

RESEARCH ARTICLE



OPEN ACCESS

Received: 10-06-2023

Accepted: 07-10-2023

Published: 17-11-2023

Citation: Ravinandan AP, Chandana C, Durge SJ (2023) Study on Knowledge, Attitude and Perception of Public on Drug Disposal, Storage and Create Awareness on Proper Disposal of Drugs in a South Indian District. Indian Journal of Science and Technology 16(43): 3934-3941. <https://doi.org/10.17485/IJST/v16i43.1426>

* **Corresponding author.**

chandana2100@gmail.com

Funding: None

Competing Interests: None

Copyright: © 2023 Ravinandan et al. This is an open access article distributed under the terms of the [Creative Commons Attribution License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Published By Indian Society for Education and Environment ([iSee](https://www.indjst.org/))

ISSN

Print: 0974-6846

Electronic: 0974-5645

Study on Knowledge, Attitude and Perception of Public on Drug Disposal, Storage and Create Awareness on Proper Disposal of Drugs in a South Indian District

A P Ravinandan¹, C Chandana^{2*}, Saurabh Jagdish Durge³

¹ Assistant Professor, Department of Pharmacy Practice, Sree Siddaganga College of Pharmacy, Rajiv Gandhi University of Health Sciences, Tumkur, 572102, Karnataka, India

² Pharm D Intern, Department of Pharmacy Practice, Sree Siddaganga College of Pharmacy, Rajiv Gandhi University of Health Sciences, Tumkur, 572102, Karnataka, India

³ Department of Pharmacology, Sree Siddaganga College of Pharmacy, Rajiv Gandhi University of Health Sciences, Tumkur, 572102, Karnataka, India

Abstract

Objectives: To determine the way of drug disposal and storage practices carried out in society and create awareness about the drug is to be disposed of properly to avoid chemical and physical issues by the pharmaceuticals. To evaluate the way of drug disposal and storage practices are carried out in society after the awareness program. **Materials and methods :** This study was carried out by community-based cross-sectional study design using ICF and KAP Forms. A study was conducted on 1004 households in the South Indian district to analyze the drug disposal and storage practices followed in the households before the awareness program. Data processed and analyzed through Statistical methods in the Epi info data Version:7.2.5.0 and Microsoft Excel 2019 Version: 1808. **Findings:** Though disposal was the main aspect, improvements in the storage conditions of the drug dosage forms were found in the study, where 93.72% of the population followed proper storage practices. The result data revealed that practices followed after the awareness program which was conducted in the study resulted in 75.89% of participants not having unused medicines after awareness and proper disposal and storage. **Novelty:** Creating awareness about methods of drug disposal and storage reduces the risk of accidental poisoning from medicine and its contamination as many of unaware of its complications. This study achieved to increase in the proper drug disposal and storage practices among household participants.

Keywords: Drug disposal; Unused medications; Storage of medicines; Medication adherence

1 Introduction

Drug is defined as any ingredient through the conceivable to avoid and/or treat disorder/disease or improve somatically or psychological well-being in the concept of pharmacology drug is defined as any biochemical agent that modifies the chemical or functional progressions of organisms or tissues⁽¹⁾. Inappropriate disposal of medicines possibly leads to an important ecological hazard and expired⁽²⁾ and unused medicines storage that cause increased accidental poisoning risks in households^(3,4). Storing medicines properly can help to ensure the good condition of drugs as well as prevent poisoning accidents⁽⁵⁾.

The different pharmaceutical disposal methods are summarised as removing expired prescription drugs and unused medications from the trash⁽⁶⁾. The people have lacked knowledge about the proper way to dispose of unused and expired medicines. This indicates that poor patient education and lack of awareness is ultimately resulting in poor disposal methods which is similar to studies done in patient education. As for drug disposal, the storage of a drug in its characteristic condition i.e. as per label is also important to receive desired therapeutic action as well as prevent hazardous reactions⁽⁷⁾.

