

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF NURSING AND MIDWIFERY
DEPARTMENT OF NURSING AND MIDWIFERY

**ASSESSMENT OF NURSES KNOWLEDGE AND
ASSOCIATED FACTORS TOWARDS PREVENTION AND
MANAGEMENT OF CYTOTOXIC EXTRAVASATION IN
SELECTED PUBLIC HOSPITALS ONCOLOGY UNITS,
ADDIS ABABA, ETHIOPIA, 2021.**

PRINCIPAL INVESTIGATOR: GIRMA ADUGNA

**A Thesis To Be Submitted To Addis Ababa University, College
Of Health Sciences, School Of Nursing And Midwifery,
Department Of Nursing And Midwifery In Partial Fulfilment
Of The Requirement For The Degree Of Master In Clinical
Oncology Nursing.**

JUNE, 2021.
ADDIS ABABA, ETHIOPIA.

**ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF NURSING AND MIDWIFERY
DEPARTMENT OF NURSING AND MIDWIFERY**

**ASSESSMENT OF NURSES KNOWLEDGE AND
ASSOCIATED FACTORS TOWARDS PREVENTION AND
MANAGEMENT OF CYTOTOXIC EXTRAVASATION IN
SELECTED PUBLIC HOSPITALS ONCOLOGY UNITS,
ADDIS ABABA, ETHIOPIA, 2021.**

PRINCIPAL INVESTIGATOR: GIRMA ADUGNA

ADVISORS:

ZELEKE ARGAW (ASS. PROFESSOR)

S/r: EMEBET BERHANE (LECTURER, PHD FELLOW)

JUNE, 2021.

ADDIS ABABA, ETHIOPIA.

APPROVAL BY THE BOARD OF EXAMINATION

This thesis produced by Girma Adugna is accepted in its present form by the board of examiners as satisfying thesis requirement for the degree of masters in clinical oncology nursing.

INTERNAL EXAMINER:

Berhanu Wordofa	BSC, MSC, Ass. Professor	_____	_____
NAME	RANK	SIGNITURE	DATE

RESEARCH ADVISORS:

Zelege Argaw	BSC, MSC, Ass. Professor	_____	_____
NAME	RANK	SIGNATURE	DATE

S/r Emebet Berhane	BSC, MSC (PhD fellow)	_____	_____
NAME	RANK	SIGNATURE	DATE

DEPARTMENT HEAD:

Niguse Tadele	BSC, MSC, Ass. Professor	_____	_____
NAME	RANK	SIGNITURE	DATE

STATEMENT OF DECLARATION

I under sign below, to declare and affirm that this thesis is my own work that is prepared by following all ethical principles in data collection and using scientific methods for data analysis and completion of this thesis. All scholarly matters that used in the thesis have been given recognition through citation. Every effort has been made to avoid plagiarism in the preparation of this thesis. This thesis may be used without special permission provided that accurate and complete acknowledgement of the source is made. This thesis is not submitted to any other institution previously for the award of academic purposes.

STUDENT

Girma Adugna	_____	_____
NAME	SIGNATURE	DATE

RESEARCH ADVISORS

Zelege Argaw	<u>BSC, MSC, Ass. Professor</u>	_____	_____
NAME	RANK	SIGNATURE	DATE

Emebet Berhane	<u>BSC, MSC (PhD fellow)</u>	_____	_____
NAME	RANK	SIGNATURE	DATE

ACKNOWLEDGMENTS

First of all, my greatest, deepest and true gratitude goes to God. I strongly indebted to my advisors Zeleke Argaw (Ass. Professor) and S/r Emebet Berhane (Lecturer, PhD fellow) generously contributed their time with unreserved support and providing encouragement and constructive comments starting from proposal development.

I would also like to forward my thanks to Addis-Ababa University, college of health sciences, school of nursing and midwifery, department of nursing and midwifery for providing me this educational opportunity and to Eka Kotabe general hospital for offering me a sponsorship. S/r Genet Merawi also deserves high praise and respect for her relentless support and gave me strength throughout the work. I also thank Saint Paul Hospital Millennium Medical College for permitting me to do the study.

At last I would like to thank all the study participants who devoted their time to give valuable information, without them the study would not have been a reality.

ACRONYMS AND ABBREVIATIONS

AAU:	Addis Ababa University
BMI:	Body Mass Index
BSc:	Bachelor Of Science
CVAD:	Central Venous Access Device
DM:	Diabetes Mellitus
DMSO:	Dimethyl Sulfoxide
ETB:	Ethiopian Birr
IRB:	Institutional Review Board
IV:	Intravenous
MOH:	Minster Of Health
MSc:	Master Of Science
Na Cl:	Sodium Chloride
PIV:	Peripheral Intravenous
QOL:	Quality Of Life
SP:	State Of Sao Paulo
SPHMMC:	Saint Paul Hospital Millennium Medical College
SPSS:	Statistical Package For The Social Sciences
TASH:	Tikur Anbessa Specialized Hospital
UK:	United Kingdom
UN:	United Nation
USA:	United States Of America

TABLE OF CONTENTS

ACKNOWLEDGMENTS	iv
ACRONYMS AND ABBREVIATIONS	v
LIST OF TABLES	ix
LIST OF FIGURES	x
ABSTRACT	xi
1. INTRODUCTION	1
1.1 Background	1
1.2 Statement of the problem	3
2. LITERATURE REVIEW	5
2.1 Nurses knowledge towards prevention and management of cytotoxic extravasation	5
2.2 Factors associated with knowledge about prevention and management of cytotoxic extravasation	8
2.2.1 Nurses Socio-demographic factors about the prevention and management of cytotoxic extravasation	8
2.2.2 Health facility related factors regards to prevention and management of cytotoxic extravasation	9
2.2.3 Patient related factors regards to prevention and management of cytotoxic extravasation	11
2.3 Conceptual framework	12
2.4 Justification of the study	13
2.5 Significance of the study	14
3. OBJECTIVES	15
3.1 General objective	15
3.2 Specific objectives	15
4. METHODS AND MATERIALS	16

4.1 Study area and period	16
4.2 Study design	16
4.3 Populations	16
4.3.1 Source population	16
4.3.2 Study population	17
4.4 Eligibility criteria	17
4.4.1 Inclusion Criteria	17
4.4.2 Exclusion Criteria	17
4.5 Sample size determination	17
4.6 Sampling technique and procedure	17
4.7 Study variables	17
4.7.1. Dependent Variables	17
4.7.2 Independent variable	17
4.8 Operational definitions	18
4.9 Data collection tools and procedures	18
4.10 Data quality control	19
4.11 Data processing and Analysis	19
4.13 Dissemination of results	20
5. RESULT	21
5.1 Socio-demographic characteristics	21
5.2 Nurses knowledge towards cytotoxic extravasation prevention and management	22
5.2.1 Nurses knowledge towards cytotoxic extravasation prevention	22
5.2.3 Nurses knowledge towards management of cytotoxic extravasation	24
5.2.4 Nurses knowledge towards health care facilities related factors regards to prevention and management of cytotoxic extravasation	26

5.2.5 Nurses knowledge towards patient related factors regards to prevention and management of cytotoxic extravasation	27
5.2.6 Knowledge towards prevention and management of cytotoxic extravasation	28
5.3 Factors associated with knowledge of nurses towards prevention and management of cytotoxic extravasation	29
6. DISCUSSION	31
7. STRENGTH AND LIMITATIONS OF THE STUDY	34
7.1 Strength of the study	34
7.2 Limitations of the study	34
8. CONCLUSION AND RECOMMENDATIONS	35
8.1 Conclusion	35
8.2 Recommendations	36
9. REFERENCES	37
10. ANNEXES	41
ANNEX A: INFORMATION SHEET	41
ANNEX B: CONSENT SHEET	42
ANNEX C: ENGLISH VERSION QUESTIONNAIRE	43

LIST OF TABLES

Table 1: Description of nurse's socio demographic characteristics working in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021. (n= 124)	22
Table 2: Nurses knowledge towards cytotoxic extravasation prevention in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021. (N=124)	23
Table 3: Nurses knowledge towards management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021. (n=124)	25
Table 4: Nurses knowledge towards health care facilities related factors in prevention and management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021. (n=124)	26
Table 5: Nurses knowledge towards patient related factors in prevention and management of cytotoxic extravasation, Addis Ababa, Ethiopia, 2021. (n=124)	27
Table 6: Factors associated with knowledge of nurses towards prevention and management of cytotoxic extravasation, Addis Ababa, Ethiopia, 2021.	30

LIST OF FIGURES

- Figure 1: Conceptual framework for assessment of nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021. 12
- Figure 2: Knowledge of nurses towards prevention and management of cytotoxic extravasation, Addis Ababa, Ethiopia, 2021. 28

ABSTRACT

Background: Cytotoxic extravasation is the major adverse effect than the combinations of sepsis, neutropenia, mucositis and gastrointestinal disorders. Pain, immobility, irreversible damage of nerve, tissues and tendon, skin grafting and loss of extremity are the significant morbidities secondary to extravasation.

Objective: The aim of this study was to assess nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation in selected public hospitals, Addis Ababa, Ethiopia, 2021.

Methods: A descriptive cross-sectional study design was conducted at Tikur Anbessa Specialized Hospital and Saint Paul Hospital Millennium Medical College that was selected purposely. A convenient sampling technique was employed for the selection of study participants. The data was collected by using a structured self-administered questionnaire. The data entry and cleaning was done by using Epi-data version 4.6 and SPSS version 25. Logistic regression analysis technique was employed to evaluate the effect of independent variables on the dependent variable. Statistical significance was declared with the $p \leq 0.05$. The data description was presented in text, tables and graphic representation.

