FUNDAMENTAL AND MANAGEMENT NURSING JOURNAL
Vol. 8, No. 1, April 2025

Laman jurnal: https://e-journal.unair.ac.id/FMNJ
http://dx.doi.org/ 10.20473/fmnj.v8i1.70019

Original Research

Bridging the Gap: Assessing Nurses' Safe Handling and Administration of Chemotherapeutic Drugs in a Tertiary Health Facility, Benin City, Nigeria

Uzezi Josiah[1], Timothy A. Ehwarieme[2*] and Hope Uzezi[1]

[1]Department of Nursing Sciences, Delta State University Abraka, Delta State, Nigeria
[2]Department of Nursing Science, School of Basic Medical Sciences, University of Benin, Benin City Edo State, Nigeria

ARTICLE HISTORY

Received: February, 28, 2025
Revised: March, 24, 2025
Accepted: March, 27, 2025
Available online: April, 25, 2025

KEYWORDS

associated factors; benin city; chemotherapy; level of knowledge; nurses; practices

CORRESPONDING AUTHOR

Timothy A. Ehwarieme
timothy.ehwarieme@uniben.edu
Department of Nursing Science, School of Basic Medical Sciences, University of Benin, Benin City Edo State, Nigeria

ABSTRACT

Introduction: The administration of chemotherapeutic drugs requires specialized knowledge and skills to ensure optimal patient outcomes and minimize risks. While global guidelines emphasize the importance of safe chemotherapy administration, there is a lack of context-specific data on the knowledge and practices of nurses in tertiary health facilities in Benin City. This study addresses the gap by providing empirical evidence on their competencies and challenges. Hence, this study aimed to assess the knowledge and practices of safe handling and administration of chemotherapeutic drugs amongst tertiary health facilities, Benin City.

Methods: The study adopted a descriptive cross-sectional study design among 278 randomly selected nurses working in the selected hospital. A researcher developed a structured, validated questionnaire that was used as an instrument of data collection. Data collected was analyzed using descriptive statistics, while hypotheses were tested using multiple logistic regression at a 5% level of significance. Data analysis was done using the IBM Statistical Package for Social Sciences (SPSS) version 28.0 for Windows.

Results: Overall, 17% of participants had poor knowledge, and 63% had fair knowledge. More than half (51%) exhibited poor practice. Most significant factors supporting the safe handling and administration of chemotherapeutic drugs are Training and Certification (3.94), Incident Encounters (3.73), Protocol Adherence (2.93), and Utilization of PPE (2.82). Being married: (OR = 1.136 (95% C.I: 1.10–3.83, p = 0.7369), Female (OR = 4.90, 95% CI: 0.23–3.54, p = 0.479), 18–34 years (OR = 7.03, 95% CI: 0.06–8.28, p = 0.298) , Bachelor Degree (OR = 7.69, 95% CI: 0.05–7.10, p = 0.174) have higher odds of exhibiting a higher level of practice compared to other categories but not statistically significant.

Conclusions: The study found that nurses have moderate knowledge and practice levels in handling chemotherapeutic drugs but still face significant gaps. It highlights the need for targeted interventions, in-service education, and institutional policies to improve competency and ensure safe chemotherapy administration.

Cite this as:

Josiah, U., Ehwarieme, T. A & Uzezi, H. (2025). Bridging the Gap: Assessing Nurses' Safe Handling and Administration of Chemotherapeutic Drugs in a Tertiary Health Facility, Benin City, Nigeria. *Fundam Manaj. Nurs. J.* 8(1), 1-10 doi.org/10.20473/fmnj.v8i1.70019

1. INTRODUCTION

Cancer is a complex disease characterized by uncontrolled cell growth and division, with some cancers forming visible tumors while others, such as leukemia, do not (Angahar, 2017). As a major global health concern, cancer ranks as the second leading cause of death worldwide, accounting for millions of new cases and fatalities each year (Purkayastha et al., 2018). The burden of cancer continues to rise, with over 10 million new cases and approximately 6 million deaths reported annually (Alrahman H.

Abdullah & Hama Rasheed, 2018). Projections from the World Health Organization (WHO) indicate that by 2050, cancer incidence will exceed 35 million new cases per year, with developing and middle-income countries experiencing the highest increases due to urbanization, sedentary lifestyles, and demographic changes (WHO, 2024).

Among the primary treatment modalities for cancer, chemotherapy remains a cornerstone in oncology care. Chemotherapeutic drugs work by targeting rapidly dividing cells to inhibit cancer progression, administered through various routes such as intravenous infusion, oral tablets, or injections, depending on the cancer type and stage (Cohen et al., 2020). However, chemotherapy administration is associated with significant risks for both patients and healthcare providers. The complexity of handling these drugs requires specialized knowledge and skills to ensure optimal patient outcomes, minimize medication errors, and prevent occupational exposure to hazardous substances. Nurses play a crucial role in chemotherapy administration, overseeing drug preparation, dosage calculation, adverse effect monitoring, and supportive care. Despite their central role in ensuring safe handling practices, research indicates persistent knowledge gaps and deficiencies in chemotherapy administration among nurses. Kapucu et al (2017) found that oncology nurses had moderate knowledge (≥50%) about catheter care during chemotherapy, emphasizing the need for continuous, evidence-based education to improve their competency. Similarly, Saker et al (2022) identified significant knowledge gaps, particularly regarding chemotherapy's impact on wound healing and healthy cells, reinforcing the need for comprehensive training programs.