The United States FDA has delineated some choices and provided directions for contemplation during the process of medicine disposal drug take-back (it is a program that is aimed at decreasing pharmaceutical waste and raising safe discarding of medications by returning expired and unused pharmaceuticals to community pharmacies), disposal in the garbage and/or flushing in toilets⁽⁸⁾.

2 Material and Methods

2.1 Materials

The study was carried out by cross-sectional study design by using ICF (Information Consent Forms) and KAP (Knowledge Attitude and Practice) Forms. The study was conducted on 1004 households in the south Indian district.

2.2 Study Design

A Study was conducted as a cross-sectional survey in the community. The data collection was done by using a structured investigator-participant questionnaire. A KAP study is conducted to collect information on the knowledge (that are known by the participants), attitudes (that are thought by the participants), and practices (that are done by the participants) about drug disposal and storage of a particular population.

2.3 Study Period and Area

In South Indian District households, the study was conducted in the city located between north latitudes 120 45' to 140 20' and east longitudes 760 20' to 770 31' in the south Indian district which has 10648 sq. km of geographical area. The study duration was three months.

2.4 Data Collection Procedures

An adopted and validated structured questionnaire was used for the data collection based on the Knowledge, Attitude, and practices of the drug disposal and storage procedures before and after the awareness program in the population. The Awareness program was given after the Pre-test data collection about the Proper methods of drug disposal and storage. It includes the participants of age above 18 years and residents in the South Indian District⁽⁹⁾.

2.5 Data Analysis

The data that was collected were entered and analyzed through Epi-info of data Version: 7.2.5.0 and Microsoft Excel 2019 Version: 1808. A chi-square test was conducted between the Proper methods of drug disposal and storage. The P-value of <0.001* was taken at a 95% confidence interval of significance.

3 Results

3.1 Characteristics of participants

The study population total of 1004 participants involved in this study the majority were males 631 (62.85%), the participant's mean age was 35 years and the other data about involved participants are given in (Table 1).

Table 1. Characteristics of participants in south Indian district 2022 N=1004

Variables	Number of participants	Percentage (%)
Gender		
Male	631	62.85
Female	373	37.15
Age		
18-30	463	46.12
31-40	234	23.3
41-50	154	15.34
51-60	109	10.86
>60	44	4.38
Educational level		
Primary Education	4	0.4
Higher Primary Education	22	2.2
Secondary Education	565	56.27
Graduation	323	32.17
Post-Graduation	90	8.96
Marital Status		
Married	619	61.65
Unmarried	385	38.35
Residency		
Urban	678	67.53
Rural	326	32.47
Family size		
≤ 3	197	19.62
3-5	641	63.85
≥ 6	166	16.53

3.2 Presence of Unused Medicines

This research was conducted from January 2022 to March 2022, in that period out of 1004 households 758 (75.5%) found that had unused medicines in their households, and after the awareness program, 242 (24.1%) of households had unused medicines. It shows that 51.4% of participants disposed of the unused medicines after the pre-test and awareness was conducted (Figure 1). The monetary value of unused medicines was found to be Rs. 56,955 (USD 727.82) to Rs.1,74,800 (USD 2233.75) during the period of data collection (Figure 2).

In the both pre-test and post-test questionnaires, the number of unused medicine questions was there to identify the quantity of unused medicines in their households. Before the awareness program about safer drug disposal and storage there were 75.5% unused medicines in 587 (58.47%) households had 1-5 unused medicines, 133 (13.25%) households had 5-10 unused medicines, 29 (2.89%) households had 10-20 and 9 (0.89%) households had more than 20 number of unused medicines. The remaining 246 (24.5%) had no medicines or/and unused medicines in their households. After awareness program, 759 (75.6%) households had no unused medicines, 219 (21.81%) households had 1-5 a number of unused medicines, 21 (2.09%) households had 5-10 number of unused medicines, 4 (0.4%) households had 10-20 and 1 (0.09%) had more than 20 number of unused medicines.

