worked only for less than 5 years. (Table 1)

Table 5. 1 Sociodemographic characteristics of the anesthesia providers TASH, September 2020. (n=114)

Variables		Count	Percentage
Age category	24- 30 years of age	74	64.9%
	above 31	40	35.1%
Gender	Male	80	70.2%
	Female	34	29.8%
Level of education	Non-physician anesthesia provider	59	51.8%
	physician anesthesia provider	55	48.2%
Experience in years	less than 5 years	75	65.8%
	above 5 year	39	34.2%

5.2. Use of Inhalational Anaesthetic Agents

Regarding usage of inhalational anesthetic agents, all anesthesia providers admitted to using halothane, isoflurane in their practice. And all of them again have never used desflurane or nitrous oxide in their practice. Only 20 (17.5%) anesthesia providers have ever used sevofluane in their practice.

5.3. Knowledge and perception anesthesia providers on the Effects of Exposure to inhalational anesthetic agents

Sixty-four (56.1%) of the anesthesia providers have scored above the mean score for knowledge. The lowest score mean and maximum score of the anesthesia providers was 2, 7.12 and 14 respectively. Eighty two (63.2%) anesthesia providers didn't know if there is an allowable limit for inhalational anesthethetics in the theater environment. See table 5.2.

Table 5. 2 Knowledge of anesthesia providers on exposure to inhalational agents at TASH, September 2020. (n=114)

Variables		Good knowledge Count (%)	Poor knowledge
Gender	Male	40(50%)	40(50%)
	Female	24(70.6%)	10(29.4%)
Level of education	Non-physician anesthesia provider	27(45.8%)	32(54.2%)
	physician anesthesia provider	37(67.3%)	18(32.7%)
Experience	less than 5 years	47(62.7%)	28(37.3%)
	above 5 year	17(43.6%)	22(56.4%)

Age	24- 30 years of age	42(56.8%)	32(43.2%)
	above 31	22(55.0%)	18(45%)

Bivariate logistic regression was done to see if there is a strong association between the variables. So being Female and being physician anesthesia care provider was strongly associated with a high score in knowledge. (P-value= 0.046 and 0.02 respectively).however on multivariate logistic regression only gender (p value =0.03 and AOR=0.38) was strongly associated with good knowledge score.so females are 62% likely to have good knowledge as compared to their male counter parts.

Table 5. 3 Bivariate and multivariate logistic regression of knowledge of anesthesia providers on exposure to inhalational anesthetic agents at TASH September 2020. (n=114)

Variables		p-value	COR	95%CI (min-max)	p-value	AOR	95%CI (min-max)
Gender	Male	0.046	0.42	0.18-0.98	0.03	0.38	0.16-0.93
	Female		1				
Educational status	Non-physician	0.022	0.41	0.19-0.88	0.15	0.5	0.19-1.29
	physician		1				
Experience	Less than 5	0.053	2.17	0.99-4.77	0.39	1.56	0.57-4.2
	Above 5		1				
Age	24-30	0.86	1.07	049-2.33			
	>31		1				

The anesthesia providers identified headache (109, 95.6%) and tiredness (108, 94.7%) as their top symptoms of effects of exposure. See table 5.3

Table 5. 4 Symptoms of chronic exposure to inhalational anaesthetic agents, TASH, September 2020.(n=114)

Symptoms	Frequency	Percentage%
Headache	109	95.6%
Tiredness	108	94.7%
Irritability	55	48.2%
Nausea	43	37.7%
Memory loss	36	31.6%

Anesthesia providers were also aware of the major organ effect of inhalational anesthetics. Teratogenicity 83(72.8%), liver disorder 81(71.1%), and fertility were the top mentioned organ effects of the inhalational anesthetics. Bone marrow disorder was the least mentioned organ effect. See table 5.5.