Furthermore, studies have examined the effectiveness of educational interventions in improving chemotherapy administration skills among nurses. Khan et al (2012) demonstrated that while training programs significantly enhanced nurses' technical knowledge, their attitudes toward chemotherapy handling remained unchanged, highlighting the challenge of addressing behavioral components in clinical practice. Nwagbo et al (2017) also reported high knowledge levels about occupational safety among oncology nurses but noted persistent gaps in specific areas, such as handling contaminated clothing and proper decontamination techniques. Similarly, Mamdouh Zakaria et al (2022) found that although 60% of nurses had good knowledge of chemotherapy administration, their practical application, particularly in patient verification and adherence to administration protocols, was inadequate. These findings collectively emphasize the critical need for targeted interventions to bridge the gap between theoretical knowledge and actual practice in chemotherapy administration. Unsafe chemotherapy handling not only compromises patient safety but also exposes healthcare professionals to hazardous drug-related risks. Nurses, in particular, face significant occupational hazards, including exposure to cytotoxic agents, which can lead to long-term health complications. Given the increasing demand for chemotherapy services, ensuring nurses' competency in safe drug administration is essential for protecting both patient and occupational health.

Despite extensive research on chemotherapy safety practices in various regions, there is limited evidence specific to Edo State, a key center for oncology care in Nigeria's South-South region. The lack of localized data on nurses' knowledge and adherence to safety protocols highlights a critical gap that this study seeks to address. By identifying deficiencies in chemotherapy handling practices, this research aims to provide evidence-based recommendations for improving training programs, enhancing institutional policies, and promoting standardized safety protocols. Ultimately, strengthening nurses' competencies will contribute to better patient outcomes, reduced occupational risks, and overall improvements in cancer care delivery. Therefore, this study aims to assess the knowledge and practices regarding the safe handling and administration of chemotherapeutic drugs among nurses in selected health facilities in Benin City.

Specific objectives

1) To evaluate the level of knowledge among nurses in selected health facilities regarding chemotherapeutic drugs, handling and administering them to patients.
2) To assess the level of practice among nurses in selected health facilities in the safe handling and administration of chemotherapeutic drugs.
3) To identify the perceived factors that support the practice of safe handling and administration of chemotherapeutic drugs among nurses in selected health facilities.
4) To determine the sociodemographic predictor of knowledge regarding safe handling of chemotherapeutic drugs and practices among the nurses.

2. METHODS

2.1 Research Design/Setting

This study used a descriptive cross-sectional correlational design to assess nurses' knowledge and practices in handling chemotherapeutic drugs. The descriptive aspect captures current knowledge and safety practices, while the cross-sectional approach provides a snapshot at a single point in time. The correlational component examines relationships between variables, such as demographic factors and adherence to safety protocols. This design is appropriate for identifying knowledge gaps, informing targeted interventions, and guiding institutional policies to improve chemotherapy safety. The research was conducted at the University of Benin Teaching Hospital (UBTH), a major healthcare tertiary institution with a 900-bed

capacity. It serves as a referral, diagnostic, teaching, and healthcare centre with various units, including Clinical Oncology and Radiotherapy.

2.2 Population, Sample Size and Sampling

The target population for the study are all registered nurses working in different oncology wards/units of the selected health facilities. They are 689 nurses in the facility according to records from the nursing services department; Medical Oncology Unit 174, Surgical Oncology Unit 182, Obstetrics and Gynecology oncology unit 175, Pediatric oncology unit 136, Outpatient oncology clinic 112

Inclusion criteria: Nurses working in the in the different oncology unit of the Tertiary health care facilities Irrespective of the duration they have spent there.

Sample size: Sample is a proportion of a population. Applying Taro Yamane formula (1967)

N = sample size

N = population size

E = level of precision (e = 0.05)

$N = N/ (1+N (e)^{2})$

$N = 689/ (1+689(0.05)^{2})$

N = 253 nurses

Applying a 10% attrition (25 nurses) we have 253+ 25 =278

Sampling: To select 278 nurses from a target population of 689 across different wards and units, a simple random sampling technique was employed. A comprehensive sampling frame was created by compiling a list of all 689 nurses, which included unique identifiers and ward/unit details. Each nurse was assigned a unique number between 1 and 689. The required sample size of 278 nurses was determined, and a random number generator was used to generate 278 unique random numbers within the range of 1 to 689. These numbers corresponded to the nurses selected for the study. To ensure proportional representation, the number of nurses selected from each ward/unit was calculated based on their proportion within the total population. Then random numbers were generated within each ward/unit to select the required number of participants. The sample was reviewed to ensure that the correct number of nurses had been selected from each ward/unit. Any discrepancies were addressed by making additional random selections. This process ensured a representative and unbiased sample for the study.