Result: A total of 124 nurses voluntarily participated in the study with a response rate of 93.2% and 58.1% were female nurses. Majority (45.2%) of study participants are from the age group of 20-29 years. The mean (\pm SD) age was 31.86 (\pm 5.987) years. 34.7% of respondents had a good levels of knowledge in the way to prevent and manage cytotoxic extravasation. Nurses who got training were 6.6 times more likely to have good knowledge of prevention and management of cytotoxic extravasation; [AOR= 6.602 (2.705-16.109)].

Conclusion and recommendation: Generally 65.3% of study participants had poor knowledge towards prevention and management of cytotoxic extravasation. High number (66.9%) of nurses are not trained on cytotoxic extravasation. Supporting nurses working in cancer centers with continuous training programs to enhance their knowledge on extravasation should be a primary task.

Key words: Nurses, cytotoxic extravasation, knowledge, prevention, management.

1. INTRODUCTION

1.1 Background

When physiology of healthy tissue and organs are interrupted by invasion and spread of abnormal cells throughout the body cytotoxic agents are principal options for treatment (1). Compounds that induce toxicity to the cells and inhibit cellular proliferation are termed cytotoxic. Exposure of both normal and abnormal cells to cytotoxic agents had different outcomes that range from minor adverse effects to cell death (2).

Cytotoxics are essential drugs used in health institutions for a variety of cancer and non-cancer disorders management. The word cytotoxic is used interchangeably with chemotherapy, antineoplastic and oncology drugs (3). Cytotoxic is a major type of systemic cancer treatment that refers to one or more anti-cancer drugs/ chemotherapeutic agents (4). Throughout the world more than one million intravenous infusions of cytotoxic is administered by nurses each day for the treatment of cancer disorders and administration of cytotoxic can result in various safety issues for nurses as well as for cancer patients (5). As a result of direct effect on cellular division cytotoxics causes so many adverse effects to the tissue besides controlling cancer cells (4).

One of the adverse effects of cytotoxic administration is extravasation, defined as accidental or unintentional outflow of cytotoxic medication from blood vessels to the nearby tissues during intravenous administration. The extravasated cytotoxic medication had a toxic effect on nerves, tendons, and joints. If immediate management doesn't take place it has diverse consequences like local pain, skin grafting, surgical debridement, patients' distrust, increased the length of hospital stay & medical costs and surgical removal of extremities (6).

There are several factors for the occurrence of extravasation in addition to health care provider's issues such as lack of knowledge and training. The veins of patients who are treated with chemotherapy are fragile, mobile, and difficult to cannulate. Certain other factors like surgical removal of breast and lymph node dissection impair the flow of venous system that result for leakage and development of extravasation (6).

Peripheral intravenous (PIV) is the most site (80%) than the other route for administration of cytotoxics. From 114 events of extravasation stated in the study finding in Milan, cytotoxic drug (109) is the major responsible than monoclonal antibody for the incidence of extravasation (7).

The symptoms of extravasation due to some cytotoxic drugs can take place immediately or lasts weeks to even months. Healing of impaired skin integrity secondary to cytotoxic extravasation is delayed in cancer patients as a result of long time reaction and extensive deep ulcers formation. Extravasations of cytotoxic drugs through the central line is rare (0.24% of 815 patients). Preparation, administration, and post-treatment follow up of cytotoxic drugs is not only the duty of nurses because clinical symptoms are different, other professional disciplines should be participated in the prevention and management of extravasation (8).

Each day extravasation happens even with the availability of effective treatment options and different preventive mechanisms are in place. Physical intervention, pharmacological intervention and surgical intervention are among treatment modalities for extravasation depending on the amount of extravasated drug, health status of patient and time of treatment is started (9).

Inspecting blood backflow, aspirating remaining drug, marking the affected area, applying cold or hot compress, administering antidote and reporting incidence are major steps in the prevention and management of cytotoxic extravasation, However nurses knowledge about prevention and management of cytotoxic extravasation is little (10).

Cytotoxic Extravasation is a medical emergency that exposes cancer patients for serious disability, reduces quality of life (QOL) and puts nurses to the risk of unprofessional conduct claims. Nurses play a major role in providing care for cancer patients in addition to prevention and management of cytotoxic extravasation. Therefore it's essential to assess the care providers knowledge on how to prevent and manage the adverse effects associated with cytotoxic administration (4).

1.2 Statement of the problem

Among different quality care indicators in cancer treatment centers cytotoxic extravasation is the major indicator, because its incidence arises ethical issues with significant morbidity and stress for nurses. Even though there are so many preventive methods, extravasation occur during peripheral intravenous (IV) lines and central line administration of cytotoxic (10).

Globally the prevalence of cytotoxic drug extravasation is estimated to be 0.01% to 6.5% when administered through peripheral intravenous access and from 0.26% to 4.7% when administered through a central venous access device (CVAD). Due to lack of accurate reporting the exact prevalence of cytotoxic extravasation is unknown and under reporting of cytotoxic extravasation is a sign of knowledge deficit among nurses (5). But, extravasation is the major adverse effect than the combinations of sepsis, neutropenia, mucositis and gastrointestinal disorders (11).

A study showed that the most cause for iatrogenic injuries to the patient in health institutions is extravasation. However, the occurrence of extravasation depends on patient condition, medication and care provider. Pain, immobility, irreversible damage of nerve, tissues and tendon, skin grafting and loss of extremity are the significant morbidities secondary to extravasation. Due to lack of accountability management of cytotoxic extravasation is under reported even with no report at all (12).

In addition to adverse events associated with extravasation, financial crisis secondary to medication prices is another headache for patients and also for care providers. Prompt and reliable assessment of tissue injury after extravasation is neglected which expose patients for delay in seeking treatment and further complication (13). Default of treatment, impairment in daily activities and psychological impact to both nurses and cancer patients are also other consequences of extravasation (14).

The most recurrent reactions or adverse events related with cytotoxic extravasation were edema (48.5%), pain (12.1%), and hypersensitivity (9.1%), erythema (3%) (15). Study finding on 114 patients revealed that 94 % (107/114) patients exposed for extravasation show signs and symptoms while 6 % (7/114) are asymptomatic (7).

Study report revealed that the knowledge of nurse's to manage and prevent cytotoxic extravasation is poor and shows cancer patients receive unsafe nursing care in addition to their current disease burden (16). Inadequate vein selection, repeated failed punctures of the vein, starting the infusion therapy using cytotoxic mixture infusion rather than normal saline, poor fixation of the cannula, too fast infusion flow rate (infusion pump), administering cytotoxic agents not in the right order, poor patient monitoring and delayed treatment of extravasation (insufficient skill and lack of extravasation kit) are factors linked with extravasation (17).

The risk of cytotoxic extravasation is diminished as nurses in oncology units are trained and evidence based practices on prevention and management of extravasation are followed (18). On the other hand, continuous training program and assessment of nurse's knowledge is critical in delivery of safe nursing care for cancer patients (19).

Currently, in Ethiopia, there is no research that reflects about cytotoxic extravasation prevention and management. In the literature search the magnitude of extravasation and the consequences may be known both by patients and nurses despite the prevalence of cancer is increasing. Therefore, this study will help to bridge the gap regarding nurse's knowledge towards cytotoxic extravasation prevention and management and its associated factors.

2. LITERATURE REVIEW

2.1 Nurses knowledge towards prevention and management of cytotoxic extravasation

The impact of adverse effects from cytotoxic extravasation will cause actual and potential health threats for cancer patients and health care providers. Therefore, prevention is always higher than cure. Study on 110 oncology nurses in United Kingdom (UK) shows that 92.7% of them know definition of extravasation, however there was a knowledge deficit, a way to precisely prevent and manage extravasation among the study participants(6).

Extra study in Sao Paulo (SP) university hospital concerning management of cytotoxic extravasation states, 81.8% of nurses disconnected the infusion of cytotoxic immediately, 54.5% remove the drug through aspiration and apply cold compress on injured part, 48.5% leave the needle in the puncture site and 36.4% removed peripheral access device(15).

In some literature infusion pump alarm is indicated as early finding of extravasation, however this is contradicted by other studies. Study conducted in Brazil revealed pressures applied by the infusion pump during administration of cytotoxic medication result in impaired blood vessels integrity and expose clients for extravasation (11). Similarly this is also supported by study finding at al-zaytoonah university of Jordan on 110 nurses shows 36.3% had knowledge on high flow pressure as a risk of extravasation while 63.7% doesn't know this scenario (20).

At the end of every nursing procedure documentation is a major component of nursing skill. Documentation improves client care and changes the delivery of health care because quality care is driven from data. Documentation regulates nursing practice and has established guidelines to ensure safe practice and to make evident nurses are liable to clients according to study in state of Minas Gerais in Brazil (11). Study report in Sao Paulo on 33 patient files shows there is no report of 33.3% and 12.1% on location of the injury and in type of cytotoxic agent respectively on 33 patient chart review and finding indicates knowledge gap in documentation (15). In contrast, the study on 16 nurses in the state of Sao Paulo revealed 93.7% of the nursing team registered (date, time, drug, site, signs and

symptoms, extravasated quantity, type and needle gauge) the occurrence of extravasation as another treatment (4).

The primary objective of cytotoxic extravasation is prevention. Study findings in the city of Recife cancer hospital on 21 nurse's shows 85.7% of them had knowledge on how to prevent extravasation and 76.2% have correct information on signs and symptoms of extravasation. Depending on specific types of cytotoxic drugs 33.3 % of them use hot and cold compress when extravasation is occurred while 66.7% does not know when to apply cold or hot compresses after extravasation according to different class of cytotoxic drug and 90.5% had knowledge on topmost factors that predispose cancer patients to extravasation while 9.5 % are not knowledgeable. The finding indicates having knowledge on factors that contribute to extravasation is basic for quality improvement (21).

Another study conducted on 165 volunteer nurses in Turkey revealed, 56.1% stated the availability of extravasation charts. The study also states, 93.9 % see whether the blood is coming back or not; then checked by giving 0.09% sodium chloride before peripheral intravenous chemotherapy administration while 1.8 % doesn't check. 75.8% of study participants had skill on how to manage extravasation (22).