When comparing before awareness program with the after-awareness program results of the number of unused medicines, there are decreases in the count of unused medicines as 36.66% of 1-5 unused medicines, 11.16% of 5-10 unused medicines,

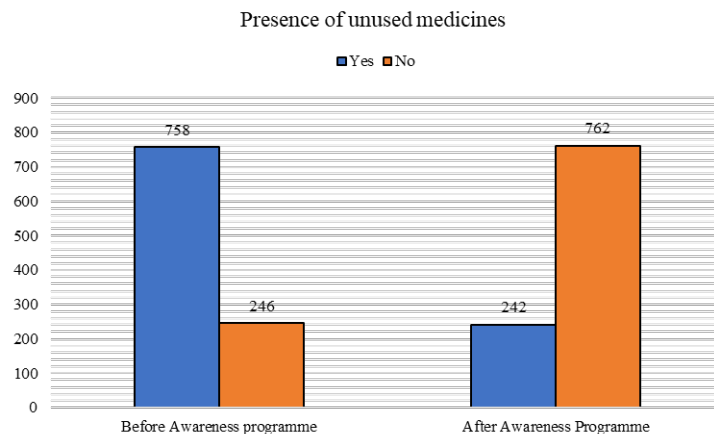


Fig 1. Presence of unused medicines before and after the awareness program

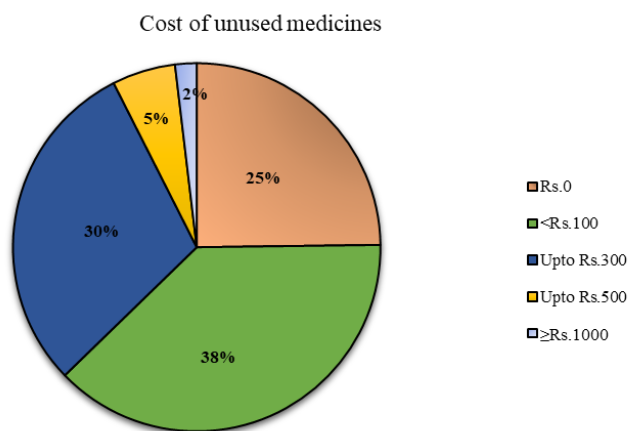


Fig 2. Price of unused medicines

2.49% of 10-20 number of unused medicines and 8.9% of more than 20 number of unused medicines. The comparison of responses to the number of unused medicines before and after the awareness program is given (Figure 3).

3.3 Practicing proper drug disposal methods

After the awareness program, 974 (97.01%) households practiced proper drug disposal methods for disposing of unused medicines, and 30 (2.99%) households who had unused medicines did not dispose of the unused medicines (Figure 4).

3.4 Reason for the presence of unused medicines

Before the awareness program, out of 1004 households 758 (75.5%) of household participants had unused medications in the reason for the presence of unused medicines are 216 (21.51%) participants self-discontinued their medications, 106 (10.56%) participants answered that their doctor changed the medicines, 100 (9.96%) participants had unused medicines due to expired date, 89 (8.86%) participants had medicines that leftover from previous OTC drugs, 82 (8.17%) participants answered that prescribed more than needed and 194 (19.32%) participants answered by combination of the given options and 1 (0.1%) participant not gave answer for presence of unused medicines and other 216 (21.51%) participants doesn't have unused medicines in their households.

After the awareness program, 242 (24.1%) of household participants had unused medications gave the following reasons 159 (15.84%) participants had lack of time to do proper drug disposal and storing hence they kept medicines with them, 49