2.3 Instrument for Data Collection

The study utilized a structured, close-ended questionnaire for data collection, divided into four sections to address the research objectives. Section A: included 6 items on respondents' demographic information. Section B: had 10 items measuring the Knowledge of chemotherapeutic drugs, handling and administration, while Section C: contained 10 items assessing Practice of safe handling and administration of chemotherapeutic drugs. Sections D had 10 items exploring factors Perceived factors that support the practice of safe handling and administration of chemotherapeutic drugs Responses in Sections were measured using a 4-point Likert scale.

Validity/Reliability of the instrument: To ensure the validity of the questionnaire Content and face Validity was used. The questionnaire was subjected to a panel of experts in Oncology medicine and Nursing research to evaluate whether the questions comprehensively cover the study's objectives and that each question aligns with the specific variables being measured. A split half reliability test was conducted with 27 nurses (10% of the sample) in another hospital, using the research instrument Internal consistency was assessed using Cronbach's alpha to compute the reliability coefficient. The reliability scores obtained for sections B, C, and D were 0.80, 0.83, and 0.79, respectively, indicating satisfactory consistency.

2.4 Procedure of Data Collection

Data for this study were collected by distributing structured questionnaires to nurses in the selected hospitals. Nurses recruited for the study were informed about the study's objectives and procedures, and the researcher worked with them to determine the most suitable times for administering the questionnaires. The questionnaires were given to nurses who agreed to participate, and they were allowed to complete them at their convenience. The researcher either waited for the completed questionnaires or arranged to collect them after a few hours. To maintain data integrity, the completed questionnaires underwent a thorough review (data cleansing) to filter out invalid responses. The valid responses were then compiled and organized for further analysis.

2.5 Method of Data Analysis

Descriptive statistics, including frequencies and percentages, were calculated for the key study variables. To assess significant relationships between the independent and dependent variables, inferential statistics, such as logistic regression, were used, with a significance level set at $p < 0.05$ for all analyses. Data from the questionnaires were analyzed using IBM SPSS version 28.0.

2.6 Ethical Consideration

Ethical approval with protocol number *ADM/E22/A/VOL.VII14838152167* was obtained from the Research ethics committee of the University of Benin and due consent and permission were taken from the participants. Other ethical principles such as confidentiality, voluntary withdrawal were strictly adhere to.

3. RESULTS

Table 1 shows the sociodemographic characteristics of the respondents. The respondents were predominantly aged 65 and older (36.34%), followed by those aged 35-49 years (22.66%). Females

(58.24%) slightly outnumbered males (41.73%). Most participants were married (45.68%), with singles (24.46%) and widowed individuals (16.55%) following. Educational levels were diverse, with many completing other training (29.14%) or holding a BNSc/Bachelor's degree (28.78%). Ethnic groups were mainly Igbo (24.46%), Yoruba (21.94%), Hausa (17.63%), Benin (13.31%), and others (22.66%). Most respondents lived in urban (46.04%) or suburban (31.29%) areas, with fewer from rural areas (22.66%).

Table 2 demonstrates the knowledge regarding chemotherapeutic drugs. The results show that most participants have a good understanding of chemotherapeutic drugs. A large majority correctly identified the primary goal of chemotherapy as "To eliminate cancer cells" (76.6%) and the most common route of administration as "Intravenous" (74.1%). Regarding safety precautions, 61.5% recognized the need for healthcare professionals to wear gloves and a lab coat. High levels of correct responses were also seen for terms like "extravasation" (86.7%) and the purpose of a central venous catheter (70.1% to 87.8%). In terms of overall knowledge, 17% of participants had poor knowledge, 63% had fair knowledge, and 20% had good knowledge.

Table 1. Sociodemographic characteristics of respondents

	Frequency	Percentage
Age		
Under 18 years	12	4.32%
18-34 years	45	16.19%
35-49 years	63	22.66%
50-64 years	57	20.50%
65 and older	101	36.34%
Gender		
Male	116	41.73%
Female	162	58.24%
Marital Status		
Single	68	24.46%
Married	127	45.68%
Divorced	37	13.31%
Widowed	46	16.55%
Level of education		
RN	14	5.04%
RN/RM	62	22.30%
Other trainings	81	29.14%
BNSc/Bachelor	80	28.78%
Postgraduate Degree	41	14.75%
Ethnicity		
Benin	37	13.31%
Hausa	49	17.63%
Igbo	68	24.46%
Yoruba	61	21.94%
Others	63	22.66%
Residential Area		
Urban	128	46.04%
Suburban	87	31.29%
Rural	63	22.66%

