Original Research Article

Assessment of Knowledge, Attitude, And Practice of Selected Community Pharmacists Towards The Disposal Of Unused And Expired Medicines At Kalaburagi City

ABSTRACT

Purpose: Disposing of unused and expired drugs presents a critical challenge with far-reaching implications for public health and environmental well-being. This issue has gained increasing attention as pharmaceutical consumption rises globally. Improper disposal practices can contaminate water bodies, soil, and ecosystems, endangering human and aquatic life. Hazards to human and environmental health and safety are high when pharmaceuticals that have been used and are no longer needed are not properly disposed of. This is why the current research is an effort to gather data on the understanding of Kalaburagi City's community pharmacists regarding proper disposal of leftover and expired medications.

Methodology: The study was conducted in various areas and colonies of Kalaburagi city, over six months from March to August 2023 for evaluating opinions with regards to disposing of unwanted medicines. Tools and teaching aids used for the study are specially designed pretested and validated questionnaires, leaflets, and videos. The study design used is “A case-control study”. The inclusion criteria were, Pharmacists willing to participate, Government pharmacists, and Private pharmacists. The exclusion criteria were, Pharmacists who were not interested in participating, and person without a pharmacy background. The survey was carried outin Kalaburagi city and was divided into two groups North (test) and South (control). The test group received counseling regarding the methods of disposal of unused and expired medicines and leaflets, whereas the control group received only leaflets.

Results:A study of 461 pharmacists found that 79% were male and 21% female, with 42.3% aged 31 to 40. Notably, 92% regularly check medication expiry dates, and 85% are concerned about drugs polluting the environment. An overwhelming 94% support drug take-back programs. Most pharmacists (84%) recognize improper disposal as a health risk, and 92% return expired medicines to manufacturers. For disposal methods, 49% suggest returning expired meds to pharmacists, while 10% recommend flushing and 24% advise disposal in sinks. There is a push for increased consumer awareness, with 50% wanting healthcare professionals to educate on safe disposal, and 38% advocating for government-led programs.

Conclusion: The awareness regarding, the impact of improper disposal of pharmaceutical products is still unknown. It is a cornered issue and needs to be focused on. The current methods and practices are not optimal and upgraded. Pharmacists possess knowledge regarding the proper disposal of unused and expired medicines. However, they often lack the attitude to implement these practices effectively. Lack of standardized disposal facilities, limited regulatory enforcement policies and public awarenessregarding safe disposal have contributed to the gap between the knowledge and practice of pharmacists.

Keywords: Unused medicines, expired drugs, pharmaceutical disposal, public health, take-back programs, safe disposal, awareness program.

INTRODUCTION:

Despite their critical role in human health, numerous medications include harmful compounds that, if not disposed of or handled correctly, may pollute the environment [1].

Incorrect disposal of pharmaceutical wastes poses a significant threat of contamination and various hazards to both humans and other animals. By consuming polluted water, humans might be exposed to or collect environmental traces and residues of medicines [2]. Indefinitely storing, discarding, or flushing down the toilet or typical municipal trash containers are common ways that many families dispose of unwanted, unused, or expired pharmaceuticals. You should be aware that these unofficial methods put both environment and its residents at risk of major health problems when people dispose of prescriptions that have neither been utilized or have expired [3]. Both adults and children have been poisoned by medications that have expired due to improper disposal[4].

In addition to many different types of bacteria already present in sewage, presence of medications that have passed their expiration date increases likelihood that these germs may develop resistance to antibiotics, turning otherwise innocuous bugs into dangerous pathogens.[5].

WHO'S VIEW ON DISPOSAL OF MEDICINES:

WHO states that UMs should never be administered to people or animals and should be disposed of as pharmaceutical waste [6].

Patient noncompliance, pharmaceutical company promotion, doctor prescription procedures, and dispensing behaviours are all potential causes of unwanted medications. Also, people are more aware of need of obtaining medical attention, which has led to a rise in use of medicines [7]. No established regulations or recommendations for disposal of wasted pharmaceuticals were discovered in earlier research that compared and contrasted the link between ecological awareness and disposal of leftover medicines in different nations worldwide.[8].