Table 5. 5 Major organ effects of inhalational anesthetics, TASH, September 2020. (n=114)

Effects	**Frequency**	**Percentage%**
Teratogenicity	83	72.8
Liver disorder	81	71.1
Fertility	78	68.4
Neurologic disorder	48	68.4
Carcinogenicity	36	31.6
Allergy	36	31.6
Renal disorder	34	29.8
Bone marrow disorder	23	20.2

All anesthesia providers feel exposed to inhalational anesthetic agents. They mentioned a poorly functioning scavenging system 97(85.1%) and improperly fitting mask 90 (78.1%) as their top

reasons for exposure to an inhalational anesthetic agent. One anesthesia provider also mentioned the absence of AC in the working environment as a reason for his perceived exposure. See table 5.6.

Table 5. 6 anesthesia providers perception of exposure to inhalational anaesthetic agents at TASH, September 2020(n=114)

Reasons for perceived exposure	Frequency	Percentage%
Poorly functioning scavenging system	97	85.1%
Improper fitting mask	90	78.9%
Leakage from breathing Circuit	83	72.8%
Use of pediatric Ayres T-Piece	82	71.9%
Leakage from anaesthetic machine	42	36.8%
High flow anesthesia	21	18.4%

5.4. Practices in applying strategies of prevention.

On practices in applying strategies to reduce exposure to inhalational anesthetic agents. Ninty eight (86%) of the anesthesia providers said the concentration of anesthetic agent in the theatre environment is not monitored. While 10(8.8%) of them said it is being monitored and 6(5.3%) of them have no idea about it. The concentration of anesthetic agents in our environment is not actually being monitored. Most of them 108 (94.5%), said they attempt to reduce exposure to inhalational anesthetic agents.

The anesthesia providers mentioned ensuring properly functioning scavenging system (94, 82.5%), Use of tight-fitting facemask/avoiding use of pediatric Ayres T-piece (81, 71.1%), use of

circle system(74,69.9%)as their top practices used to decrease the exposure to inhalational agents. See table 5.7.

Table 5. 7 Strategies employed by anesthesia providers to reduce exposure to inhalational agents at TASH September 2020(n=114)

Strategy	Frequency	%
Ensuring properly functioning scavenging system	94	82.55
Use of tight fitting facemask/avoiding use of pediatric Ayres T-piece	81	71.1
Use of circle system	74	69.9
Use of regional anesthetic techniques	69	60.5
Use of low flow anesthesia	46	40.4
Use of TIVA	25	21.9
Ensuring properly functioning air conditioners in theatres	25	21.9

5.5.Practice and associated factors

Regarding on practicing the strategies on decreasing exposure to inhalational anesthetics. 63(55.3%) of them have a good practice. see table 5.8

Table 5. 8 practice of anesthesia providers TASH, September 2020. (n=114)

Variables		Good practice Count (%)	Poor practice Count (%)
Gender	Male	41(51.3%)	39(48.8%)
	Female	22(64.7%)	12(35.3%)
Level of education	non physician anesthesia provider	35(59.3%)	24(40.7%)
	physician anesthesia provider	28(50.9%)	27(49.1%)

Experience	less than 5 years	42(56.0%)	33(44.0%)
	above 5 year	21(53.8%)	18(46.2%)
Age	24- 30 years of age	40(54.1%)	34(45.9%)
	above 31	23(57.5%)	17(42.5%)

Non-physician anesthesia provider and being a female was associated with good practice in applying the strategies to decrease exposure to inhalational agents (OR=1.744 and 0.711 respecti1vely). But there was no strong association on bivariate logistic regression (see table below 5.9).

Table 5. 9 bivariate logistic regression of practice of anesthesia providers at TASH 2020. (n=114)

Variables		p-value	COR	95% CI (min-max
Gender	Male	1.88	0.57	0.25-1.31
	Female		1	
Educational status	Non physician	0.37	1.40	0.67-2.95
	Physician		1	
Experience	Less than 5	0.83	1.09	0.5-2.37
	Above 5		1	
Age	24-30	0.86	0.87	0.4-1.88
	>31		1	

CHAPTER 6 Discussion

This study shows halothane and isoflurane were the commonly used inhalational anesthetic agents in clinical practice in TASH. Some (17%) also used sevoflurane. This result is comparable with the study done in Ghana. Isoflurane and halothane are less costly as compared to the other anesthetic agents. This explains their widespread usage in developing countries like Ethiopia. In other parts of the world nitrous oxide, halothane, isoflurane, sevoflurane and desflurane are commonly used. In USA desflurane and sevoflurane are commonly used. Nitrous oxide has favorable properties which is well documented in different kinds of literatures, but because of its side effects its usage is decreasing(1,18,19). This explains why nitrous oxide, desflurane, and sevoflurane are not commonly used in our setup.

