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Original Research Article

Assessment of Institutional Support on Healthcare Workers in Safe Handling of Cytotoxic Agents and Related Waste at Kenyatta National Hospital

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ABSTRACT

Background: Healthcare workers are exposed to cytotoxic agents and waste in their day to day practice as they handle them. These agents are known to be carcinogenic, mutagenic and teratogenic. Institutions need to protect their workers from exposure to cytotoxic agents.
Objective: To assess the institutional support of healthcare workers in safe handling of cytotoxic agents and related waste at Kenyatta National Hospital.
Methodology: This was a descriptive cross-sectional using quantitative method. A questionnaire and an observation check list were used to collect data. The sample size was 162 respondents. Stratified simple random sampling was used to select the study participants. Data analysis was done using SPSS.
Results: Majority (77.3%) of the respondents were females. The mean age of the respondents was 35.9±9.98 years. Only 12% of the healthcare workers had a specialized oncology training. Fifty four percent of the respondents had no training on handling of the cytotoxic drugs and wastes. Majority, 52% of the respondents were not aware of existence of any policy document. There was reported stock outs of PPEs especially the shoe covers eye and face shields and hair covering. There was lack of spill kits as reported by 82% of the respondents.
Conclusion: There was lack of necessary support to healthcare workers in handling cytotoxics as shown by shortage and lack of appropriate personal protective equipment, lack of knowledge on the available policy at the operational level and most healthcare workers lacking specialized training in oncology.

Key Words: Cytotoxics, safe handling, Chemotherapy spills, institutional support

INTRODUCTION

Cancer is estimated to account for 9.6 million deaths in 2018 making it the second leading cause of death globally. [1] It is estimated that by the year 2020, the number of healthcare workers exposed to hazardous effects of antineoplastic agents will be more that 5.5 million. [2]

Occupational cytotoxic exposure occurs to healthcare workers through various methods namely: inhalation of the aerosolized drugs, skin absorption in case of spills and needle injuries during preparation and administration, handling of waste from the drugs and patients during their transport, disposal and cleaning of spills. [3,4]

Chemotherapy safety protocols and standard operating procedures are important in managing, administration and patient care before, during and after treatment though most of the workers do not follow the them. [4] Institutions dealing with cytotoxic agents

and materials must seek to support and protects its workers handling the cytotoxic drugs. It is recommended that institutions should: train its workers on handling cytotoxics, provide PPEs, avail the guidelines for dealing with the cytotoxic drugs and waste and do continuous health surveillance monitoring of healthcare workers to ensure that they comply with the policy and the various legislations. [5]

Personal protective equipment provides protection to workers against exposure to aerosols and residues that are cytotoxic and hazardous in nature. Correct and consistent use of the PPEs when handling the cytotoxic drugs and waste reduces exposure and the risk of getting cancer due to the exposure. [6] It is the employers' responsibility to provide the necessary PPEs and the training on how to use the equipment. [7]

Employees who handle cytotoxic drugs and related waste must be provided with appropriate and adequate information and instruction that is appropriate to their day to day work. These training help create awareness on the various ways of exposure and the precautions to protect themselves, other staff and patients handling cytotoxic wastes and drugs. [3,7]

Institutions should develop and avail policies and guidelines for handling chemotherapy safely; advance training in hazard communication; have a biological safety cabinet for drug preparation; provide suitable personal protective equipment for those handling chemotherapy drugs and monitor all employees who are potentially-exposed in a medical surveillance program. [8,9]

A study carried out in Iran on management of cytotoxic drugs and wastes showed that in developing countries there is persistent rise in the new cases of cancer and the usage of antineoplastic drugs. Despite availability of the various guidelines on how to manage the cytotoxic waste, studies reveal that there is low compliance on the same and it cuts across the government and private facilities. [10]

Patients may release some of the cytotoxic and radioactive materials through their feces and urine. This increases the risk of other patients with whom they share the toilets with and the staff who handle their linen. [10-12] The three studies recommend that the linen filled with urine, feces or vomitus of the patients on chemotherapy should be labelled separated transported and cleaned separately without mixing with other linen