According to the study conducted at Amal national hospital in Baghdad city on 45 nurses, 51.1% of nurses had good level of knowledge and 48.9% had poor level of knowledge about cytotoxic extravasation management (16).

The study result in tertiary care hospital at Karachi, Pakistan on twelve nurses to compare cytotoxic extravasation knowledge before and after teaching (intervention) shows 65% of nurses aspirate the remaining drug before training while 90 % of nurses aspirate the remaining drug after training. Before training 65% and after training 100% of the study participants report the incidence of extravasation. 40% of nurses mark the injured area before intervention but after intervention it is increased to 90%. After delivery of training the percent of cold and warm application is increased from 40% to 100% (10).

Study finding on 110 nurses in Jordan states 90.9% (100) of them had knowledge towards sign and symptoms of cytotoxic extravasation such as tingling, burning, discomfort/pain, swelling, erythema and blistering while 9.1% (10) does not have knowledge. According to

the report nurses had knowledge towards extravasation risk factors like Small fragile and mobile veins (72.2%), obesity (27.8%), sensory deficits (38.1%), communication difficulties or lack of early reporting (45.5%) while 27.8%, 72.2%, 61.9% and 54.5% had poor knowledge respectively (20).

According to a study outcome in Jordan University on 110 nurses, 92.7 % of nurses know the definition of extravasation while 7.3% are unable to define it. 92.7%, 18.2%, 27.8% and 31.8% had knowledge on how to manage cytotoxic extravasation by aid of stop the drug infusion, withdraw the infusion equipment but not the venous catheter, aspirate 5–10 ml of blood through the cannula to extract as much as the extravasated drug and discontinue or remove the cannula respectively (20).

Nurses had knowledge on preventive strategies of cytotoxic extravasation through avoiding of cannulation over joints and lower extremities (90.9%), avoid cannulation where lymphedema is present (36.3%), avoid use of butterfly needles (31.8%) and use of flexible cannula (27.8%) whereas 9.1%, 63.7%, 68.2% and 72.2% of nurses are incompetent in prevention of cytotoxic extravasation respectively as study findings in Jordan. In addition 76.2% study participant had good knowledge on factors that influence the severity of extravasation while 23.8% had poor knowledge on the study finding on 21 nurses (20).

Patient assessment is a major tool in the prevention and management of extravasation before and after administering cytotoxic. 92.7% nurses frequently assess the IV insertion site but 7.3% are unable to perform patient assessment on study finding on 110 nurses in Jordan. Impeccable assessment is a golden rule for nurses to protect their patients during caring. Unsafe nursing would not affect the patient alone, but also put the nursing profession unfaithful. Such nursing skills are a cornerstone in exercising quality care and risk reduction in the health institutions (20). On the other hand study on 10 nurses in Cairo university Hospital shows high incidence of extravasation is associated with reduced knowledge of nursing practice (23).

2.2 Factors associated with knowledge about prevention and management of cytotoxic extravasation

2.2.1 Nurses Socio-demographic factors about the prevention and management of cytotoxic extravasation

A study of 21 nurses' in Brazil pointed out the predominance of females (90.4%) over males (9.6%) in delivery of nursing care in the oncology center. Seventeen study participants are specialized in oncology and the rest 4 are undergoing their studies in oncology. Out of 21 nurses in the study only 2 nurses had master's degrees. However, the Percentage of right responses by study participants on venipuncture site and extravasation management is 33.4% (21).

Study findings in South Korea on 293 nurse's shows the mean score for performance of extravasation prevention is higher for nurses with age greater than 50 years (70.66) and married (67.17), with a clinical career of more than 10 years (70.64). This shows as age increases nurses are more experienced in their clinical experience and risk of cytotoxic extravasation is decreased (24).

Study in Baghdad city on 45 participants states male (42.2%) are dominated by females (57.8%) in involvement of patient care in oncology unit. 26.6% of male and 24.4% of female participants had good level of knowledge on extravasation while 15.5% and 33.3% of male and female participants had poor level of knowledge on extravasation respectively. Majority of study participants had 5-9 years of working experience in the oncology unit. On the other hand, training was not provided for most of them. In addition there is no relationship (p -value > 0.05) between nurses knowledge and their demographic data (12 male and 11 female had good knowledge and less than five and greater than five year of working experience had the same level of good knowledge) on extravasation management, but level of education and training are highly significant (16).

High number of cytotoxic extravasation is associated with unfavorable work settings like unbalanced distribution of duties. Study on all nurses (10) working at the outpatient chemotherapy clinic states the majority (8 out of 10) of nurses administer chemotherapy individually for 15 patients per their duty time (23).

2.2.2 Health facility related factors regards to prevention and management of cytotoxic extravasation

All types of cytotoxic extravasation are different in their mechanism of tissue injury, but they are similar in affecting patients. Secondary to differences in their nature it's challenging to apply specific management for each category of cytotoxic extravasation. In addition to this type, volume (>1000ml) and concentration of cytotoxic drugs had also impact on patient outcome according to study in Nebraska, USA (25).

According to a study report in Nottingham City Hospital, total rejection of adverse effects secondary to treatment and health care provider's mistakes is too tough to prevent, but if there is a functional health strategy it is easy to counteract different hazards. Delivery of ongoing quality training was thought by scholars in the reduction of harmful effects in every institution including health sectors (6).

Study in Gyula, Hungary states informing patient about possible harm of cytotoxic administration and recording his willingness for treatment is the primary task in the prevention of extravasation. Therefore, Patient education and involvement concerning their planned treatment prior to intervention is fundamental in the prevention and timely management of cytotoxic extravasation (17).

Study carried out in a medical university of Nepal on 125 nurse's shows all of the participants does not receive training on cytotoxic drugs and any kind of medical monitoring or assessment of patients (26).

Knowledge and some treatment guidelines may help to prevent extravasations. Compression by 0.9% sodium chloride for patients before and after cytotoxic administration is evidenced in prevention of extravasation. Application of sodium chloride (NaCl) compress on 46 study participants at Ulin Hospital Banjarmasin, Indonesia shows none of them (100%) developed extravasation signs. Additionally it decreases pain and erythema and increases circulation in recovery of impaired skin integrity (27).

Establishing full functional patient safety management teams, using standard protocols and educating nurses on their gap continuously are core in the extravasation prevention. Study findings on 293 nurses in Yeungnam University Medical Center states 99.7% Needs

continuous gap filling education on prevention of extravasation while 0.3% not need and 58.4% need establishing of full functional patient safety management teams and the rest 41.6% are unwillingness in establishment of safety team (24).

Having skill on how to prevent and manage extravasation alone is inadequate without teaching patients on extravasation. Findings on 293 nurses in South Korea shows 81.9% deliver extravasation education for patients and 18.1% of participants does not provide information on extravasation (24).

Absence of staff development results in a knowledge deficit among nurses towards prevention and management of cytotoxic extravasation and this in turn expose cancer patients for unsafe care. Study on 110 in Jordan states the majority (94.6%) of nurses do not receive continuous training programs regarding extravasation at hospital. Only 5.4% receive continued education on extravasation (20).

Cytotoxic extravasation is decreased through delivery of training to improve nurse's knowledge. This is supported by study conducted on 12 nurses in Karachi shows, 63.02% (before training) and 96.87% (after training) had demonstrated the steps of identification and management of cytotoxic extravasation (10).

Nurses are advocates of their patient and also to their families. Since some cytotoxic drugs take a longer period of days (after patient discharge) for formation of extravasation health education for both parties on symptomatic presentations associated with extravasations had good prognosis due to early return of the patient to medical centers (10).

Lack of knowledge in anticipation, management and prevention of cytotoxic extravasation is indicated on 45 nurses at Amal national hospital in Iraq. Fruitless delivery of ongoing training in the study setup and inability to familiarize themselves with new scientific findings was associated with nurses poor performance (16).

Study on 10 participants at Egyptian university hospital shows chemotherapy related training was not given for 100% (10) of nurse working at the outpatient chemotherapy clinic and this is associated with higher incidence of cytotoxic extravasation due to nurses poor performance (23).

Therefore, nurse competence is essential to prevent extravasation, this is supported by study conducted at a university hospital in Cairo. This finding proves extravasation is prevented as the nurses advanced in their care. High workload, unbalanced nurse to patient's ratio, poor work setup and unavailability of training for nurses are factors that predisposed patients for extravasation according to the study result (23).

2.2.3 Patient related factors regards to prevention and management of cytotoxic extravasation

The risk of acquiring extravasation depends on the condition of patient's vein locations, type of drug administered and presence of radiation scars on site of cytotoxic administration. Extravasation is higher for women (56%) than men (42%) mostly between 50-64 years of age. Study on 47 participants Jakarta, Indonesia shows 51.1% respondent's venous locations for cytotoxic administration is in the metacarpal veins and majority (80.9%) of them are not exposed for extravasation (28).

Study at Seoul, Korea on factors related to intravenous extravasation revealed that out of 203 study participants; intravenous extravasation had occurred due to bed fast, chair fast, walks infrequently and walks frequently; on 1, 6, 27 and 169 participants, respectively. This implies that as the patient activity increased, the risk of acquiring extravasation is high while bed confinement decreases risk of cytotoxic extravasation (29).

Study report on 48 voluntary participants at university hospital of Egypt states lethargic (17.9%), presences of scar at injection site (14.3%), thin veins (14.3%), presences of lymphedema (13.4%) and diabetes mellitus (DM) (12.2%) and hypertension (12.2%) are factors associated with incidence of extravasation according to patients risk factors. In addition patients who cannot read and write (17.24%) are more exposed for the incidence of extravasation than patients in university level (13.33%). This indicate the more education level of patient is increased the incidence rate of extravasation is decreased (23). Other factors that can open door for occurrence of extravasation were impaired in the peripheral feeling (26.7%), obesity (30%), atherosclerosis (36.7%) and hypotension (23.3%). Another risk factor is peripheral cannula fixation, 13.3%, 20.0%, and 23.3% control group had inefficient cannula fixation in the first cycle, fourth cycle and sixth cycle respectively in Egypt study report (30)

2.3 Conceptual framework

This conceptual framework is adapted and modified after reviewing different literatures (16), (20), (24),(23), (29). It shows the relationship between independent variables (Socio-demographic factors, health care facility related factors, and patient related factors) on dependent variable knowledge.