All anesthesia providers feel exposed to inhalational anesthetic ages. This result is not similar to the study done in Ghana where 70% of the anesthesia care providers feel exposed to inhalational anesthetics. That is probably because they may have a better operation theater. But the reasons for exposure(listed above) were similar in Ghana and even in other studies(1,20,21).

The anesthesia providers identified headache, irritability, nausea, memory loss, and tiredness as symptoms of the effects of exposure. This is also similar to the study done in Ghana and other studies. Anesthesia providers were also aware of the organ effects of inhalational anesthetic agents like Teratogenicity, liver disorder, fertility problems, Renal disorders, Carcinogenicity, Allergic reaction, Neurological disorders, and Bone marrow suppression This is also similar to the study done in Ghana and other studies(1,22,23).

Regarding the difference in knowledge of the anesthesia providers being female and physician anesthesia provider was strongly associated with high knowledge score on the risks of exposure to inhalational anesthetics. There was no previous study that assesses the knowledge of anesthesia providers on exposure to inhalational anesthetics to compare it. But the reason for females could be the belief that inhalational anesthetics could be associated with infertility that

made them concerned to know about risks of exposure. Although no strong association being a physician anesthesia care provider was associated with good knowledge score. The probable reason could be the detailed education and detailed reading they have could make them know more about the risks of inhalational anesthetics as compared to their non-physician anesthesia care providers.

Almost all of them (94.5%) attempt to reduce exposure to inhalational anesthetic agents. They use different strategies to decrease exposure like properly functioning scavenging system, use of circle system, and so on. (See table 5).The respondents who don't attempt to reduce exposure didn't mention their reason. But in the study done in Ghana, all of them attempt to reduce exposure to inhalational anesthetic agents but the strategies used were similar(1).

The findings of the study may not be generalized because of differences in a geographical location of the hospitals, available equipments for the anesthesia providers, presence or absence of policies and regulatory frameworks for monitoring anesthetic gas exposure.

CHAPTER 7 Strength and limitations

7.1.Strength

- To our knowledge and searches this is the first ever study tried to assess knowledge and practice of anesthesia providers in Ethiopia

7.2.Limitation of the study

- The study only involved anesthesia providers in TASH.The attitude part of the anesthesia providers was not evaluated.
- The surgeons and OR nurses were not involved
- The study was cross sectional study we can't tell causal relationship

There is a huge gap in knowledge to exposure to inhalational anesthetic agents and poor practice in applying the strategies to minimize exposure to inhalational agents in the OR. So the poor knowledge may have contributed to the poor practice in our set up. Even among physician anesthesia care providers and females who have better knowledge of the risks of exposure, the gap in practicing it is high. Therefore Standard procedures of prevention of inhalational anesthetics should be implemented by TASH to minimize exposure. These standards can be given as a form of training for anesthesia care providers and also put as a protocol by the department.

CHAPTER 8 Conclusion

The knowledge on exposure to inhalational anesthetic agents and the practice in applying the strategies to minimize exposure to inhalational agents in the OR is good. Even though most anesthesia providers scored above the mean they are supposed to be experts in the field.so continuous training should be given to all anesthesia care providers. Being female anesthesia providers was associated with better knowledge score on the risks of inhalational anesthesia. Standard procedures of prevention of inhalational anesthetics should be implemented by TASH to minimize exposure. These standards can be given as a form of training for anesthesia care providers and also put as a protocol by the department.

CHAPTER 9 Recommendation

All the anesthetic equipment should be routinely monitored for leaks, spills and the scavenging system should be regularly checked.it is also important for our hospital to have an effective maintenance program that is responsible for equipment checking and services if needed. And finally, there should be effective training seminars about the risks of these inhalational agents and strategies of prevention.