MATERIALS AND METHODS

This was a hospital based descriptive cross-sectional study which utilized quantitative methods to assess institutional support on healthcare workers in safe handling of cytotoxic agents. The study was carried out in oncology wards in Kenyatta National Hospital. Healthcare workers were stratified into cadres i.e. doctors, nurses, cleaners and pharmaceutical staff the simple random sampling method was used to number of participants per cadre. A sample size of 162 healthcare workers in oncology wards were selected to participate in the study. Data was collected using a self-administered questionnaire and an observation checklist. Trained research assistants were engaged in data collection. Respondents who met the inclusion criteria were given questionnaires to answer during their free time.

Statistical Analysis

Data entry and cleaning was done for data quality and to detect any errors of omissions. Data was analyzed using Statistical Package of Social Sciences (SPSS) version 23.0 at 95% confidence interval and a P-value of 0.05 or less was considered significant. Descriptive statistics derived from SPSS e.g. mean and median were used for data presentation. Descriptive statistics were presented using figures and tables. A Chi-Square test was performed to test the relationship between study variables.

RESULTS

Socio-Demographic Characteristics

Over two thirds (77.3%) of the respondents were females (Table 1). The mean age of the respondents was 35.9 years (SD=±9.98) and the median class was 26-35 years. The respondents with Bachelor's degree (38.7%) were slightly above those with diploma (34.7%). Majority (72%) of the respondents were nurses. All the consultant doctors had master's degree, 95.1% of the registrars had a bachelor's degree, and 78.6% of cleaners had secondary education while 44.4% of the nurses had a diploma. Further analysis showed that HCW who had specialized in oncology or had high education level were more likely to practice safe handling of the cytotoxic drugs and waste (P=0.027, P=0.000 respectively).

All of the consultant doctors had more than five years of professional experience, majority (57.1%) of the registrars had 3-5 years, majority (75.9%) of the nurses had >5 years of professional experience, 50% of the pharmacist had <1 year of professional experience while all the pharmaceutical technologist had >3 years of professional experience. Hundred percent of the consultants and pharmacists had >5 years and <1 years of oncology experience respectively. All the consultants, 50% of pharmacists and pharmaceutical technologists, 11.1% of nurses and 4.8% registrars had a specialized oncology training. The specialized courses were: 35% had a fellowship in oncology, 30% had a higher diploma in oncology and 10% had a masters in an oncology and 25% had other forms of training such short courses on safe handling of cytotoxic drugs and waste.

Table 1: Socio-demographic characteristics of the respondents

Variable	Category	Frequency (N=150)	Percentage (%)
Sex	Female	116	77.3
	Male	34	22.7
Age	<25 years	10	6.7
	26-35 Years	71	47.3
	36-45 Years	40	26.7
	46-55 Years	28	18.7
	>56 Years	1	.7
Cadre	Consultant Doctor	3	2.0
	Registrars	21	14.0
	Nurse	108	72.0
	Pharmacist	2	1.3
	Pharmaceutical Technologist	2	1.3
	Cleaner	14	9.3
Academic qualification	Master's Degree	8	5.3
	Bachelor's Degree	58	38.7
	Higher Diploma	20	13.3
	Diploma	52	34.7
	Secondary	11	7.3
	Primary	1	.7
Professional experience	<1 Year	4	2.7
	1-3 Years	14	9.3
	3-5 Years	33	22.0
	>5 Years	99	66.0
Oncology experience	<1 Year	42	28.0
	1-3 Years	49	32.7
	3-5 Years	24	16.0
	>5 Years	35	23.3
Specialized Oncology training	Yes	20	13.3
	No	130	86.7

Training Opportunities on Safe Handling of Cytotoxic Drugs and Wastes

Majority (54%) of the respondents had no any form of training on handling of the cytotoxic drugs and the related wastes (Figure 1). Of the respondents, 71.4% of registrars and 55.6% of nurses who had no training on handling cytotoxic drugs and waste.