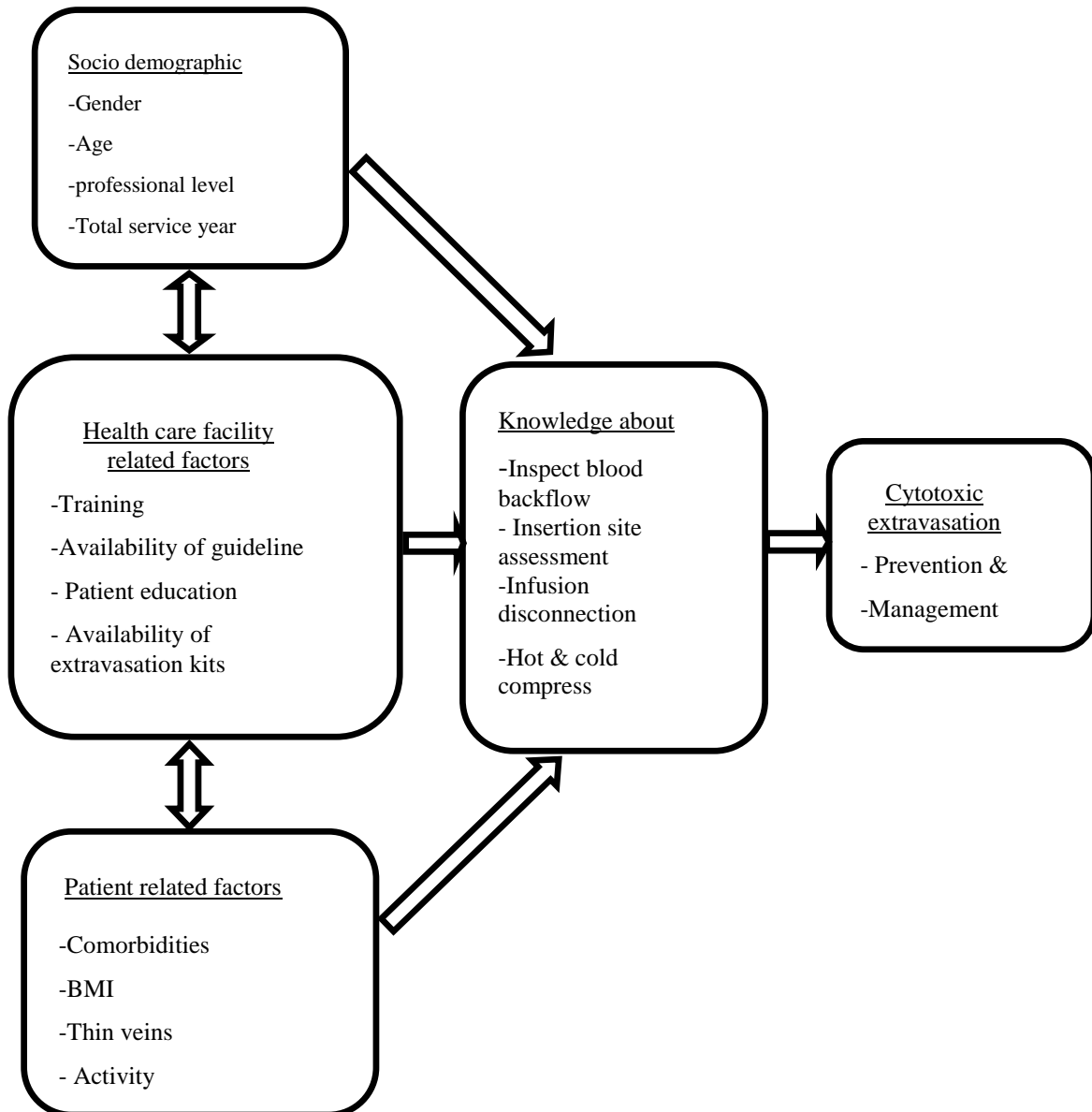


Figure 1: Conceptual framework for assessment of nurse's knowledge and associated factors towards prevention and management of cytototoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021.

2.4 Justification of the study

In Ethiopia where oncology practice is so young, awareness of cytotoxic extravasation among medical professionals about oncology is much inferior to expected. It's always a challenge for nurses to monitor their patients due to an unbalanced nurse to patient ratio and even health education related to sign and symptoms of extravasation is not delivered for patients. On the other side majority of patients complaining pain, burning sensation, skin colour change on the site of infusion and sluggish of infusion rate. These are some signs related to extravasation. The most important approach to extravasation is prevention with adequate knowledge and by aid of extravasation kit, but there is a gap in availability of such equipment and delivery of continued education for nurses. This in turn improves the quality of nursing care provided to cancer patients.

Since little studies conducted to the study area, this study will contribute to identify and fill the gaps in nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021.

2.5 Significance of the study

Prevalence of cancer is rising beside rapid population growth and unhealthy lifestyles. Most of the patient are on systemic treatment with cytotoxic chemotherapy, which is one modality of therapy for such patients. In addition to expensive cost of cancer treatment, cytotoxic extravasation leads to other extra payments and prolong admission of the patient in the hospital. Therefore, this study will assess the knowledge level of nurses and associated factors towards prevention and management of cytotoxic extravasation, this study focuses on nurse's work in oncology centers because administration of cytotoxic chemotherapy is one of their daily routine procedure and the first health care witnessing adverse effects are also nurses.

The findings obtained in this study, could be utilized by minster of health (MOH), hospitals and policy makers for planning, evaluating and strong focus on prevention of extravasation. The finding could also be used as input to improve the quality of care given to cancer patients.

Additionally, the study will offer final analysis data on nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation. The generated result will also put baseline information for other health care providers and researchers for further research in the topic and for policy makers.

3. OBJECTIVES

3.1 General objective

To assess nurses knowledge and associated factors towards prevention and management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021.

3.2 Specific objectives

To determine nurses knowledge towards prevention and management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021.

To identify factors associated with prevention and management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021.

4. METHODS AND MATERIALS

4.1 Study area and period

The study was conducted in two selected public hospitals in Addis Ababa, the capital city of Ethiopia. Addis Ababa is the largest city in Ethiopia, with estimated population size of 4,793,699 on the estimated area of 527 square kilometer according to United Nation (UN) world urbanization prospects (31). People from different regions of Ethiopia populate the city. There was 13 public hospitals among them Tikur Anbessa specialized hospital (TASH) and Saint Paul hospital millennium medical college (SPHMMC) provides multi-dimensional aspects of care to cancer patients who need health care services for the entire country. Both hospitals provides teaching and clinical care service in oncology and other different medical disciplines. According to sources from the human resource office, TASH comprises more than 650 nurses and other health professionals dedicated to providing health care service. TASH was a tertiary care teaching hospital of AAU with 800 beds and provides services for about 370, 000 to 400, 000 patients per year; among these 60,000 were oncology case patients. Currently, the clinical service is run by diverse professionals and 103 nurses with different educational ranks in different oncology units. SPHMMC is the second largest hospital in Ethiopia with inpatient capacity of 700 beds and more than 300,000 patients per year are served among these more than 6,000 were oncology case patients. The oncology units of SPHMMC deliver health care by different professionals including 30 nurses. According to the human resource office there are a total of 133 nurses working in different oncology units of both selected public hospitals with varied educational positions.

The study was conducted from February 08/2021 - March 08/2021.

4.2 Study design

A quantitative descriptive cross-sectional study design was employed in this study.

4.3 Populations

4.3.1 Source population

All nurses who were working in the selected public hospitals, Addis Ababa Ethiopia.

4.3.2 Study population

Nurses who were working in oncology units of the selected hospitals, Addis Ababa Ethiopia.

4.4 Eligibility criteria

4.4.1 Inclusion Criteria

- All nurses with more than 6 months of working experience in oncology units (32).
- All nurses working in the oncology units in the selected hospitals and who were willing to take part in the study (20).

4.4.2 Exclusion Criteria

- Nurses serving less than six months was excluded.
- Nurses who were on leave such as; maternity leave, sick leave and annual leave.

4.5 Sample size determination

All Nurses (133) works in oncology departments were included in the study and the study participants were selected by using a convenient sampling technique.

4.6 Sampling technique and procedure

From thirteen public of hospitals; two public hospitals were selected using purposive sampling since they are the health care service providers to cancer patients. Finally all (133) study participants from oncology units of both TASH and SPHMMC were selected by convenient sampling technique.

4.7 Study variables

4.7.1. Dependent Variables

Knowledge on prevention and management of cytotoxic extravasation

4.7.2 Independent variable

Socio-demographic:

- Gender
- Age

- Professional level
- Total service year

Health care facility related factors:

- Training
- Availability of guideline
- Availability of extravasation kits
- Patient education

Patient related factors:

- Comorbidities
- BMI
- Thin veins
- Activity

4.8 Operational definitions

Cytotoxic: type of drug that harm both functional and unfunctional cell.

Extravasation: outflow of cytotoxic drugs external to blood vessels.

Good knowledge: Nurses are categorized as having good knowledge if they have knowledge score above or equal to ≥ 23 points towards prevention and management of cytotoxic extravasation (20).

Poor knowledge: Nurses are categorized as having poor knowledge if they have knowledge score below or equal to ≤ 22 points towards prevention and management of cytotoxic extravasation (20).

Nurse: Nurse is defined as a profession who provides care and support for cancer patients.