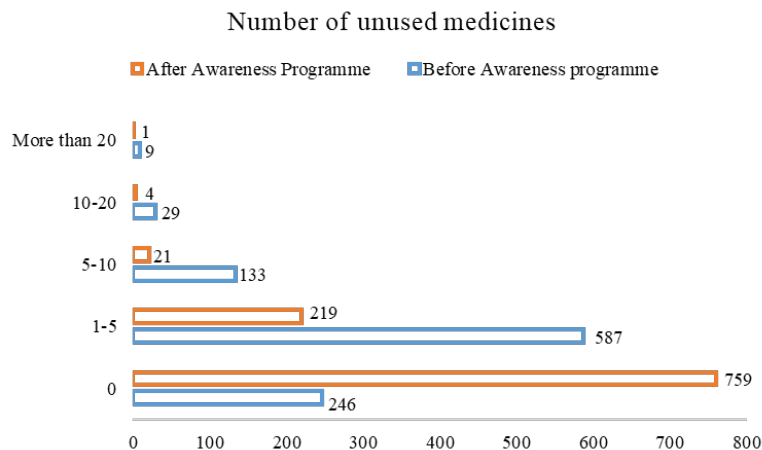


Fig 3. Number of unused medicines before and after the awareness program

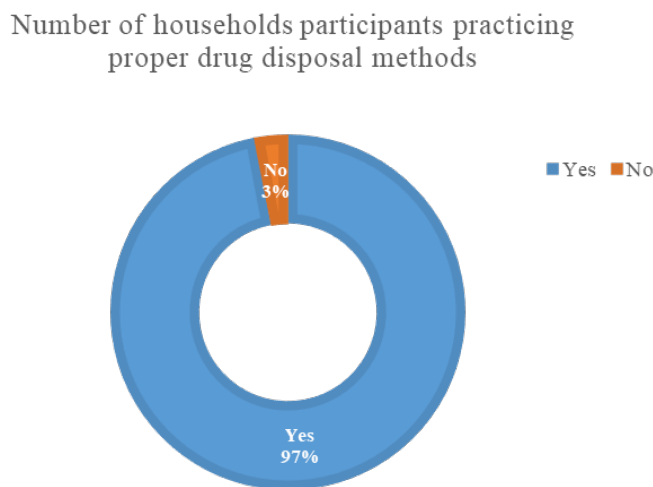


Fig 4. Number of households' participants practicing proper Drug Disposal methods

(4.88%) participants faced difficulty to remember drug disposal procedures, for 31 (3.08%) participants given information was not understood, 9 (0.89%) participants were not interested to practice proper drug disposal, 17 (1.69%) participants gave further reasons, 2 were not answered for reason for presence of unused medicines and other 737 (73.40%) participants had no expired or/and unused medicines in their households.

3.5 Storage condition of medicines

Before the awareness program, the storage condition of the medicines was collected by the KAP forms by providing options like kitchen, bedroom, bathroom, and others; some of the participants ticked the two or more options they are all concluded as combinations that 16 (1.59%). After the awareness program, the KAP forms contain two options stored as per label and stored as per old practices (Table 2).

The statistical analysis of the storage of drugs before and after the awareness program was considered as stored as per label and stored as per old practices that analyzed by chi-square test and standard deviation between the before and after awareness program. The pre-test form options are mentioned in the same as the post-form by analyzing their house visits and the storage practices of participants. The statistical analysis of the storage of unused medicines is given in (Table 4).

Table 2. Storage condition of medicines before and after the awareness program

Before Awareness programme	Pro-Response Achieved-n (%)	After Awareness Programme	Response Achieved-n (%)
Storage Condition of Medicines as Households	Kitchen: 202 (20.12%)	Storage Condition of Medicines as Households	As per Label: 941 (93.73%)
	Bedroom: 741 (73.8%)		As per old practices: 63 (6.27%)
	Bathroom: 22 (2.19%)		
	Combinations: 16 (1.59%)		
	Others: 23 (2.29%)		

3.6 Methods of drug disposal

The collected data about methods of drug disposal practices before and after the awareness program are mentioned in (Table 3).