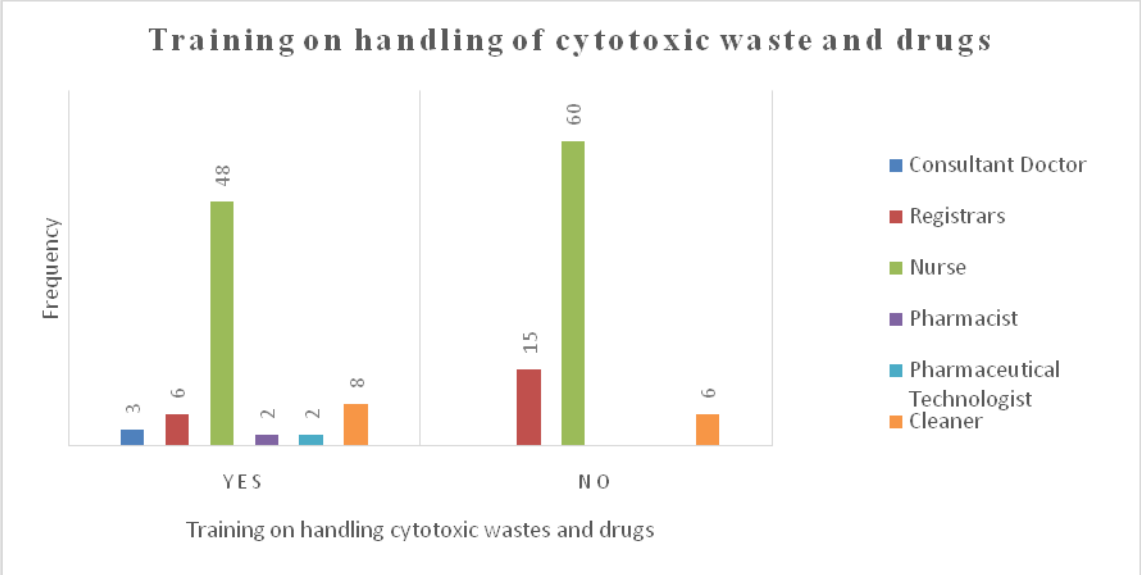

Figure 1: Training on handling of the cytotoxics drugs and related wastes per cadre

All the pharmacists, pharmaceutical technologists and cleaners as well as 81.3% of the nurses trained on handling of cytotoxic drugs and waste received training in hospital organized workshops while 50% of the registrars had been trained at the university as shown in table 2. The hospital organized training was in form of seminars, workshops and continuous medical education lasting from 6 hours to 5 days across the respondents.

Table 2: Respondent's place of training

		Consultant Doctor	Registrars	Nurse	Pharmacist	Pharmaceutical Technologist	Cleaner
	N	3 (%)	6(%)	48(%)	2(%)	2(%)	8(%)
Place of Training	University	3 (100)	3(50)	5 (10.4)	0	0	0
	Hospital Organized Workshop	0	1 (16.7)	39(81.3)	2(100)	2(100)	8(100)
	Others	0	2(33.3)	4(8.3)	0	0	0

The topics taught during trainings were, disposal of cytotoxic waste (87.3%) and general knowledge about the cytotoxic risks (84.5%) and use of PPEs (80.3%) (Table 3).

Table 3: Topics covered in various trainings of safe handling of cytotoxic drugs and wastes

Topic	Category	Frequency (n=71)	Percentage (%)
General knowledge about the cytotoxic risk	Yes	60	84.5
	No	11	15.5
Use of PPE	Yes	57	80.3
	No	14	19.7
Cleaning techniques and management of excreta	Yes	33	46.5
	No	88	53.5
Cleaning of spills	Yes	36	51.4
	No	34	48.6
Chemotherapy preparation and administration	Yes	35	50.7
	No	34	49.3
Transport and storage of chemotherapy	Yes	37	53.6
	No	34	46.4
Disposal of cytotoxic waste	Yes	62	87.3
	No	9	12.7

A further analysis was conducted to determine the relationship between training and safe handling of cytotoxic waste across the cadre. The outcome showed that there was no significant association (χ^2=0.26, P=0.61). Training across cadre was not associated with increased safe handling of cytotoxic drugs and wastes.