Table 3 shows the Practice of safe handling and administration of chemotherapeutic drugs. The results on the practice of safe handling and administration of chemotherapeutic drugs show that 31.7% of participants administer chemotherapy drugs always, while 16.2% do so rarely. A majority (68.4%) reported having formal training in safe handling. Regarding Personal Protective Equipment (PPE), 40.3% always use it, and 34.2% use it often. 43.2% of respondents expressed confidence in their knowledge of chemotherapy side effects, while 43.2% always adhered to protocols for verifying patient identity and treatment plans. However, 37.8% were often knowledgeable about spillage cleanup procedures. Regular updates on chemotherapy safety were reported by 35.2% of participants, and 28.1% had encountered drug extravasation incidents. 46.8% indicated having regularly updated safety guidelines, and 36% often educate patients and families about chemotherapy precautions. Regarding the overall practice level, 51% exhibited low practice, 45% had moderate practice, and 4% had high practice.

Figure 1 shows the perceived factors that support the practice of safe handling and administration of chemotherapeutic drugs. The findings show that factors like "Training and Certification" (3.94), "Incident Encounters" (3.73), "Frequency of Administration" (2.50), and "Protocol Adherence" (2.93) are considered highly important for the safe handling and administration of chemotherapeutic drugs, as indicated by their high mean scores. In contrast, "Response to Spills or Leakage" (1.93) and "Guidelines and Protocols" (2.45) are viewed as less significant. Factors such as "Utilization of PPE" (2.82), "Knowledge of Side Effects" (2.73), "Continual Education" (2.57), and "Patient Education" (2.53) fall into the moderate range, reflecting a moderate level of agreement or importance.

Table 4 shows the association between sociodemographic characteristics and level of practice of safe handling of chemotherapeutic drugs. It reflects that there is no significant association between gender, distance and duration of chemotherapy, while others showed statistical significant association ($p<0.05$) with level of practice. We therefore reject the null hypothesis.

Logistic regression associating sociodemographic characteristics with level of practice Married: OR = 1.136 (95% C.I: 1.10–3.83, p = 0.7369): Married nurses have slightly higher odds (13.6% more likely) of exhibiting a higher level of practice compared to divorced, single and widower nurses, but this result is not statistically significant. Widowed: OR = 0.368 (95% C.I: 0.12–9.14, p = 0.0291): Widowed nurses are 63.2% less likely to exhibit higher practice levels compared to divorced nurses, and this relationship is statistically significant. **Residential Area** OR = 0.524 (95% C.I: 9.01–10.15, p = 0.055) **and** OR = 0.597 (95% C.I: 2.35–5.11, p = 0.0998) Nurses residing in suburban and urban areas have 47.6% 40.3% lower odds of a

Table 2. Knowledge of chemotherapeutic drugs

	Correct	Wrong
What is the primary goal of administering chemotherapeutic drugs?	213(76.6)	65(23.4)
Which route of administration is commonly used for chemotherapy drugs?	206(74.1)	72(25.9)
Before administering chemotherapy, what should healthcare professionals wear to protect themselves?	171(61.5)	107(38.5)
Which term describes the use of chemotherapy to shrink a tumor before surgery or radiation therapy?	228(82.0)	50(18.0)
What is the main purpose of a central venous catheter during chemotherapy?	195(70.1)	83(29.9)
Which of the following statements about chemotherapy side effects is correct?	255(91.7)	23(8.3)
What is the purpose of antiemetic drugs in chemotherapy?	220(79.1)	58(20.9)
When should patients be educated about potential chemotherapy side effects?	231(83.1)	47(16.9)
What does the term “extravasation” refer to in chemotherapy?	241(86.7)	37(13.3)
Which precaution should healthcare professionals take when handling chemotherapy drugs?	244(87.8)	34(12.2)

Level of knowledge

Classification	Criteria	Frequency	Percentage
Poor	0-40%	47	17%
Fair	41-69%	175	63%
Good	70-100%	56	20%
Total		278	100%

Table 3. Practice of safe handling and administration of chemotherapeutic drugs

Questions	Rarely (1)	Sometimes(2)	Often (4)	Always (5)
Frequency of Chemotherapeutic Drug Administration	45 (16.2%)	0 (0.0%)	0 (0.0%)	88 (31.7%)
Formal Training in Safe Handling of Chemotherapeutic Drugs	0 (0.0%)	0 (0.0%)	0 (0.0%)	190 (68.4%)
Consistent Use of Personal Protective Equipment (PPE)	16 (5.8%)	55 (19.8%)	95 (34.2%)	112 (40.3%)
Confidence in Knowledge of Chemotherapy Side Effects	0 (0.0%)	0 (0.0%)	0 (0.0%)	120 (43.2%)
Adherence to Patient Verification Protocol for Chemotherapy Administration	18 (6.5%)	45 (16.2%)	95 (34.2%)	120 (43.2%)
Knowledge of Correct Steps for Cleanup in Case of Spillage	0 (0.0%)	0 (0.0%)	105 (37.8%)	112 (40.3%)
Frequency of Updating Knowledge on Chemotherapy Safety	60 (21.6%)	0 (0.0%)	90(32.4%)	98 (35.2%)
Encountering Incidents of Drug Extravasation During Administration	0 (0.0%)	78 (28.1%)	0 (0.0%)	50 (18.0%)
Presence of Written Guidelines for Chemotherapy Safety	0 (0.0%)	60 (21.6%)	0 (0.0%)	130 (46.8%)
Confidence in Educating Patients and Families on Chemotherapy	0 (0.0%)	0 (0.0%)	100 (36.0%)	75 (27.0%)