Table 3. Methods of drug disposal before and after the awareness program

Before Awareness programme	Pro-Response Achieved-n (%)	After Awareness Programme	Response Achieved-n (%)
Throw to trash/Dustbin	608 (60.56%)	Drug take-back system	35 (3.49%)
Burn	38 (3.78%)	Flushing to toilet	27 (2.69%)
Bury in the ground	106 (10.56%)	Dispose with trash	859 (85.56%)
Return to the health care professional	32 (3.19%)	Return to health care professional	50 (4.98%)
Toilet flushing	9 (0.9%)	Combination of the above options	26 (2.59%)
Sharing with friends or family or given to poor people	22 (2.19%)	Others	7 (0.69%)
Never disposed	86 (8.56%)		
Combination of the above options	102 (10.16%)		
Others	1 (0.1%)		

The options given in the KAP forms were selected by the FDA. Those are responded to by ticking more than two options, those responses are considered as a combination of the above options. The methods of response were compared by analyzing the participant's drug disposal practices by their house visits. The statistical analysis of the methods of drug disposal before and after the awareness program is given (Table 4).

Table 4. Chi-square, Standard deviation between response achieved before and after awareness program

Variables	Response achieved before awareness program (n)	Response achieved after awareness programme (n)	Standard deviation	Chi-square	P-value
Methods of drug disposal					
Drug take-back system	0	35	103.68	386.76	0.001*
Flushing to toilet	9	27			
Dispose with trash	608	859			
Return to health care professional	32	50			
Combination of the above options	102	26			
Others	253	7			
Storage condition of medicines					
As per label	741	941	282.84	146.48	0.001*
As per old practices	263	63			

Out of 1004 participants, 364 (36.25%) participants had information about the proper drug disposal and storage of medicines before the awareness program, and the remaining 640 (63.75%) participants did not know about drug disposal and storage. Also, 273 (27.19%) participants knew about the hazards of unsafe drug disposal and storage, and 731 (72.81%) participants were not aware of the hazards of unsafe drug disposal and storage.

The chi-square value is greater than the critical value for both Methods of drug disposal and storage condition of medicines at P-value 0.001*. Hence, the researcher can reject the null hypothesis and accept the alternative hypothesis.

4 Discussion

As the above summarised pharmaceutical methods of disposal of various dosage forms and the storage practices were to be performed as the label of the formulation. The result data revealed that more number of the population was not aware of proper drug disposal and storage practices. The researcher assessed participant behavior concerning the disposal of drug options and understanding of drugs and investigated participants' attitudes and endorsements about unused drug disposal practices as in previous studies^(2,10,11). This study specifies that there is a need for proper education or awareness in patients to create awareness regarding the disposal methods of unused medicines and expired drugs safely^(12–15). Later followed the practices after the awareness program was conducted in the study which resulted in a 51.4% increase in awareness and proper disposal and storage based on the number of unused medications in the households which resembles previous studies^(3,16,17).

As given in (Table 4) the data also statistically analyzed as its chi-square value is greater compared to the critical value at a 95% confidence interval of P-value 0.001* and it is rejected the null hypothesis.

Also, Study results determined that the population following the proper drug disposal and storage practices can be improved by creating awareness amongst people through awareness programs that help improve both pharmaceutical and population benefits even though the population may vary in their educational qualifications or gender across any area of the globe.

As unused medications the household possess a waste of the economy as well as chemical hazards the awareness program helped to improve the number i.e 75.89% of the population did not possess any unused medication after the program which was more than 24.5% hence the study also helped people save their economy, which gave solution to the previous studies^(18–20).

Therapeutic potency has its important priority to show desired action which can be depleted by the improper storage conditions which were improved by the awareness program as 93.72% population of started storing the medications as per label which was seen in the study. As presented in (Table 4) the data also statistically analyzed as its chi-square significance is greater than the critical value at a 95% confidence interval of P-value 0.001* and it is rejected the null hypothesis.

This study has several strengths over other previous studies as this is a funded project, the result of this project is validated and certified by the granted university and statistical analysis was analyzed, it is significant to the data. The awareness was created among the population and it is assessed as similar to before the awareness programme. Despite strengths, this study has certain limitations as this study was completed within the certain time limit prescribed by the granted university.