Knowledge on chemotherapy exposure

The respondents were knowledgeable about various ways of chemotherapy exposure with a score of 88%-95% (table 4). Of the respondents 92.6% of nurses cited that "chemotherapy can enter the body through breathing and ingesting it" which is true. However, 83.3% of the nurses wrongly said that "all types of gloves offer the same level of protection" and 71.4% of the registrars and 61.1% of the nurses wrongly answered that "alcohol hand sanitizer is as effective as soap and water in removing chemotherapy"

Table 4: Knowledge on chemotherapy exposure

		Consultant Doctor	Registrars	Nurse	Pharmacist	Pharmaceutical Technologist	Cleaner
Enter the body through Breathing it in	True	3 (100)	18(85.7)	100(92.6)	2(100)	2(100)	11(78.6)
	False	0	1(4.8)	4(3.7)	0	0	0
	I don't know	0	2(9.5)	4(3.7)	0	0	3(21.4)
Enter the body through Ingesting it	True	3(100)	20(95.2)	100(92.6)	2(100)	2(100)	1(85.7)2
	False	0	0	4(3.7)	0	0	1(7.1)
	I don't know	0	1(4.8)	4(3.7)	0	0	1(7.1)
Though Contact with Contaminated Surfaces	True	0	8(38.1)	29(26.9)	0	0	4(28.6)
	False	3(100)	12(57.1)	73(67.6)	2(100)	2(100)	7(50)
	I don't know	0	1(4.8)	6(5.6)	0	0	3(21.4)
Though contact with spills and splashes	True	3(100)	19(90.5)	98(90.7)	2(100)	2(100)	13(92.9)
	False	0	1(4.8)	8(7.4)	0	0	0
	I don't know	0	1(4.8)	2(1.9)	0	0	1(7.1)
Chemo gas can enter the body through skin and mucous membranes	True	3(100)	17(81)	94(87)	1(50)	1(50)	4(28.6)
	False	0	0	7(6.5)	0	0	2(14.3)
	I don't know	0	4(19)	7(6.5)	1(50)	1(50)	8(57.1)
Oral forms can be absorbed on the skin	True	0	6(28.6)	26(24.1)	0	1(50)	3(21.4)
	False	3(100)	11(52.4)	62(57.4)	2(100)	1(50)	4(28.6)
	I don't know	0	4(19)	20(18.5)	0	0	7(50)
liquid Forms absorbed through the skin	True	3(100)	19(90.5)	95(88)	2(100)	2(100)	12(85.7)
	False	0	0	8(7.4)	0	0	1(7.1)
	I don't know	0	2(9.5)	5(4.6)	0	0	1(7.1)
Surgical masks provide protection from Chemo aerosols	True	0	11(52.4)	54(50)	2(100)	1(50)	7(50)
	False	3(100)	5(23.8)	45(41.7)	0	1(50)	2(14.3)
	I don't know	0	5(23.8)	9(8.3)	0	0	5(35.7)
All types of gloves offer the same level of protection	True	1(33.3)	1(4.8)	16(14.8)	0	0	4(28.6)
	False	2(66.7)	19(90.5)	90(83.3)	2(100)	2(100)	6(42.9)
	I don't know	0	1(4.8)	2(1.9	0	0	4(28.6)
enters easily through damaged skin	True	3(100)	21(100)	103(95.4)	2(100)	2(100)	13(92.9)
	False	0	0	3(2.8)	0	0	0
	I don't know	0	0	2(1.9)	0	0	1(7.1)
alcohol hand sanitizer is as effective as soap and water in removing chemotherapy	True	0	2(9.5)	27(9.5)	0	0	3(21.4)
	False	3(100)	15(71.4)	66(61.1)	1(50)	1(50)	4(28.6)
	I don't know	0	4(19)	15(13.9)	1(50)	1(50)	7(50)
Through contaminated foods, beverages or cosmetics	True	3(100)	15(71.4)	74(68.5)	2(100)	1(50)	9(64.3)
	False	0	4(19)	22(20.4)	0	1(50)	3(21.4)
	I don't know	0	2(9.5)	12(11.1)	0	0	2(14.3)