Level of safe handling of chemotherapeutic drugs

Classification	Criteria	Frequency	Percentage
Poor	0-40%	142	51%
Fair	41-69%	125	45%
Good	70-100%	11	14%
Total		278	100%

higher level of practice respectively compared to rural residents.

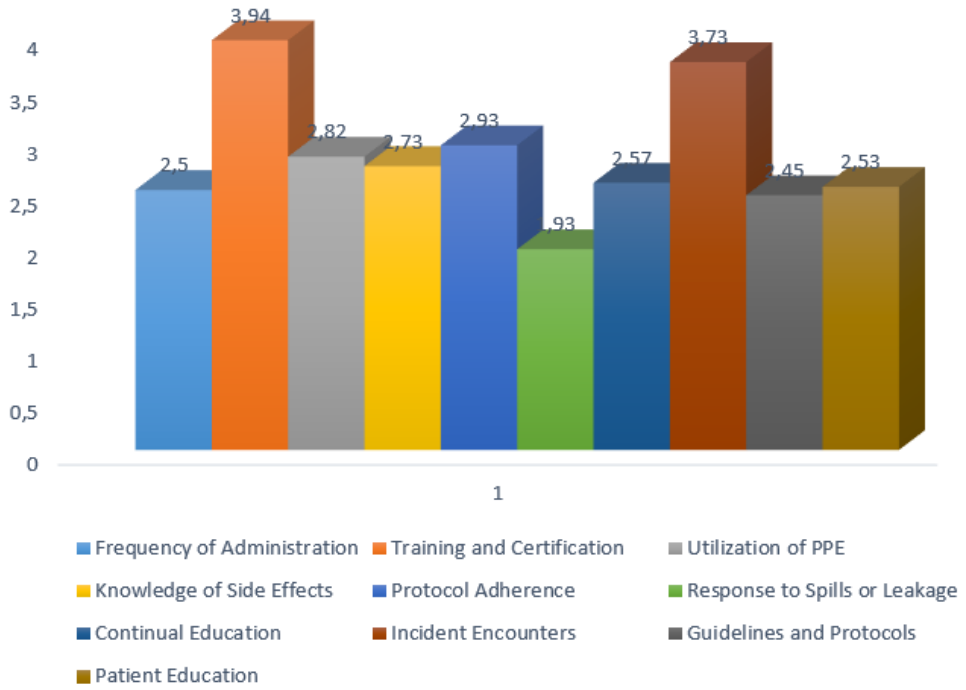

Figure 1. Perceived factors that support the practice of safe handling and administration of chemotherapeutic drugs

Table 4. Association between sociodemographic characteristics and level of practice of safe handling of chemotherapeutic drugs

Category	Low	High	χ^2	P
Age				
Under 18 years	6 (50.0%)	6 (50.0%)	72.304	0.000
18-34 years	18 (40.0%)	27 (60.0%)		
35-49 years	23 (36.5%)	40 (63.5%)		
50-64 years	20 (35.1%)	37 (64.9%)		
65 and older	75 (74.3%)	26 (25.7%)		
Gender				
Male	60 (51.7%)	56 (48.3%)	2.6643	0.1026
Female	82 (50.6%)	80 (49.4%)		
Marital Status				
Single	30 (44.1%)	38 (55.9%)	76.621	0.000
Married	76 (59.8%)	51 (40.2%)		
Divorced	21 (56.8%)	16 (43.2%)		
Widowed	15 (32.6%)	31 (67.4%)		
Educational Level				
RN	8 (57.1%)	6 (42.9%)	58.007	0.000
RN/RM	28 (45.2%)	34 (54.8%)		
Other trainings	38 (46.9%)	43 (53.1%)		
BNSc/Bachelor	38 (47.5%)	42 (52.5%)		
Postgraduate Degree	30 (73.2%)	11 (26.8%)		
Ethnicity				
Benin	22 (59.5%)	15 (40.5%)	11.281	0.024
Hausa	25 (51.0%)	24 (49.0%)		
Igbo	34 (50.0%)	34 (50.0%)		
Yoruba	29 (47.5%)	32 (52.5%)		
Others	32 (50.8%)	31 (49.2%)		
Residential Area				
Urban	63 (49.2%)	65 (50.8%)	23.317	0.000
Suburban	40 (46.0%)	47 (54.0%)		
Rural	39 (61.9%)	24 (38.1%)		