4.9 Data collection tools and procedures

The questionnaire was adopted from related studies and it was reliable with an acceptable value of cronbach's alpha which is 0.83 (20). The tool was revised by two experts (MSc in clinical oncology nurse). The questionnaire consisted of five sections. Section 1: Nurses socio-demographic data contains six questions, Section 2: Nurses knowledge question on

prevention of cytotoxic extravasation contains fifteen questions. Section 3: Nurses knowledge question on management of extravasation contains thirteen questions. Section 4: Questions related to health care facilities regards to prevention and management of cytotoxic extravasation contains five questions. Section 5: Questions to patient related factors regards to prevention and management of cytotoxic extravasation contains five questions.

Data was collected by using a structured self-administered questionnaire. Both the supervisor and the data collectors received training for one day prior to data collection. Three nurses with bachelor's degree were collected the data and two supervisors including the principal investigator was participated in the collection of data. The supervisors and the principal investigator were responsible for controlling and supervising the data collection process. Data collectors had responsibility to take informed consent and explain the aim of the study from each participant. Confidentiality was kept and any participant information was not transferred to third parties. Daily meetings were held on any challenges and appropriate feedback was offered.

4.10 Data quality control

The proper design of the questionnaire ensured the quality of the data. The data collection tool was prepared in the English version since the participants are nurses who were capable to read and understand English. In 10% of the total sample size, pre-test was performed with a similar study population outside of the study area one week before the actual data collection time. The aim is to make necessary modifications accordingly. Training was given for one day for data collectors and supervisors by the principal investigator about the purpose of the study, data collection tools and procedures. Every day, questionnaires was reviewed and checked for completeness by the principal investigator's and supervisor then necessary feedback was offered to data collectors the next morning before data collection.

4.11 Data processing and Analysis

The principal investigator assigned each questionnaire a unique code after data collection, and it was double-checked for completeness and consistency. Epi-data version 4.6 and SPSS version 25 were used to enter and clean the data. The strength and significance of an

association between dependent and independent variables were calculated using odds ratio with a 95% confidence interval. Logistic regression analysis was employed to evaluate effect of independent variables on dependent variables. Those with a P value less than or equal to 0.05 were considered as statistically significant. Text, tables, and charts representations were used to present the results.

4.12 Ethical considerations

Prior to data collection ethical clearance was obtained from the ethical committee of the department of nursing and midwifery, college of health sciences, school of nursing and midwifery of Addis Ababa university and additional obtained from institutional review board (IRB) of SPHMMC. Letter of permission was written by the school of nursing and midwifery of Addis Ababa University and provided to selected hospitals for the study. The study respondent's identity was not disclosed to third parties, and the confidentiality of the information they provided to this study was safeguarded.

Finally, after explaining the purpose of the study and how long it takes to fill the question, informed consent was obtained from each participant prior to data collection. All participants have the right to decide not to participate in the study. Participants was also informed whom to get in touch with for their question.

4.13 Dissemination of results

The result of this study was submitted to the school of nursing and midwifery of Addis Ababa University College of health sciences, nursing service director of the hospitals, and federal ministry of health. Efforts will also be made to publish it in local or international journals.

5. RESULT

5.1 Socio-demographic characteristics

A total of 124 study participants in selected public hospitals voluntarily participated in the study and the response rate was 93.2%. Among 124 nurses in the study, majority of the respondents were female, 58.1% (n=72). Regarding age distribution this study showed majority [(45.2% (n=56)] of study participants were classified in the age group of 20-29 years. The minimum age of the respondents in the study is 24 and the maximum is 55 years with a median age of 30 years. The mean (\pm SD) age was 31.86 (\pm 5.987) years. Regarding the Professional level and specialty in oncology nursing, majority of the respondents (86.3%) are BSc degree holders and lower percentage (12.9%) of respondents were specialized in oncology nursing. Regarding work experience and training majority (83.9%) of respondents had work experiences below or equal to 5 years. The mean (\pm SD) duration of work experience in the oncology department 3.45 \pm 2.457 years. Most (66.9%) of the respondents did not receive or participated in cytotoxic extravasation training.

Table 1: Description of nurse’s socio demographic characteristics working in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021. (n= 124)

Variables	Category	Frequency	Percent (%)
Gender	Female	72	58.1
	Male	52	41.9
Age in years	20-29	56	45.2
	30-39	53	42.7
	40-49	12	9.7
	>=50	3	2.4
	Professional level	BSc	107
	MSc	17	13.7
Specialized in oncology nursing	Yes	16	12.9
	No	108	87.1
Years at work in oncology units	<=5 yrs	104	83.9
	6-10 yrs	17	13.7
	>=11 yrs	3	2.4
Training courses on cytotoxic Extravasation	Yes	41	33.1
	No	83	66.9

5.2 Nurses knowledge towards cytotoxic extravasation prevention and management

5.2.1 Nurses knowledge towards cytotoxic extravasation prevention

According to this study the percentage of correct answer were 26.6% regarding to the statement butterfly needles must not be used for cytotoxic infusion which increase the risk of extravasation. Of the nurses participated in the study, 91.2% of them had answered the correct answer towards inspection of the puncture site prior to IV cannulation and 16.1% of the respondents had selected wrong answer on selection of IV cannulation site. Majority (97.6%) of nurses in the study had selected correct answer on assessing the patient’s condition prior to cytotoxic infusion (table 2).

Table 2: Nurses knowledge towards cytotoxic extravasation prevention in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021. (N=124)

Variables	Correct	Incorrect
Phlebitis and infiltration around the puncture site is checked first.	113 (91.2%)	11 (8.8%)
Avoid cannulation over joints, inner wrist and the lower extremities.	104 (83.9%)	20 (16.1%)
Avoid cannulation where lymphedema is present.	96 (77.4%)	28 (22.6%)
Butterfly needles must not be used.	33 (26.6%)	91 (73.4%)
Flexible cannula is recommended.	101 (81.5%)	23 (18.5%)
CVAD should be used for long period infusion (12 -24 hrs)	68 (54.8%)	56 (45.2%)
Check for blood flow after cannulation and flush with 10 ml of normal saline.	115 (92.7%)	9 (7.3%)
Flushing with 10 - 20 ml of saline solution between different drug infusions is recommended.	103 (83%)	21(17%)
Flashback of blood should always be obtained before drugs are administered.	113 (91.1%)	11 (8.9%)
Frequent assessment of the insertion site for swelling, pain, redness and sluggish of infusion rate is recommended.	113 (91.1%)	11 (8.9%)
Double check by two nurses is needed for cannulation and drug dose calculation.	104 (83.9%)	9 (7.3%)

5.2.3 Nurses knowledge towards management of cytotoxic extravasation

Majority (83.8%) of the study participants had selected the correct answer towards definition of cytotoxic extravasation. Regarding to nurses knowledge towards management of cytotoxic extravasation 68.6% of respondents have correctly answered as the first step management of cytotoxic extravasation is to stop and disconnect the IV infusion tube immediately, but leave secured cannula in place.

Regard to specific types of cytotoxic extravasation management, nearly half (49.2%) of the respondents selected corrected answer towards application of local cold for extravasation incidents due to doxorubicin, epirubicin and daunorubicin and again majority (50.8%) of nurses have selected the correct answer towards application of dry heat in the injured area after extravasation secondary to vinblastine, vincristine and vinorelbine. Depending on drug specific antidote such as dimethyl sulfoxide (DMSO) 50–99% was administered post cytotoxic extravasation to counteract the injury; but, more than half (65.3%) of nurses in the study selected wrong answer towards specific extravasation antidote (table 3).

Table 3: Nurses knowledge towards management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021. (n=124)

Variables	Correct	Incorrect
Cytotoxic extravasation is infiltration of chemotherapy into sub dermal tissues surrounding the administration site.	104 (83.8%)	20 (16.2%)
Extravasation occurs when any liquid leaks into the surrounding tissue.	91 (73.3%)	33 (26.7%)
1 st step management is to stop and disconnect the infusion, but leave cannula in place.	85 (68.6%)	39 (31.4%)
Identify extravasated agents.	106 (85.4%)	18 (14.6%)
Aspirate extravasated solution with 10-20 ml syringe and record the volume.	76 (61.3%)	48 (38.7%)
Remove the cannula and mark the area.	109 (87.9%)	15 (12.1%)
Raise affected extremity over height of heart and administer analgesia as needed.	98 (79%)	26 (21%)
Avoid pressure application and alcohol compress at the affected area.	96 (77.5%)	28 (22.5%)
Pharmacologic treatments with or without hot or cold can be applied.	91 (73.4%)	33 (26.6%)
For daunorubicin, doxorubicin and epirubicin apply local cold for 1 hrs and repeat every 8 hours for three days.	61 (49.2%)	63 (50.8%)
For vinblastine, vincristine and vinorelbine apply dry heat for 30 minutes.	63 (50.8%)	61 (49.2%)
DMSO 50–99% is an antidote of extravasation.	43 (34.7%)	81 (65.3%)
Record the occurrence (date, site, drug & etc.).	117 (94.4%)	7 (5.6%)

5.2.4 Nurses knowledge towards health care facilities related factors regards to prevention and management of cytotoxic extravasation

Beyond the knowledge of nurses, there are various factors that can affect prevention and management of cytotoxic extravasation and one is health care facilities factors. The study finding indicates, majority (58.1%) of nurses in the study were able to respond correctly to questions on high incidence rate of extravasation occur with unfavorable environmental factors such as unavailability of extravasation kits in the caregiving areas. Majority (93.5%) of nurses responded correctly to questions on the necessity of continuous training of nurse's in decreasing the new onset of cytotoxic extravasation. On the other hand, 94.4% correctly answered the question on risk of cytotoxic extravasation increase secondary to lack of experience and non-adherence to the guidelines of chemotherapy administrations.