Availability and Accessibility of Policy/Guidelines on Handling Of Cytotoxics

Most (71.4%) of cleaners were not aware whether the institution has any policy regarding handling of cytotoxic drugs and waste, 70% of registrars affirmed that the policy was inaccessible for perusal by all staff as presented in Table 5.

Table 5: Availability and accessibility of Institutional policy regarding safe handling of cytotoxic drugs and wastes

		Consultant Doctor	Registrars	Nurse	Pharmacist	Pharmaceutical Technologist	Cleaner
Institutional Policy availability	Yes	3 (100)	10(47.6)	49(45.4)	1(50)	1(50)	4(28.4)
	I don't Know	0	11(52.4)	59(54.6)	1(50)	1(50)	10(71.4)
Accessibility of Institutional Policy	Yes	2(100)	3 (30)	27(45)	1(100)	0	1(25)
	No	0	7(70)	33(55)	0	1(100)	3(75)

Provision of Personal Protective Equipment

Majority (57.1%) of the cleaners and registrars (55%) reported that the hospital does not provide personal protective equipment for use in handling chemotherapy as presented in figure 2.

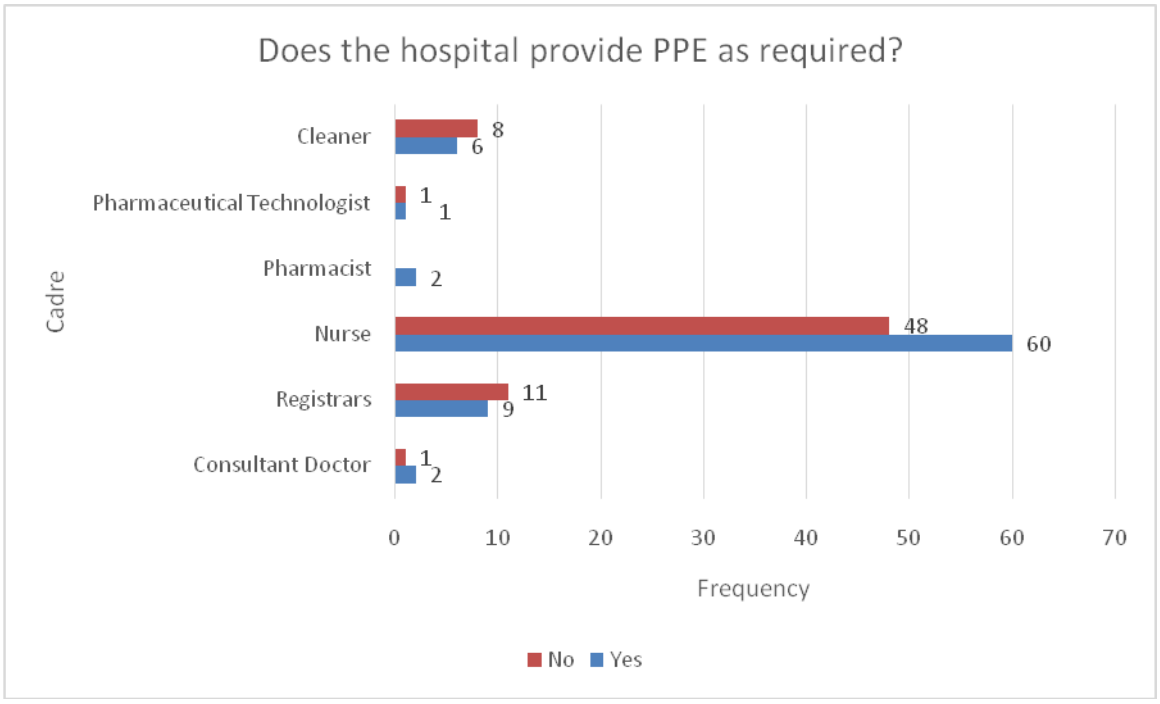

Figure 2: provision of personal protective equipment

Supplies reported to frequently run out

Shoe covers (63.3%), eye and face shields (66%) and hair covering (50.7%) are the supplies reported to be mostly run out of stock (figure 3).

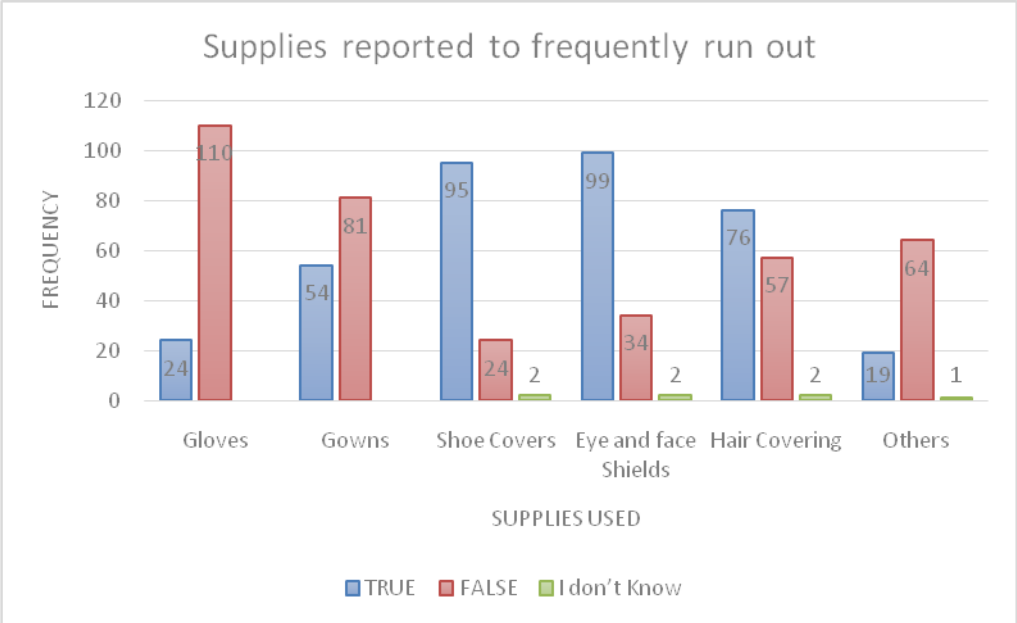

Figure 3: Supplies reported to frequently run out