Table 5. Logistic regression associating sociodemographic characteristics with level of practice

Predictor Variable	p-value	Odds Ratio	95% C.I for O.R	
			Lower	Upper
Marital Status				
Divorced		1.000	2.54-203.3	0.100
Married	0.7369	1.136	1.10-3.83	1.594
Single	0.2173	0.601	2.05-9.10	1.771
Widowed	0.0291*	0.368	0.12-9.14	1.974
Ethnicity				
Benin		1.000	8.44-103.16	0.100
Hausa	0.437	0.710	9.20-8.83	0.294
Igbo	0.354	0.681	0.05-2.10	0.872
Others	0.402	0.703	1.12-6.14	0.174
Yoruba	0.254	0.617	9.32-10.14	0.374
Residential Area				
Rural		1.000	1.13-3.11	0.973
Suburban	0.0550.	0.524	9.01-10.15	0.271
Urban	0.0998.	0.597	2.35-5.11	0.672
Sex				
Male	0.211	0.21	0.56-14.06	0.208
Female	0.479	4.90	0.23-3.54	0.879
Age				
Under 18 years	0.971	1.04	0.12-9.14	0.371
18-34 years	0.298	7.03	0.06-8.28	0.798
35-49 years	0.174	1.06	0.25-43.26	0.974
50-64 years	0.408	0.96	0.04-0.66	0.011
Educational Qualification				
RN	0.000	1.64	8.54-203.16	0.000
RN/RM	0.894	0.60	3.10-5.83	0.494
Other trainings	0.174	7.69	0.05-7.10	0.579
BNSc/Bachelor	0.977	1.04	2.12-4.14	0.974
Postgraduate Degree	0.987	1.06	2.10-4.30	0.984

Female (OR = 4.90, 95% CI: 0.23–3.54, p = 0.479) have higher odds (5 times) of exhibiting a higher level of practice than male, this result is also not statistically significant. **Age** 18–34 years (OR = 7.03, 95% CI: 0.06–8.28, p = 0.298) are more likely to have higher odds exhibiting a higher level of practice, but the result is not significant. Bachelor Degree (OR = 7.69, 95% CI: 0.05–7.10, p = 0.174): Higher odds of exhibiting a higher level of practice compared to other categories but not statistically significant.

4. DISCUSSION

The findings of this study revealed that the majority of respondents had a fair level of knowledge regarding chemotherapeutic drugs, while 17% demonstrated poor knowledge, and 20% exhibited good knowledge. These results suggest that while nurses possess foundational knowledge, significant gaps remain in advanced understanding and application. This trend aligns with Kapucu et al (2017) who found moderate knowledge levels among oncology nurses but emphasized the need for evidence-based education to enhance competency. However, the persistence of these gaps across studies suggests that the issue is not solely a matter of individual knowledge deficiencies but also reflects systemic challenges, such as limited access to training programs and institutional support for continuous education. The observed deficiencies in knowledge, with 17% of respondents exhibiting poor understanding, reinforce findings from Saker et al (2022) and Sarita et al (2019), both of whom reported substantial gaps in chemotherapy-related knowledge among nurses.

However, the variation in knowledge levels across different settings may be attributed to differences in educational curricula, resource availability, and the extent to which healthcare institutions prioritize oncology-specific training. Unlike settings where nurses receive structured chemotherapy education as part of their professional development, many institutions rely on in-service training, which may be inconsistent or insufficient. This highlights the need for standardized training programs that ensure all nurses handling chemotherapy drugs receive comprehensive and ongoing education. The finding that only 20% of respondents exhibited good knowledge underscores the potential benefits of structured education programs, as demonstrated in Khan et al (2012). Their study showed that targeted educational interventions significantly improved oncology nurses' chemotherapy-related knowledge and skills. However, their findings also revealed that knowledge

gains did not always translate into improved attitudes toward chemotherapy handling, suggesting that behavioral and institutional factors play a role in shaping nursing practices. This underscores the importance of a holistic approach that combines knowledge enhancement with strategies to foster adherence to safety protocols through policy enforcement and workplace culture shifts.