INDIA'S PERSPECTIVE TOWARDS DISPOSAL METHODS:

The ongoing issue of how to properly dispose of old, unused, or unwanted medications has persisted in India. Precise consequences were not understood in full up until now due to lack of thorough research on subject. No respectable legislation existed in the nation to address this issue. The waste-handling municipal corporations were unaware of its existence. People weren't organized enough to care about it, and the media didn't care either. Consequently, environmental degradation persisted and ultimately resulted in ever-increasing human and environmental problems. Until expiration date stated on the medicine package, pharmaceutical items guarantee the efficacy and safety of the included medication. Under ideal storage circumstances, the drug should have retained 90% of its initial efficacy by the time it expired. Just because a drug has an expiration date doesn't mean it will become fully ineffective or even hazardous once time limit has passed. The typical shelf life of a drug is between two and five years from date of manufacture [9]. Optimal storage conditions allowed certain medications to maintain 90% of their efficacy for at least five years after the stated expiration date, and sometimes much longer. Some medications maintained their initial effectiveness up to a decade beyond the expiration date[10]. Drug resistance and therapeutic failures may be worsened if some medications, such as antibiotics, are used beyond their expiration dates. [9,11].

ENVIRONMENTAL THREAT DUE TO PHARMACEUTICALS:

Dangerous drug disposal practices caused pollution and health problems in addition to endangering the ecosystem [12]. Field of "eco-pharmacovigilance" was crucial in this regard; it is defined as follows: study and practice of identifying, assessing, comprehending, and avoiding the negative environmental impacts of medicines [13]. Medicines that had expired, were unused, or were undesirable were a constant source of pollution in India. The precise consequences were unclear since there weren't enough research in this field [14].

The development of an appropriate disposal guideline with a monitoring system is necessary, and there has not been enough of a voice in India to advocate for the safe disposal of pharmaceutical goods. It is the responsibility of the National Formulary of India to create and disseminate information about the take-back schemes.[15].

GOVERNMENT INITIATIVES ADDRESSING THE ISSUE AT HAND:

In an effort to preserve these ecologically responsible cleaners, several governmental and non-governmental groups stepped up their game. The government of India outlawed the usage of diclofenac in veterinary medicine in an effort to restore ecological harmony [16]. But instead of focusing on eliminating any one drug, we should be investigating the root causes of chemical pollution in our ecosystems. Environmental consciousness, accessibility to official state standards, dose forms, and cultural and societal attitudes all play a role in shaping people's medicine disposal practices. Most people dispose of their old medications in the sink, toilet, or trash, but this is not an eco-friendly option. Many people do not know how to properly dispose of pharmaceuticals or how they impact environmental health, which leads to a massive buildup of unused and expired prescriptions in people's medicine cabinets [17]. People in India are still not very knowledgeable about correct disposal, even though the FDA has published specific instructions on the matter [18].
There is a risk to the environment from drugs and their byproducts. As they dissolve in water, they raise the risk of antibiotic resistance or contamination.

MATERIALS AND METHODS:

The study was conducted in various areas and colonies of Kalaburagi city, over six months from March to August 2023 for evaluating opinions with regards to disposing of unwanted medicines. Tools and teaching aids used for the study are specially designed pretested and validated questionnaires, leaflets, and videos. The study design used is "A case-control study". The inclusion criteria were, Pharmacists willing to participate, Government pharmacists, and Private pharmacists. The exclusion criteria were, Pharmacists who were not interested in participating, and person without a pharmacy background. The survey was carried out in Kalaburagi city and was divided into two groups North (test) and South (control). The test group received counseling regarding the methods of disposal of unused and expired medicines and leaflets, whereas the control group received only leaflets.

RESULTS AND DISCUSSIONS:

TABLE NO 1. DETAILS OF KNOWLEDGE SCORES IN PRE AND POST-INTERVENTION

Details of Knowledge Assessment				
Group	PRE (MEAN±SD)	POST (MEAN±SD)	PAIRED T-TEST	P-VALUE
TEST Group	3.93±1.33	6.74±1.06	-26.93	0.0001
Control Group	4.03±1.39	3.59±1.49	5.01	0.0001

TEST GROUP: The present study involves a test group, the pre-intervention mean score is 3.93 and the standard value is 1.33. After pharmacist intervention, the Post-intervention values were improved with 6.74 as the mean score and a standard value of 1.06. It was found that the T-value is -26.93 and with the P-value 0.0001 depicting it's statistically highly significant.
CONTROL GROUP:The present study involves a control group, Pre-intervention mean score is 4.03 and the standard value is 1.39. In the Post-intervention, as the pharmacists were not educated, the values were found to be decreased with a mean score of 3.59 and a standard value is 1.49. it was found that the T-value is 5.01 with the P-value 0.0001 depicting it's statistically significant.