Table 4: Nurses knowledge towards health care facilities related factors in prevention and management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia, 2021. (n=124)

Variables	Correct	Incorrect
High incidence rate of extravasation occurs with unfavorable environmental factors such as unavailability of extravasation kits.	72 (58.1%)	52 (41.9%)
Informing a patients about possible harm of cytotoxic administration and recording his/her willingness for treatment is helpful in prevention of extravasation.	101 (81.5%)	23 (18.5%)
Continuous training of nurse's decreases incidences of extravasation.	116 (93.5%)	8 (6.4%)
High workload & unbalanced nurse to patient's ratio are factors that expose patients for extravasation.	109 (87.9%)	15 (12.1%)
Lack of experience and non-adherence to the guidelines of chemotherapy administrations increase the risk of extravasation.	117 (94.4%)	7 (5.6%)

5.2.5 Nurses knowledge towards patient related factors regards to prevention and management of cytotoxic extravasation

The other factor that can affect prevention and management of cytotoxic extravasation is patient related factors. According to the study result 91.9% of nurses in the study were able to respond correctly to questions on Patients with small and/or fragile veins are more at risk for the development of cytotoxic extravasation. Majority (80.6%) of the respondents answered correctly on the statement: Increased patient activity and unconsciousness is a risk for cytotoxic extravasation.

Table 5: Nurses knowledge towards patient related factors in prevention and management of cytotoxic extravasation, Addis Ababa, Ethiopia, 2021. (n=124)

Variables	Correct	Incorrect
Patients with small and/or fragile veins are more at risk for the development of extravasation.	114 (91.9%)	10 (8%)
Incidence rate of extravasation is higher among patients who can't read & write.	32 (25.8%)	92 (74.2%)
Incidence rate of extravasation is higher among patients who had breast cancer, diabetes mellitus and hypertension.	43 (34.6%)	81 (65.4%)
Women are at higher risk of acquiring extravasation than men.	62 (50%)	62 (50%)
Increased patient activity and unconsciousness is a risk for cytotoxic extravasation.	100 (80.6%)	24 (19.4%)

5.2.6 Knowledge towards prevention and management of cytotoxic extravasation

Majority (65.3%) of respondents had poor level of knowledge in the way to prevent and manage cytotoxic extravasation. The minimum and maximum knowledge score of the respondents is 7 and 28, respectively.

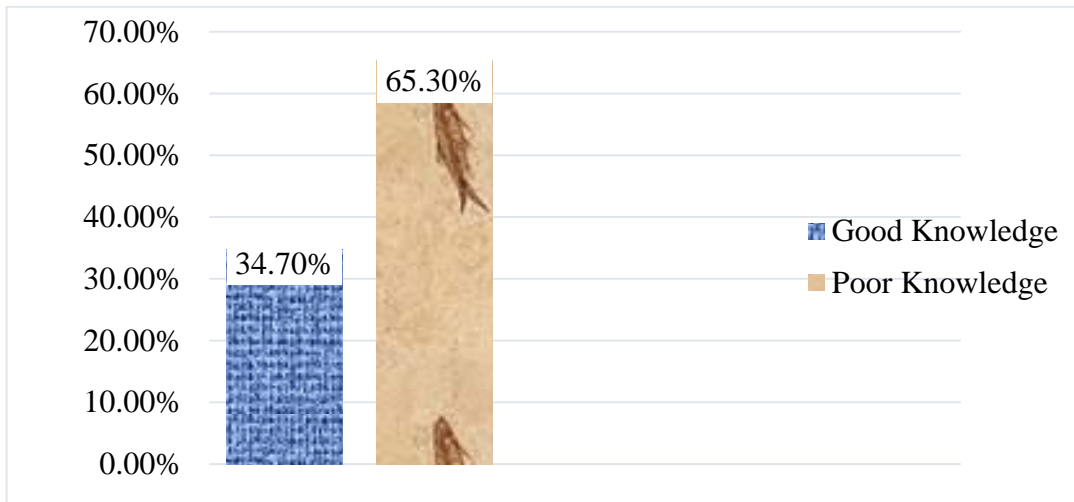


Figure 2: Knowledge of nurses towards prevention and management of cytotoxic extravasation, Addis Ababa, Ethiopia, 2021.

5.3 Factors associated with knowledge of nurses towards prevention and management of cytotoxic extravasation

Result of binary logistic regression indicated that professional level, Specialization in oncology nursing, Service years, receive cytotoxic extravasation training, patient related factors and health care facilities related factors were significantly associated with knowledge of nurses towards prevention and management of cytotoxic extravasation.

In this result training was a factor that highly associated with nurses knowledge on prevention and management of cytotoxic extravasation; the result indicated nurses who got training were 6.6 times more likely to have good knowledge of prevention and management of cytotoxic extravasation; [AOR= 6.602 (2.705-16.109)]. The result also indicated nurses who specialized in oncology were 5.7 times more likely to have good knowledge of prevention and management of cytotoxic extravasation; [AOR= 5.750 (1.770-18.681)]. In addition, the result indicated being BSc nurse is 0.2 times less likely to have good knowledge of prevention and management of cytotoxic extravasation than the MSc nurses; [AOR= 0.208 (.067-.643)] (table 6).

Table 6: Factors associated with knowledge of nurses towards prevention and management of cytotoxic extravasation, Addis Ababa, Ethiopia, 2021.

Variables	Category	Knowledge (prevention and management)		P value	COR (95% CI)	AOR (95% CI)
		Good	Poor			
Profession	BSc	32 (29.9%)	75 (70.1%)	0.008	0.233 (0.079-.684)	0.208 (0.067-.643)*
	MSc	11 (64.7%)	6 (35.3%)	.	.	.
Specialize in oncology nursing	Yes	11 (68.7%)	5 (31.3%)	0.004	5.225 (1.680-16.255)	5.750 (1.770-18.681)*
	No	32 (29.6%)	76 (70.4%)	.	.	.
Service years	<=5	32 (30.7%)	72 (69.3%)	0.017	0.353 (0.150-.830)	4.280 (1.320-13.88)*
	>=6	11 (55%)	9 (45%)	.	.	.
Training	Yes	27 (65.8%)	14 (34.2%)	0.001	8.076 (3.469-18.801)	6.602 (2.705-16.109)*
	No	16 (19.2%)	67 (80.8%)	.	.	.
Patient related factors	Yes	12 (54.4%)	10 (45.4%)	0.001	0.101 (0.034-.300)	9.938 (3.335-29.620)*
	No	8 (7.8%)	94 (92.2%)	.	.	.
Health care facilities related factors	Yes	73 (76%)	23 (24%)	0.015	0.244 (.078-.757)	4.105 (1.321-12.761)*
	No	13 (46.4%)	15 (53.6%)	.	.	.

6. DISCUSSION

This study has undertaken to assess the nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation in selected public hospitals oncology units, Addis Ababa, Ethiopia. Preventing the incidence of cytotoxic extravasation is cost effective than managing and this requires adequate knowledge. However, the findings of this study showed that nurses in the study had poor knowledge towards prevention and management of cytotoxic extravasation. The main suggested reason for poor levels of nursing knowledge in this study is due to lack/shortage of training and oncology nursing specialties. This study revealed being specializing in oncology nursing is 5.750 times more likely to had knowledge towards preventing and managing cytotoxic extravasation than nurses who does not specialize [AOR= 5.750 (1.770-18.681)]. In this study 87.1% of nurses are not specialized in oncology.

According to the finding of this study, the socio-demographic characteristics of the respondents were, male (41.9%). Similarly, the finding of a study conducted in Baghdad city revealed that 42.2 % of the study participants are male (16). But, it's quite different in the study of Brazil which states the dominance of females (90.4%) over male (9.6%) in the care of cancer patients. In another finding, 12.9% of the study participants in this study had a master degree in oncology nursing which is higher than in Brazil study that revealed 9.5% nurses had a master degree in oncology nursing. This might be due to the difference in the sample size and study period between the countries (21).

According to this study 66.9% of respondents do not received training on cytotoxic extravasation. In contrast to a study conducted at the university hospital of Egypt, cytotoxic extravasation related training was not given for 100% of nurses working at the outpatient chemotherapy clinic (23). In addition to this study which was conducted in Jordan states 94.6% of nurses do not receive training on extravasation (20).

In contrast the study conducted in Karachi revealed that nurses had increased their knowledge in demonstrating the steps of identification and management of cytotoxic extravasation from 63.02% to 96.87%. This confirms training & knowledge of nurses towards identification & management of cytotoxic extravasation is associated (10).

With regard to the prevention of cytotoxic extravasation, 92.7% of nurses in the study had knowledge to check blood flow after cannulation and to flush with 10 ml of normal saline prior to administration of cytotoxic. This is nearly similar to the finding of a study conducted in Turkey, that is 93.9% see whether the blood is coming back or not; then checked by giving 0.09% sodium chloride before peripheral intravenous chemotherapy administration (22).

Some studies had reported that high flow pressure applied by the infusion pump during administration of cytotoxic medication result in impaired blood vessels integrity and expose clients for extravasation (11). The results of this research show that only 35.5% of the respondents were respond the correct answer on cytotoxic or vesicant drug administration is not infused by an infusion pump but by gravity. Similarly 36.3% of nurses in Jordan know high flow pressure as a risk factor of extravasation. This might be because nurses are not engaged in capacity development which focuses on extravasation (20).

Various studies have concluded that as patient activity increases, the risk of acquiring extravasation is high while bed confinement decreases risk of cytotoxic extravasation. The results of this study showed 58.9% of study participants had knowledge in splinting of irritable patients (child) during administration of cytotoxic (29).