In terms of safety practices, more than half of the respondents recognized the importance of wearing gloves and lab coats when handling chemotherapy drugs. This finding is in line with Nwagbo et al (2017) and Mamdouh Zakaria et al (2022), both of whom reported that nurses had basic awareness of safety precautions but struggled with full compliance. While awareness of safety measures is a necessary first step, adherence remains a challenge due to factors such as workload pressures, inadequate supervision, and lack of institutional reinforcement. The reliance on practical experience over formal training, observed in this study and echoed by Yu et al (2013) further exacerbates this issue. Without structured educational interventions, nurses may develop unsafe habits or incomplete knowledge that can compromise patient and occupational safety. The study's findings highlight a critical gap between knowledge and practice. Despite moderate knowledge levels, only 4% of nurses demonstrated a good level of practice in the safe handling and administration of chemotherapeutic drugs. This low adherence rate raises concerns about the effectiveness of existing training programs and institutional support mechanisms. The finding that 51% of nurses exhibited poor practice is consistent with Sarita et al (2019), who reported similarly low adherence rates. However, these results also suggest that factors beyond individual knowledge—such as institutional policies, workload management, and availability of protective equipment—play a significant role in shaping practice behaviors. For instance, inadequate staffing and high patient loads may force nurses to prioritize efficiency over safety, leading to inconsistent adherence to chemotherapy protocols.

The study by Mamdouh Zakaria et al (2022) further supports this interpretation. While 60% of nurses in their study demonstrated good knowledge, their actual practices were unsatisfactory, particularly in patient verification and chemotherapy administration protocols. This suggests that knowledge alone is insufficient to drive behavior change. Institutional policies that enforce compliance, regular monitoring, and accountability mechanisms are necessary to bridge the knowledge-practice gap. Similarly, Nwagbo et al (2017) found that while nurses at the University College Hospital, Ibadan, had high awareness of chemotherapy safety measures, their adherence to occupational safety protocols was inconsistent. Factors such as limited access to personal protective equipment (PPE), inadequate training reinforcement, and weak enforcement of safety policies contributed to this discrepancy. A key institutional barrier to proper practice is the inconsistent enforcement of safety protocols. Callahan et al (2016) identified barriers such as limited PPE accessibility, time constraints, and perceived inconvenience as major deterrents to compliance. These factors are likely at play in the present study, where only 40.3% of respondents consistently used PPE. This suggests that improving adherence requires not only educational interventions but also systemic changes to ensure that nurses have the necessary resources and institutional support to follow safety guidelines consistently.

The study also identified factors that influence safe chemotherapy handling practices, including frequency of administration, training and certification, PPE use, incident encounters, knowledge of side effects, and protocol adherence. The role of training and certification in promoting safe practices aligns with Abu-Alhaija et al (2023) who emphasized that familiarity with chemotherapy handling guidelines reduces occupational exposure risks. However, beyond individual training, institutional commitment to structured certification programs is necessary to ensure long-term competency. Similarly, Abu Sharour et al (2021) highlighted self-efficacy as a predictor of adherence to safe handling precautions. Nurses who receive regular competency assessments and hands-on training are more likely to develop confidence in their ability to follow safety protocols, reinforcing the importance of continuous professional development initiatives. Adherence to standardized safety protocols was another key factor identified in this study. Abu-Alhaija et al (2023) noted that managerial support and workplace policies significantly influence compliance with chemotherapy safety measures. Healthcare institutions that prioritize safety by providing clear guidelines, sufficient resources, and continuous monitoring create an environment that fosters adherence. This aligns with findings from Abu Sharour et al (2021), who reported that a strong workplace safety culture enhances nurses' compliance with handling protocols. Therefore, addressing gaps in practice requires not only education but also institutional policies that reinforce and monitor adherence to safety standards.

The logistic regression analysis in this study revealed associations between sociodemographic factors and adherence to safe chemotherapy handling practices. Married nurses were slightly more likely to demonstrate better practices compared to their single, divorced, or widowed counterparts, though this finding was not statistically significant. However, widowed nurses had significantly lower odds of exhibiting high adherence to safety protocols. This aligns with Sarita et al (2019), who suggested that personal stressors and lack of family support may negatively impact professional performance. Similarly, nurses in suburban and urban areas exhibited lower adherence levels compared to their rural counterparts, which may be linked to the higher

workload demands and increased stress commonly observed in urban healthcare settings (Abu Sharour et al., 2021; Callahan et al., 2016). These findings underscore the need for targeted interventions that address both individual knowledge gaps and institutional barriers to safe practice. Implementing structured educational programs, enforcing safety policies, and fostering a supportive work environment are critical to improving chemotherapy administration practices. Without these measures, the disconnect between knowledge and practice will persist, posing risks to both patient safety and healthcare worker well-being.

5. CONCLUSION

The conclusion of the study is that while nurses in the selected healthcare setting have moderate knowledge and practice levels regarding the safe handling and administration of chemotherapeutic drugs, significant gaps remain in both areas. Despite the presence of training programs, consistent adherence to safety protocols, use of Personal Protective Equipment (PPE), and knowledge of chemotherapy side effects require further improvement. The study underscores the need for targeted interventions, in-service education programs, focusing on comprehensive chemotherapy safety, including safe drug handling, PPE use, spill management, adherence to protocols, and risk mitigation. The implementation of practical workshops, standardized guidelines, and certification programs has the potential to significantly enhance professional competencies, improve patient safety, and strengthen occupational health protections. These findings underscore the critical need to address existing barriers to safe-handling practices, particularly in oncology settings, in order to optimize safety outcomes and elevate the overall quality of cancer care. Given the complexity and high-risk nature of oncology treatments, there is a clear imperative for continued research. Future studies should focus on evaluating the impact of safety interventions on the quality of care delivered to cancer patients, with particular attention to measurable outcomes, staff adherence, and patient experiences.