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Questionnaire

Research title: Knowledge of Anaesthesia Providers on Exposure to Inhalational Anaesthetic Agents in black lion hospital

Name of principal investigator:

A. Yirgalem Atsbha, Anesthesiology resident

This information is prepared by the principal investigator whose main aim is to assess **Knowledge of Anaesthesia Providers on Exposure to Inhalational Anaesthetic Agents in black lion hospital.**

You are kindly invited to participate in the study. Participation is on voluntary basis. Information will only be used for this research, and will be kept anonymous and confidential. You are expected to fill this questioner to the best of your ability and knowledge and may choose not answer any question or refuse to participate/withdraw at any time from the research. There is no harm you may get by participating in the study, and there is no specific benefit you may get from it to. If you have any question or comment about the research please feel free to contact the principal investigator with the following address

Name: YirgalemAtsbha

Phone: +251975412960

Email:Yirga242@yahoo.com

If the responder agrees to participate in the study please circle yes.

- Yes
- No

Part I

S.N.	Questions	Choices
101	What is your age in complete year?	1. 24-30 2. 31-45 3. Above 45
102	Sex	1. Male 2. Female
105	What is your educational status?	1. Diploma 2. First degree 3. Second degree (Master) 4. Anesthesiology resident 5. Senior anesthesiologist
106	What is your number of years of practice as an Anaesthesia provider?	1. Less than 5 years 2. 5 - 10 years 3. More than 10 years

Part II

S.N.	Questions	Choices	Skip
201	Do you use inhalational anesthetics in your practice?	1. Yes 2. No	If no, skip to 203
202	If your answer is yes to Q-201, which type(s)? (Multiple answer is possible)	1. Halothane 2. Isoflurane 3. Desflurane 4. Sevoflurane 5. Others(mention) _____	

203	Do you use Nitrous Oxide in your practice?	1. Yes 2. No	

Part III

S.N.	Questions	Choices	Skip
301	Do you feel exposed to inhalational anesthetics at your workplace?	1. Yes 2. No	If no, skip to 303
302	If your answer to Q-301 is yes, why? (Circle) (Multiple answer is possible)	1. Poorly functioning scavenging system 2. Use of pediatric Ayres T-Piece 3. Leakage from breathing circuit 4. Leakage from anaesthetic machine 5. Lack of scavenging system 6. Improper fitting facemask 7. High flow anaesthesia 8. Other reason (mention)_____	
303	If your answer to Q-301 is no, why? If any circle please. (Multiple answer is possible)	1. Presence of properly functioning scavenging system 2. Does only regional anesthetic cases 3. Only give TVIA	

		4. Others(mention)_____	
304	Is there an allowable limit to the concentration of inhaled Anaesthetic agents in the theatre environment?	1. Yes 2. No	

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Part IV

S.N.	Questions	Choices	Skip
	What are the symptoms related to acute/chronic exposures of inhaled anesthetics? (Multiple answer is possible)	1. Tiredness 2. Headache 3. Irritability 4. Nausea 5. Memory disorder 6. Others(mention)_____	
	What are the major organ effects of chronic exposure to inhaled anesthetics? (Multiple answer is possible)	1. Teratogenicity 2. Liver disorders 3. Renal disorders 4. Carcinogenicity 5. Allergic reaction 6. Fertility problems 7. Neurological disorders 8. Bone marrow suppression 9. Other	

Part V

S.N.	Questions	Choices	Skip
501	Are the concentrations of inhaled Anaesthetic agents routinely monitored	1. Yes 2. No	

	in your working environment?	3. I don't know	
502	Do you make any attempt(s) to reduce your exposure to inhaled anesthetics?	1. Yes 2. No	If no, skip to 504
503	If your answer to Q-502 is yes, what strategies are you adopting to reduce your exposure to inhaled Anaesthetic? (Multiple answer is possible)	1) Ensuring properly functioning scavenging system 2) Use of regional anesthetic techniques 3) Use of total intravenous Anaesthesia (TIVA) 4) Use of circle system 5) Ensuring properly functioning air conditioners in theatres 6) Use of tight fitting facemask/avoiding use of pediatric Ayres T-piece 7) Use of low fresh gas flow during anesthesia 8) Others(mention)_____	
504	If your answer to Q-503 is no, why?		

Thank You.