A further analysis with Chi-square test for association showed that there was statistically significant association between provision of PPEs and safe handling among nurses (P=0.049). Thus among nurses, the provision of PPEs by the hospital increases the level of practice of safe handling of the cytotoxic drugs and waste as presented in Table 6.

Table 6: Provision of PPEs as Required and safe handling

Cadre			Safe handling			
			Yes	No	X^2	P-value
Registrars	Provision of PPEs as Required	Yes	2(22.2)	7(77.8)	0.51	0.822
		No	2(18.2)	9(81.8)		
Nurse	Provision of PPEs as Required	Yes	16(26.7)	44(73.3)	3.46	0.049
		No	21(43.8)	27(56.3)		
Cleaner	Provision of PPEs as Required	Yes	2(33.3)	4(66.7)	0.117	0.733
		No	2(25)	6(75)		
Total	Provision of PPEs as Required	Yes	23(28.8)	57(71.3)	1.34	0.247
		No	26(37.7)	43(62.3)		

From the checklist administered in various wards, there were no written guidelines/procedures available in the wards concerning management of patients on chemotherapy, chemotherapy administration, PPE use, spill management, waste management or linen/laundry handling

Assessment of the Disposal of Cytotoxic Wastes

Majority (66.8%) of the respondents reported that they were responsible for disposing chemotherapy drugs and waste including all the cleaners and 64.8% of nurses (Table 7). When disposing the cytotoxic drugs and waste, all the pharmaceutical technologists and pharmacists and ninety percent of nurses wore the PPEs as required.