TABLE NO 2.DETAILS OF ATTITUDE SCORES IN PRE AND POST-INTERVENTION

TEST GROUP:The present study involves a test group, in which the Pre-intervention mean score is 3.22 and the standard value is 0.89. In the Post-intervention, the values were improved with a mean score of 3.67 and a standard value is 0.52. It was found that the T-value is -6.505 and P-value is 0.0001, depicting it's statistically highly significant.

CONTROL GROUP:Present study involves a control group, In the Pre-intervention mean score is 3.10, and the standard value is 0.90. In the Post-intervention, the values were found to decrease with a mean score of 1.55 and a standard value of 1.05. It was found that the T-value is 20.825 and P-value is 0.0001 stating that it is statistically highly significant.

TABLE NO. 3 DETAILS OF PRACTICE SCORES IN PRE AND POST-INTERVENTION

Details of Practice Assessment				
Group	PRE (MEAN±SD)	POST (MEAN±SD)	PAIRED T-TEST	P-VALUE
TEST Group	2.77±1.00	4.56±1.07	-20.10	0.0001
Control Group	2.94±1.15	2.46±1.16	5.503	0.0001

TEST GROUP:The study involves a test group. In the Pre-intervention, the mean score is 2.77 and the standard value is 1.00. In the Post-intervention, the values were improved with a mean score of 4.56 and a standard value of 1.07. It was found that the T-value is -20.10 with the P-value 0.0001 which states that it is statistically highly significant.
CONTROL GROUP:The study involves a control group. In the Pre-intervention, the mean score is 2.94 and the standard value is 1.15. In the Post-intervention, we noticed that the values decreased, the mean score was 2.46 and the standard value was 1.16. It was found that the T-value is 5.503 with a P-value of 0.0001 which states that, it is highly significant.

TABLE NO. 4COMPARES PRE AND POST-TOTAL KAP SCORES IN THE TEST AND CONTROL GROUP

TOTAL KAP SCORES

Details of Attitude Assessment				
Group	PRE (MEAN±SD)	POST (MEAN±SD)	PAIRED T-TEST	P-VALUE
TEST Group	3.22±0.89	3.67±0.52	-6.505	0.0001
Control Group	3.10±0.90	1.55±1.05	20.825	0.0001

Group	PRE (MEAN±SD)	POST (MEAN±SD)	PAIRED T-TEST	P-VALUE
TEST Group	9.92±1.96	14.97±1.80	-30.64	0.0001
Control Group	10.07±2.29	7.59±2.59	16.197	0.0001

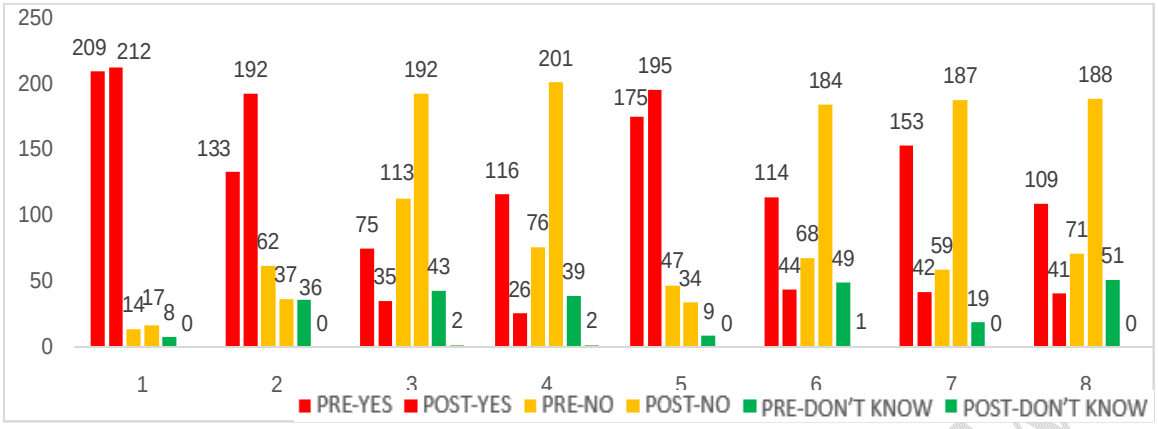
TEST GROUP:The present study involves a test group. In the Pre-intervention, the mean score is 9.92 and the standard value is 1.96. In the Post-intervention, the values were improved with a mean score of 14.97 and a standard value of 1.80. It was found that the T-value is -30.64 with a P-value of 0.0001 which states that, it is highly significant.