This study also discovered that 83.8 % of the study participants knew the definition of cytotoxic extravasation which was lower than a study outcome in Jordan University on 110 nurses, 92.7 % of nurses know the definition of extravasation. Regarding the management of cytotoxic extravasation 68.8% of nurses in this study know the first step (stop & disconnect the infusion). This finding is lower than the study done in Jordan which states 92.7% of the nurses had knowledge on how to manage cytotoxic extravasation by aid of stop the drug infusion and this could be as a result of early reporting of the incident and follow up of patients to prevent the injury. However, 61.3% and 87.9% of nurses in this study had knowledge on aspiration of extravasated solution with 10-20 ml syringe and remove or withdraw cannula respectively. This finding is higher when compared with the same study in Jordan study which states 27.8% and 31.8% of nurses had knowledge on aspiration of extravasated solution and withdrawal cannula or venous catheter respectively.

The difference could be as a result of shortage of nursing specialty in oncology and lack of training (20).

In this study the overall percentage of nurse's knowledge in prevention and management of cytotoxic extravasation is 34.7% and 65.3% of nurses had good and poor knowledge respectively which is lower than the study conducted in Baghdad city Amal national hospital, which is 51.1% of nurses had good level of knowledge and 48.9% had poor level of knowledge. This might be due to the difference in the region and cancer treatment is also in infant stage in Ethiopia (16).

When there is an unbalanced nurse to patient ratio nurses will be overloaded with care and this expose nurses to provide poor quality care and as a result patient will be exposed for extravasation. In this study 87.9% of respondents know high workload and unbalanced nurse to patient's ratio are factors that expose patients for extravasation in cancer centers. This is supported by study conducted at a university hospital in Cairo. The finding proves high workload, unbalanced nurse to patient's ratio and poor work setup for nurses are factors that predisposed patients for extravasation (23).

In this study, 91.9% of the nurses knew that Patients with small and/or fragile veins had a higher risk of developing cytotoxic extravasation, which was higher than the results of the Jordan study (72.2%) of nurses had knowledge towards extravasation risk factors such as Small fragile and mobile veins. This may be due to inadequacy of education on the subject matter in the undergraduate courses and majority of the study participants are also degree holders (20).

7. STRENGTH AND LIMITATIONS OF THE STUDY

7.1 Strength of the study

This study seeks to address a key, timely, and invisible health problem in the study setting. The purpose of the study was explained to the respondent before the data were collected. After collecting the data, it was entered and cleaned carefully. Since there is no similar studies in the study settings so far it gives information about level of nurse's knowledge towards the prevention and management of cytotoxic extravasation. This study can also be used as a baseline data for future studies and put baseline data for the future strategy of the health plan. Furthermore, standardized questionnaires were used and the up-to-date literature is reviewed.

7.2 Limitations of the study

The limitation of this study is that it was conducted only in Addis Ababa public hospitals due to limited time and resources. This study is the first of its kind in Ethiopia, and there are limitation/gap in finding literature on this topic and this challenges the discussion. Furthermore, the research was conducted in a limited institution with a small sample size. This could restrict the study's generalizability. Nurse's knowledge was assessed only through the respondents' report through self-administered questionnaires, and no other assessment methods were addressed in this study.

8. CONCLUSION AND RECOMMENDATIONS

8.1 Conclusion

In conclusion, the study summarizes the following:

This study showed that professional level, Specialization in oncology nursing, Service years, receive cytotoxic extravasation training, patient related factors and health care facilities related factors are significantly associated to knowledge of nurses towards prevention and management of cytotoxic extravasation.

In general, knowledge about the prevention and management of cytotoxic extravasation is poor among study participants (65.3%) and this exposes cancer patients to morbidities secondary to extravasation. The study also identified that a large number (66.9%) of nurses are not trained on extravasation. This result implicates that improving a nurses level of knowledge concerning cytotoxic extravasation can eliminate the consequences of injury.

8.2 Recommendations

The following recommendations are forwarded based on the study findings to advance the nurses knowledge on cytotoxic extravasation prevention and management:

For MOH and stakeholders:

The ministry of health and stakeholders need to promote and enhance on-going educational opportunities for cancer care that have already begun in order to increase the knowledge of nurses. In addition, it should always be mandatory to develop and provide guidelines and access for extravasation kits at cancer treatment centers.

For researchers:

Additional studies need to be conducted at multiple sites on large sample size in the future to assess nurses' knowledge of the prevention and management of cytotoxic extravasation.

For health care settings:

Prevention of extravasation has always been the standard practice, and proper treatment and care after injury should be given as soon as possible before further complications occur. Healthcare facilities should facilitate ongoing training programs for nurses in the oncology unit on the prevention and early treatment of cytotoxic extravasation.

For health care workers (Nurses):

Nurses should empower patients through health education on early reporting and signs and symptoms of cytotoxic extravasation before administering cytotoxic drugs. Nurses working in the cancer centers should follow guidelines in reducing the consequences of extravasation injury and also upgrading their knowledge on extravasation through different mechanism is recommended.

9. REFERENCES

1. Federal Ministry of Health E. National Cancer Control Plan 2016-2020 of Ethiopia. *This Prev Control Dir.* 2015;2015(10):83.
2. Istifli ES, Hüsünet MT, Ila HB. Cell Division, Cytotoxicity, and the Assays Used in the Detection of Cytotoxicity. *Cytotoxicity-Definition, Identification, and Cytotoxic Compounds: IntechOpen*; 2019.
3. Boiano JM, Steege AL, Sweeney MH. Adherence to safe handling guidelines by health care workers who administer antineoplastic drugs. *Journal of occupational and environmental hygiene.* 2014;11(11):728-40.
4. de Oliveira Gozzo T, Costa Santos LA, Prado da Cruz LA. KNOWLEDGE OF THE NURSING TEAM ON THE PREVENTION AND MANAGEMENT OF EXTRAVASATION OF CHEMOTHERAPY DRUGS. *Journal of Nursing UFPE/Revista de Enfermagem UFPE.* 2017;11(12).
5. Kreidieh FY, Moukadem HA, El Saghir NS. Overview, prevention and management of chemotherapy extravasation. *World Journal of Clinical Oncology.* 2016;7(1):87.
6. Al-Benna S, O'Boyle C, Holley J. Extravasation injuries in adults. *ISRN dermatology.* 2013;2013.
7. Ferrari LA, Dinoi GL, Saibene G, Re B, Balzarini A, Giordano L, et al. Cytotoxic extravasation: an issue disappearing or a problem without solution? *Tumori Journal.* 2016;102(3):290-3.
8. Rubach M. Management of extravasation of antineoplastic agents. *Oncology in clinical practice.* 2018;14(1):15-22.
9. Yan Y-M, Gong M, Chen J-L, Li D, Xu T-T, Zou H, et al. Incidence, risk factors and treatment outcomes of drug extravasation in pediatric patients in China. *The Turkish Journal of Pediatrics.* 2017;59(2):162-8.
10. Aziz A, Samoon Z, Shaheen Z, Feroz A, Khurshid M, Ayoub N, et al. Audit on incidents and knowledge of nurses regarding chemotherapy extravasations at day care

oncology of a tertiary care hospital in Karachi, Pakistan. *Journal of Oncology and Cancer Research*. 2019;3(1).

11. Melo JMA, Oliveira PPd, Souza RS, Fonseca DFd, Gontijo TF, Rodrigues AB. Prevention and conduct against the Extravasation of antineoplastic chemotherapy: a scoping review. *Revista Brasileira de Enfermagem*. 2020;73(4).

12. Reynolds PM, MacLaren R, Mueller SW, Fish DN, Kiser TH. Management of extravasation injuries: a focused evaluation of noncytotoxic medications. *Pharmacotherapy: The Journal of Human Pharmacology and Drug Therapy*. 2014;34(6):617-32.

13. Pluschnig U, Haslik W, Bartsch R, Mader RM. Extravasation emergencies: state-of-the-art management and progress in clinical research. *memo-Magazine of European Medical Oncology*. 2016;9(4):226-30.

14. Kim JT, Park JY, Lee HJ, Cheon YJ. Guidelines for the management of extravasation. *Journal of educational evaluation for health professions*. 2020;17.

15. de Oliveira Gozzo T, Domingues de Almeida T, Prado da Cruz LA. NOTIFICATION OF EXTRAVASATION OF CHEMOTHERAPEUTIC AGENTS IN A UNIVERSITY HOSPITAL. *Ciencia, Cuidado e Saude*. 2018;17(2).

16. Hussin BK, Ahmed WAR. Nurses knowledge about Management Extravasation Intravenous Cytotoxic Medication At Amal National Hospital in Baghdad City. *Indian Journal of Forensic Medicine & Toxicology*. 2020;14(3):1159-64.

17. Pikó B, Laczó I, Szatmári K, Bassam AA, Szabó Z, Ócsai HH, et al. Overview of extravasation management and possibilities for risk reduction based on literature data. *Journal of Nursing Education and Practice*. 2013;3(9):93.

18. Melo JMA, Oliveira PPd, Rodrigues AB, Souza RS, Fonseca DFd, Gontijo TF, et al. Bundle construction and assessment before antineoplastic extravasation: a methodological study. *Acta Paulista de Enfermagem*. 2020;33.