Table 7: Waste disposal practice

		Cadre					
		Consultant Doctor	Registrars	Nurse	Pharmacist	Pharmaceutical Technologist	Cleaner
Are you responsible for disposing Chemo drugs and Waste	Yes	1(33.3)	11(52.4)	70(64.8)	1(50)	2(100)	14(100)
	No	2(66.7)	10(47.6)	38(35.2)	1(50)	0	0
Wearing PPEs during disposal	Yes	1(33.3)	13(86.7)	87(90.6)	2(100)	2(100)	12(85.7)
	No	2(66.7)	2(13.3)	9(9.4)	0	0	2(14.3)
Segregation of cytotoxic waste before disposal	Yes	0	10(55.6)	69(75.8)	0	0	9(64.3)
	No	1(100)	8(44.4)	22(24.2)	2(100)	2(100)	5(35.7)
Hand Washing Immediately after Disposal	Yes	0	14(77.8)	87(93.5)	0	0	13(92.9)
	No	1(100)	4(22.2)	6(6.5)	2(100)	2(100)	1(7.1)
Sharps Disposal	Sharps Container	1(100)	16(88.9)	90(98.9)	2(100)	2(100)	14(100)
	Others	0	2(11.1)	1(1.1)	0	0	0
Responsible for handling excreta	Yes	0	2(10)	73(68.9)	0	0	13(92.9)
	No	3(100)	18(90)	33(31.1)	2(100)	2(100)	1(7.1)
Availability of Chemotherapy Spill kit	Yes	1(33.3)	2(9.5)	20(18.5)	0	0	3(21.4)
	No	2(66.7)	19(90.5)	88(81.5)	2(100)	2(100)	11(78.6)
Cleaning Chemotherapy Spill	Cleaner	0	6(28.6)	67(62.6)	0	0	12(85.7)
	Nurse	0	1(4.8)	31(29)	0	0	1(7.1)
	Medical Doctor	0	11(52.4)	6(5.6)	0	0	0
	Others	3(100)	3(14.3)	3(2.8)	2(100)	2(100)	1(7.1)
Demarcation of Cytotoxic spill area before Cleaning	Yes	0	2(9.5)	31(28.7)	0	0	2(14.3)
	No	3(100)	19(90.5)	77(71.3)	2(100)	2(100)	12(85.7)
Technique for cleaning Spill area	From Centre of spill gradually towards the outer	0	5(29.4)	22(22.2)	0	0	4(40)
	From the Outer of the spill gradually towards the centre	2(100)	12(70.6)	77(77.8)	2(100)	2(100)	6(60)

The cleaners handled the contaminated linen and 93% of them reported that they mixed both the contaminated and non-contaminated linen together.

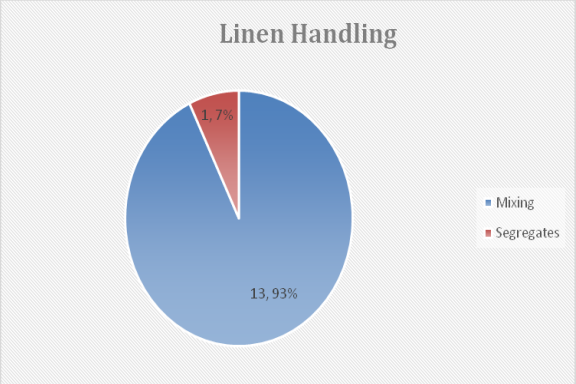

Figure 4: Linen Handling

DISCUSSION

Majority of the respondents had no training in handling of the cytotoxic drugs and related wastes. These findings are similar to a study carried out in Karachi Pakistan which showed that only 43.33% of the nurses working in oncology units were trained on handling of the cytotoxic drugs and related wastes. [13] This could be attributed to limited resources for training of healthcare workers.