6. REFERENCES

Abu-Alhaija, D., Bakas, T., Shaughnessy, E., & Miller, E. (2023). The Factors That Influence Chemotherapy Exposure Among Nurses: An Integrative Review. *Workplace Health & Safety*, *71*(5), 212–227. https://doi.org/10.1177/21650799221140583

Abu Sharour, L., Subih, M., Bani Salameh, A., & Malak, M. (2021). Predictors of Chemotherapy Safe-Handling Precautions and Knowledge Among a Sample of Jordanian Oncology Nurses: A Model-Building Approach. *Workplace Health & Safety*, *69*(3), 115–123. https://doi.org/10.1177/2165079920959991

Alrahman H. Abdullah, D., & Hama Rasheed, O. (2018). Nursing Staff Knowledge regarding Safe Chemotherapy Administration at Oncology Center in Kirkuk City. *Kirkuk University Journal-Scientific Studies*, *13*(1), 144–155. https://doi.org/10.32894/kujss.2018.142401

Angahar, L. T. (2017). An Overview of Breast Cancer Epidemiology, Risk Factors, Pathophysiology, and Cancer Risks Reduction. *MOJ Biology and Medicine*, *1*(4). https://doi.org/10.15406/mojbm.2017.01.00019

Callahan, A., Ames, N., Manning, M. Lou, Touchton-Leonard, K., Yang, L., & Wallen, G. (2016). Factors Influencing Nurses' Use of Hazardous Drug Safe-Handling Precautions. *Oncology Nursing Forum*, *43*(3), 342–349. https://doi.org/10.1188/16.ONF.43-03AP

Cohen, A. C., Roane, B. M., & Leath, C. A. (2020). Novel Therapeutics for Recurrent Cervical Cancer: Moving Towards Personalized Therapy. *Drugs*, *80*(3), 217–227. https://doi.org/10.1007/s40265-019-01249-z

Kapucu, S., Özkaraman, A. O., Uysal, N., Bagcivan, G., Şeref, F. C., & Elöz, A. (2017). Knowledge level on administration of chemotherapy through peripheral and central venous catheter among oncology nurses. *Asia-Pacific Journal of Oncology Nursing*, *4*(1), 61–68. https://doi.org/10.4103/2347-5625.199081

Khan, N., Khowaja, K. Z. A., & Ali, T. S. (2012). Assessment of knowledge, skill and attitude of oncology nurses in chemotherapy administration in tertiary hospital Pakistan. *Open Journal of Nursing*, *02*(02), 97–103. https://doi.org/10.4236/ojn.2012.22015

Mamdouh Zakaria, M., Mohamed Alaa, S., & Mohamed Desoky, G. (2022). Oncology Nurses' Knowledge and Practices regarding Safe Administration of Intravenous Chemotherapy. *Egyptian Journal of Health Care*, *13*(1), 1218–1231. https://doi.org/10.21608/ejhc.2022.225111

Nwagbo, S., Ilesanmi, R., Ohaeri, B., & Oluwatosin, A. (2017). Knowledge of chemotherapy and occupational safety measures among nurses in oncology units. *Journal of Clinical Sciences*, *14*(3), 131. https://doi.org/10.4103/jcls.jcls_88_16

Purkayastha, A., Sarin, A., Bhatnagar, S., & Sharma, N. (2018). *Dealing With Psychosocial Care Including Psychological and Emotional Issues in Cancer Patients and Cancer Survivors*.

Saker, N. S., Maziad Zrek, A., Naheem Taha, S., & Prof, A. (2022). Nurses' Knowledge About The Safe Administration of Chemotherapy in The Oncology Center at Tishreen University

Hospital in Lattakia. *BNIHS (Bulletin of National Institute of Health Sciences)*, *140*(02), 1343–4292.

Sarita, D., Preksha, S., Shaminder, K., & P.S., B. R. (2019). Knowledge and Attitude Regarding Safe Handling of Chemo Among Nurses: a Cross Sectional Survey. *International Journal of Current Research*, *11*(8), 6380–6386.

WHO. (2024). *Global cancer burden growing, amidst mounting need for services*. World Health Organization. https://www.who.int/news/item/01-02 2024-global-cancer-burden-growing--amidst-mounting-need-for-services

Yu, H.-Y., Yu, S., Chen, I.-J., Wang, K.-W. K., & Tang, F.-I. (2013). Evaluating Nurses' Knowledge of Chemotherapy. *The Journal of Continuing Education in Nursing*, *44*(12), 553–563. https://doi.org/10.3928/00220124-20131015-03