5 Conclusion

According to this study, most of the participants (75.5%) dispose and store medicines in an improper way, which causes disastrous results and effects. Proper medication disposal and storage methods are essential to maintain good health and a good environment and also increase medication adherence that was achieved by awareness program. Creating awareness about methods of drug disposal and storage reduces the risk of accidental poisoning from medicine and its contamination. Through this study, the researcher achieved to increase in the proper drug disposal and storage practices in the study site in 97.01% of households.

6 Acknowledgment

All the authors are thankful to Rajiv Gandhi University of Health Sciences(RGUHS) has funded this Research project under the Short-term Research Grants for Undergraduate Students (PROJECT CODE: UG21PHA334) and the Sree Siddaganga College of Pharmacy, Tumakuru for providing the essential facilities needed to complete this study.

7 Abbreviations

ICF: Informed Consent Form, KAP: Knowledge Attitude and Practice form, FDA: Food and Drug Administration, USD: United States Dollar

References

- 1) Terminology and Information on Drugs. 2nd ed. Vienna. United Nations Office on Drugs and Crime. 2003. Available from: https://www.unodc.org/pdf/publications/report_2003-09-01_1.pdf.
- 2) Purohit K, Kumar V, Vardhan G, Dhamija P. A cross-sectional assessment of knowledge, attitudes, and practices of safe drug disposal practices in pharmacies. *National Journal of Physiology, Pharmacy and Pharmacology*. 2022;12(7):1027–1032. Available from: <https://doi.org/10.5455/njppp.2022.12.03129202223052022>.
- 3) Malini S, Jaykar B, Mathews SM, Venkateswarlu BS, Kumar S. A Study on Assessment of Knowledge Attitude and Practice KAP Towards Good Pharmacy Practice GPP Among Working Pharmacist. *Journal of Pharmaceutical Negative results*. 2022;13(8):4019–4024. Available from: <https://doi.org/10.47750/pnr.2022.13.S08.506>.
- 4) Kusturica MP, Sabo A, Tomic Z, Horvat O, Šolak Z. Storage and disposal of unused medications: knowledge, behavior, and attitudes among Serbian people. *International Journal of Clinical Pharmacy*. 2012;34(4):604–610. Available from: <https://doi.org/10.1007/s11096-012-9652-0>.
- 5) Put Your Medicines Up and Away and Out of Sight. . Available from: <https://www.cdc.gov/patientsafety/features/medication-storage.html>.
- 6) Safe disposal of unwanted pharmaceuticals in and after emergencies. *The Revista Panamericana de Salud Pública/Pan American Journal of Public Health*. 2000;7(3):205–208. Available from: <https://iris.paho.org/bitstream/handle/10665.2/8837/1418.pdf;jsessionid=824F6DDF17084EACC791040599A5ACF9?sequence=1>.
- 7) Huang Y, Wang L, Zhong C, Huang S. Factors influencing the attention to home storage of medicines in China. *BMC Public Health*. 2019;19(1):1–10. Available from: <https://doi.org/10.1186/s12889-019-7167-5>.
- 8) Akici A, Aydin V, Kiroglu A. Assessment of the association between drug disposal practices and drug use and storage behaviors. *Saudi Pharmaceutical Journal*. 2018;26(1):7–13. Available from: <https://doi.org/10.1016/j.jsps.2017.11.006>.
- 9) Yimenu DK, Teni FS, Ebrahim AJ. Prevalence and Predictors of Storage of Unused Medicines among Households in Northwestern Ethiopia. *Journal of Environmental and Public Health*. 2020;2020:1–10. Available from: <https://doi.org/10.1155/2020/8703208>.