Most of the health care workers in this study were knowledgeable about various ways of chemotherapy exposure. The findings differ with an Indian study that revealed knowledge and practice of hospital staff about cancer drugs were not to the level required to mitigate the risks associated with handling of these drugs. [14] The knowledge could have been acquired in their basic training on the various ways of exposure to various drugs and diseases.

Most of the healthcare workers were trained through hospital organized workshops, continuous medical education and having mentorship programs. A study in Nepal revealed that most health care workers knowledge on handling cytotoxics drugs and related wastes was through hospital organized trainings. [15] The findings are consistent with the South Australian government recommendations that state that it is the duty of institutions dealing with cytotoxics to provide information, instruction, training and supervision of all healthcare workers handling cytotoxic drugs and related waste. [5,16] This is may be because currently most of the trainings are free, accessible and are offered within the hospital environment.

In this study majority of the respondents reported that the institutional policy document was not readily available for perusal and reference by the staff working in oncology wards. Majority of the healthcare workers were not practicing safe handling of the cytotoxic drugs and wastes. In this study, the availability of policy document does not have any influence on the practice of safe handling of cytotoxic wastes across cadres. This study contradicts a study carried out in Pakistan that showed that for successful handling of the chemotherapy and related wastes the healthcare workers must be provided with the appropriate guidelines and policies. [13] This could be due to the ignorance on the part of the part of healthcare workers or lack of knowledge on the possible effects of chemotherapy in the body.

Shortage of supplies such as the N95 respirator masks, spill kits, appropriate gloves (vinyl) and biosafety cabinets was reported by most of the respondents. It was observed that chemotherapy drugs are reconstituted in the ward and stored with non-cytotoxic drugs. The results are inconsistent with NIOSH guidelines of continuous supply of the appropriate PPEs to promote careful and consistent use hence minimizing occupational exposure to cytotoxic agents. [9] Correct and consistent use of the PPEs when handling the cytotoxic drugs and waste reduces the risk of getting cancer due to exposure. [6] Poor planning by the management could be attributed to the shortage of the supplies and lack of the appropriate storage facilities.

Only a minority of the respondents did not practice waste segregation before disposal. This is against the guidelines that recommend that all the wastes must be segregated before disposal and disposed in the appropriate color coded bins. [17] Most studies have reported lack of waste disposal segregation by the healthcare workers handling cytotoxic waste at the point of generation. [4,17,18] Healthcare workers in

Kenya are trained on medical waste segregation preservice and the department of the public health has stepped up campaign on medical waste segregation and these could have contributed to the good practice noted.

Increased use of PPEs during disposal of waste improved the level of safe handling of cytotoxic wastes (P=0.02). There was no separation of linen contaminated with chemotherapy and the rest of linen by the house keepers. This practice goes against recommendations in several studies that the linen should be separated well and labeled with a cytotoxic label. [10,11,19] This could be due to of lack of knowledge among the cleaners who handled the contaminated linen and lack of appropriate guideline in the wards

CONCLUSION

There is lack of sensitization to the healthcare care workers on the available policy regarding handling of the cytotoxic drugs and disposal of related wastes to minimize the exposure. There is shortage and lack of appropriate personal protective equipment in the various wards for handling cytotoxic drugs e.g. biosafety cabinets, N95 Masks and face Shields as recommended hence putting the healthcare workers in those wards at high risk of exposure. Most of the healthcare workers in various oncology wards lack specialized training in oncology and a basic training in the handling of the cytotoxics drugs and related wastes. Handling of the chemotherapy spills is not in accordance with the recommended guidelines hence putting healthcare workers handling them at a high risk of exposure.

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