19. Chan KM, Chau JPC, Choi KC, Fung GPG, Lui WW, Chan MSY, et al. Clinical practice guideline on the prevention and management of neonatal extravasation injury: a before-and-after study design. *BMC pediatrics*. 2020;20(1):1-10.
20. Sharour LA. Oncology nurses' knowledge about exploring chemotherapy related-Extravasation care: A cross-sectional study. *Clinical Epidemiology and Global Health*. 2020.
21. Souza N, Bushatsky M, Figueiredo E, Melo J, Freire D, Santos I. Oncological emergency: the work of nurses in the extravasation of antineoplastic chemotherapeutic drugs. *Esc Anna Nery*. 2017;21(1):e20170009.
22. Kapucu S, Özkaraman AÖ, Uysal N, Bagcivan G, Şeref FÇ, Elöz A. Knowledge level on administration of chemotherapy through peripheral and central venous catheter among oncology nurses. *Asia-Pacific journal of oncology nursing*. 2017;4(1):61.
23. Abd El-Salaheen MH, Ahmed BO, Mahmoud AS. Correlates to extravasation among patient receiving chemotherapy at a university hospital. *Egyptian Nursing Journal*. 2018;15(1):71.
24. Chung S-A, Choi E-H, Lee K-S, Chung K. Nurses' Knowledge and Performance for Prevention of Extravasation at Peripheral Intravenous Therapy. *Journal of the Korea Academia-Industrial cooperation Society*. 2016;17(8):183-91.
25. Ong J, Van Gerpen R. Recommendations for Management of Noncytotoxic Vesicant Extravasations. *Journal of Infusion Nursing*. 2020;43(6):319-43.
26. Chaudhary R, Karn BK. Chemotherapy-knowledge and handling practice of nurses working in a medical university of Nepal. 2012.
27. Istiqamah I, Ramadhan R, Rahmayani D, Rahman S, Al Kahfi R, editors. Granting NaCl Compress To Extravasaion Prevention In Chemotherapy Patients At Ulin Hospital Banjarmasin. 2nd Sari Mulia International Conference on Health and Sciences 2017 (SMICHS 2017)–One Health to Address the Problem of Tropical Infectious Diseases in Indonesia; 2017: Atlantis Press.

28. Sartika M, Hutahaeen S, Iriani R, editors. The Relationship Between Venous Location and Chemotherapy Extravasation Incidence in Cancer Patients. International Conference of Health Development Covid-19 and the Role of Healthcare Workers in the Industrial Era (ICHHD 2020); 2020: Atlantis Press.
29. Lee JM, Lee J, Jang YS, Kim YH. Factors Related to Extravasation of Non-chemotherapy Vesicant Drugs in Peripheral Vein Catheters. Journal of Korean Critical Care Nursing. 2018;11(2):11-20.
30. Mohamed SAM, Abou Elmaati HMB, Mohamed EMH. Eliminating Extravasation Events: Impact of Intervention Guidelines on Patients Receiving Chemotherapy.
31. DESA U. World urbanization prospects 2018. United Nations Department for Economic and Social Affairs. 2018.
32. Rohani C, Kesbakhi MS, Mohtashami J. Clinical empathy with cancer patients: a content analysis of oncology nurses' perception. Patient preference and adherence. 2018;12:1089.

10. ANNEXES

ANNEX A: INFORMATION SHEET

Hello...My name is _____. I am working as a data collector in the study conducted by collaboration of Addis Ababa University, college of health sciences, department of nursing and midwifery and by Girma Adugna (BSc. Nurse) to assess nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation in selected public hospitals oncology units Addis Ababa, Ethiopia 2021.

Objective: To assess a nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation.

Procedures to be carried out: filling self-administered questionnaire's that takes 20 minutes.

Risks associated with the study: There are no risks associated with the study.

Benefits of the study: No direct benefit as a result of participating in this study.

Confidentiality of your information: Any secret will not transfer to third parties.

The right to refuse or withdraw: Fully guaranteed.

I would also like to inform you that this study will be approved and ethically cleared by Addis Ababa University, college of health sciences, school of nursing and midwifery, department of nursing research committee.

The address is Addis Ababa University, college of health sciences, school of nursing and midwifery, department of nursing.

Advisors: Mr. Zeleke Argaw and S/r Emebet Berhane.

If you have any questions regarding this study, please feel free to contact the principal investigator. Name: Girma Adugna

Tel: 0983007940

Email: Girmolehab21@gmail.com

ANNEX B: CONSENT SHEET

CONSENT FORM

Hello. How are you, my name is Girma Adugna. I am a final year postgraduate oncology nursing student at Addis Ababa University. The assessment of nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation in selected public hospitals oncology units made for the partial fulfillment of my master's degree in oncology nursing. The aim of this study is to assess a nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation. The results of the study will be used as baseline information to design appropriate interventional strategies to provide comprehensive care for oncology patients.

The information you provide is confidential and is used only for the purpose of this study. Your cooperation and participation until the completion of the questionnaire is very necessary for the successful completion of the assessment. You will neither get harmed nor will you get benefit as a result of participating in this study except 20 minutes of wasting your time, but your response will help to identify the gap and to take appropriate solution from concerned and interested parties. Your participation in the study will be highly appreciated. I therefore ask for your genuine willingness. However, you have the right to decline if you don't volunteer to participate at any time.

If you have any question and confusion regarding the questions, you have the right to ask me at any point or you can contact me on the following address.

Email address: Girmolehab21@gmail.com and phone number +251983007940

Are you willing to participate? Yes No

Data collector: Name _____

Signature: _____ Date: _____

ANNEX C: ENGLISH VERSION QUESTIONNAIRE

ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES

SCHOOL OF NURSING DEPARTMENT OF NURSING AND MIDWIFERY

This questionnaire is designed to assess nurse's knowledge and associated factors towards prevention and management of cytotoxic extravasation at selected Public hospitals Addis Ababa, Ethiopia 2021. Please read the questionnaire and provide your honest response to each item. Thank you for your cooperation!!

Part I: -Information on socio demographic characteristics

Instruction: Circle the responses provided and write your answer on the space provided.

S.No	Socio demographic characteristics	Response
1	Age	_____
2	Sex	1. Male 2. Female
3	professional level	1. Diploma 2. BSc 3. MSc 4. Other (specify)
4	Specialization in oncology nursing	1. Yes 2. No
5	Years at work in oncology department	_____
6	Did you receive training on cytotoxic extravasation?	1. Yes 2. No

Part II. Questions related to nurses knowledge about extravasation prevention

Instruction: This questionnaire provides a real picture of what you know about prevention of cytotoxic extravasation. Please do not rely on help from any sources to complete it. Tick (x) your answer in the box.

S. No	Items	Answers		
		Correct	Incorrect	I don't know
1	Phlebitis and infiltration around the puncture site is checked first.			
2	Cannulation should be avoided over joints, inner wrist, and the lower extremities.			
3	Avoid cannulation where lymphedema is present.			
4	Butterfly' needles must not be used.			
5	Flexible cannula is recommended.			
6	Central venous access should be used for long period infusion (12–24 hrs).			
7	Check for blood flow after cannulation and flush with 10 ml of normal saline.			
8	Flushing with 10 - 20 ml of saline solution between different drug infusions is recommended.			
9	Flashback of blood should always be obtained before drugs are administered.			

10	Frequent assessment of the insertion site for swelling, pain, redness and sluggish of infusion rate is recommended.			
11	Children and elder can occasionally splint to fix.			
12	Educate patients for extravasation and encourage expressing of extravasation suspects.			
13	Check the patient's condition before infusion.			
14	Vesicant drug administration is not infused by an infusion pump but by gravity.			
15	Double check by two nurses is needed for cannulation and drug dose calculation.			

Part III. Questions related to nurses knowledge about extravasation management.

Instruction: This questionnaire provides a real picture of what you know about management of cytotoxic extravasation. Please do not rely on help from any sources to complete it. Tick (x) your answer in the box.

S. No	Items	Answers		
		Correct	Incorrect	I don't know
1	Cytotoxic extravasation is infiltration of chemotherapy into the subcutaneous or sub dermal tissues surrounding the intravenous or intra-arterial administration site.			
2	Extravasation occurs when any liquid leaks into the surrounding tissue.			
3	First step management is to stop and disconnect the infusion, but leave cannula in place.			
4	Identify extravasated agents.			
5	Try to aspirate as much extravasated solution as possible with a 10 to 20 ml syringe and record volume removed.			
6	Remove cannula and mark the area with a pen.			
7	Raise the affected extremity over the height of the heart and administer analgesia if necessary.			
8	Do not apply pressure at the affected area. Avoid bandages and alcohol compress.			
9	Pharmacologic treatment with or without hot or cold treatment can be repeated if necessary after 12 and 24 hours.			
10	For daunorubicin, doxorubicin, epirubicin, & idarubicin apply local cold for 60 min and repeat every 8 hours for three days.			
11	For vinblastine, vincristine and vinorelbine apply dry heat for 30 minute.			
12	Dimethyl sulfoxide (DMSO) 50–99% is an antidote of extravasation.			

13	Record the occurrence (date, time, drug, site, signs and symptoms, amount extravasated, type and needle gauge).			
----	---	--	--	--

Part IV: Questions on health care facilities related to prevention and management of cytotoxic extravasation.

Instruction: This questionnaire provides a real picture of what you know about factors related to health care facility in prevention and management cytotoxic extravasation. Please do not rely on help from any sources to complete it. Tick (x) your answer in the box.

S.No	Items	Answers		
		yes	No	I don't know
1	High incidence rate of extravasation occur with unfavorable environmental factors such as unavailability of extravasation kits.			
2	Informing a patient about possible harm of cytotoxic administration and recording his/her willingness for treatment is helpful in prevention of extravasation.			
3	Continuous training of nurse's decreases the incidences of extravasation.			
4	High workload and unbalanced nurse to patient's ratio are factors that expose patients for extravasation.			
5	Lack of experience and non-adherence to the guidelines of chemotherapy administrations increase the risk of extravasation.			

Part V: Questions on patient related factors regards to prevention and management of cytotoxic extravasation.

Instruction: This questionnaire provides a real picture of what you know about factors related to patient in prevention and management cytotoxic extravasation. Please do not rely on help from any sources to complete it. Tick (x) your answer in the box.

S.No	Items	Answers		
		Yes	No	I don't know
1	Patients with small and/or fragile veins are more at risk for the development of chemotherapy extravasation.			
2	The incidence rate of extravasation is higher among patients who cannot read and write.			
3	The occurrence of high incidence rate of extravasation is among patients who had breast cancer, diabetes mellitus and hypertension.			
4	Women are at higher risk of acquiring cytotoxic extravasation than men.			
5	Increased patient activity and unconsciousness is a risk for extravasation.			