- 10) Ehrhart AL, Granek EF, Nielsen-Pincus M, Horn DA. Leftover drug disposal: Customer behavior, pharmacist recommendations, and obstacles to drug take-back box implementation. *Waste Management*. 2020;118:416–425. Available from: <https://doi.org/10.1016/j.wasman.2020.08.038>.
- 11) Hajj A, Domiati S, Haddad C, Sacre H, Akl M, Akel M, et al. Assessment of knowledge, attitude, and practice regarding the disposal of expired and unused medications among the Lebanese population. *Journal of Pharmaceutical Policy and Practice*. 2022;15(1):1–16. Available from: <https://doi.org/10.1186/s40545-022-00506-z>.
- 12) Soni D, Deepanker A, Saroshe S, Yuwane P, Singh A, Dixit S, et al. Perception And Practice Of Hospital Waste Management Among Medical And Nursing Personnel. *International Journal of Medical and Pharmaceutical Research*. 2023;4(2):19–23. Available from: <https://ijmpr.in/uploads/article/IJMPR42128-19-23.pdf>.
- 13) Adedeji-Adenola H, Adesina A, Obono M, Onedo T, Okafor GU, Longe M, et al. Knowledge, perception and practice of pharmaceutical waste disposal among the public in Lagos State, Nigeria. *Pan African Medical Journal*. 2022;42:1–15. Available from: <https://www.panafrican-med-journal.com/content/article/42/106/full/>.
- 14) Khansa N, Gazy AAK, El-Lakany A, Domiati S. Assessment of The Knowledge , Attitude , and Practice Towards Expired Drug Disposal among the Community in Beirut City , Lebanon. *BAU Journal - Health and Wellbeing*. 2023;5(2):1–12. Available from: <https://digitalcommons.bau.edu.lb/hwbjournal/vol5/iss2/8/>.
- 15) Shwetha N, Jha A. Knowledge and Awareness Regarding Safe Drug Disposal System among General Population of India. *Journal of Pharmacovigilance*. 2018;6(2):1–4. Available from: <https://www.walshmedicalmedia.com/open-access/knowledge-and-awareness-regarding-safe-drug-disposal-system-among-generalpopulation-of-india-2329-6887-1000256.pdf>.
- 16) Sarraf DP, Rauniar GP, Kushwaha RP, Keshwar S, Maharjan R. Knowledge, Attitude and Practice of Disposal of Unused, Unwanted and Expired Medicines among Healthcare Professionals. *Kathmandu University Medical Journal*. 2022;20(79):323–329. Available from: <https://pubmed.ncbi.nlm.nih.gov/37042374/#:~:text=Conclusion%20Majority%20of%20the%20Healthcare,at%20home%20by%20healthcare%20professionals>.
- 17) Yang S, Patel P, Corcoran A, Dobberpuhl E, Isidro S, Le D, et al. Gaps in Patient Education on Safe Handling and Disposal of Oral Chemotherapy Drugs: A Pilot Prospective Cohort Survey Study. *Journal of Contemporary Pharmacy Practice*. 2022;70(2):23–33. Available from: <https://doi.org/10.37901/jcphp21-00009>.
- 18) Bawa R, Khurana D, Girdhar P, Verma N. Biomedical Waste Management-Related Knowledge, Attitude, and Practices among Clinical Dental Undergraduates in State of Punjab in India: A Cross-Sectional Study. *Dental Journal of Advance Studies*. 2022;10(02):55–63. Available from: <https://www.thieme-connect.com/products/ejournals/pdf/10.1055/s-0042-1744218.pdf>.
- 19) Agrawal T, Agrawal N, Gupta V, Patel BB. Occupational Exposure to Needle Stick Injuries among Health Care Workers in a Tertiary care hospital: A KAP study. *Indian Journal of Community Health*. 2022;34(2):234–240. Available from: <https://www.iapsmupuk.org/journal/index.php/IJCH/article/view/2332>.
- 20) Malla B, Deepti KC. Knowledge, attitude and practice of over-the-counter drug among undergraduate medical students-a cross sectional study. *Journal of Gandaki Medical College-Nepal*. 2021;14(2):153–159. Available from: <https://doi.org/10.3126/jgmcn.v14i2.39336>.