CONTROL GROUP:The present study involves a control group. In the Pre-intervention, the mean score is 10.07 and the standard value is 2.29. In the Post-intervention, the values were decreased with a mean score of 7.59 and a standard value of 2.59. It was found that the T-value is 16.197 with a P-value of 0.0001 which states that, it is highly significant.

TABLE NO 5. DETAILS OF KNOWLEDGE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE TEST GROUP

SL. NO	QUESTIONNAIRES	PRE-INTERVENTION			POST-INTERVENTION		
		YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
1	Before buying any medications, do you make sure to check their expiration date?	209	14	8	212	17	0
	PERCENTAGE%	90.4	6.06	3.46	92.5	7.42	0
2	Do you know the procedure for disposing of nearly expired medicines?	133	62	36	192	37	0
	PERCENTAGE%	57.57	15.5	15.5	83.8	16.1	0
3	Does your pharmacy presently contain any drugs that you do not intend to use?	75	113	43	35	192	2
	PERCENTAGE%	32.4	48.9	18.6	15.2	83.8	0.87
4	Do you know the average shelf life of the medicines?	116	76	39	26	201	2
	PERCENTAGE%	50.2	32.9	16.8	11.3	87.7	0.87
5	Are you aware that medications have the potential to harm the environment?	175	47	9	195	34	0
	PERCENTAGE%	75.7	20.3	3.89	85.1	14.8	0
6	Have you ever gotten instructions on what to do with old or unwanted medications?	114	68	49	44	184	1
	PERCENTAGE%	49.3	29.4	21.2	19.2	80.3	0.43
7	Do you dispose of leftover medicines monthly?	153	59	19	42	187	0
	PERCENTAGE%	66.2	25.5	8.22	18.3	81.6	0
8	Do you know different guidelines for the safe disposal of drugs?	109	71	51	41	188	0
	PERCENTAGE%	47.1	30.7	22.07	17.9	82.09	0

FIGURE NO 1. KNOWLEDGE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE TEST GROUP



- A total number of 461 pharmacists were included in our study, out of which, we randomly selected the North and south group naming them as test and control group respectively. The test group contains 231 pharmacist and the control group contains 230 pharmacists.

- In the test group, about 231 pharmacists in the pre-intervention and in the post- intervention we had 229, 2 dropouts were seen in the test group.

1. In Kalaburagi city, out of 231 pharmacists about 209 (90.4%) of the pharmacists told that they check the expiry date of the medicines before purchasing, 14 (6.06%) do not check the expiry date of the medicines and about 8 (3.46 %) however, don't know about it, in Pre-intervention. In the Post-intervention, there were two dropouts, out of 229 pharmacists, about 212 (92.2%) check the expiry date of the medicines before purchasing, 17 (7.42%) did not check the expiry date. This shows after educating the pharmacists about the need to check the medicines was improved as most of the pharmacists check the expiry of the medicines.

2. Out of 231 pharmacists, In Pre- intervention, 133 (57.57%) knew how to dispose of nearly expired medicines, 62 (26.8%) did not know how to dispose of the nearly expired medicines and 36 (15.5%) do not know about the disposal of nearly expired medicines. In the Post-intervention, out of 229, 192 (83.8%) knew how to dispose of nearly expired medicines, 37 (16.1%) did not know how to dispose of the nearly expired medicines. This shows that the pharmacists knowledge was improved in the post intervention.

3. It is interesting to know in Pre-intervention, 75 (32.4%) currently had unused medications stored at their pharmacies, 113 (48.9%) did not store any unused medications stored at their pharmacies and 43 (18.6%) do not know whether they stored any unused medications at their pharmacies. In Post-intervention, 35 (15.2%) currently had unused medications stored at their pharmacies, 192 (83.8%) did not store any unused medications stored at their pharmacies and 2 (0.87%) do not know whether they stored any unused medications at their medications. This clearly indicates, Post-intervention the pharmacists knowledge enhanced about the storage of the unused medications currently.

4. While interacting with the pharmacists, out of 231 in Pre-intervention, 116 (56.2%) said they knew about average shelf life of the medicines, 76 (32.9%) did not know about the average shelf life, 39 (16.8%) don't know about it. In the post-intervention, 26 (11.3%) knew about average shelf life of the medicines, 201 (87.7%) did not know about the average shelf life and 2 (0.87%) knew anything about it.

5. It was compelling to know, 175 (75.7%) of them, knew drugs can cause environmental pollution, 47 (20.3%) did not know about, 9 (3.87%) don't know anything about the drug causing environmental pollution in the Pre-intervention. In the Post-intervention, 195 (85.1%) knew drugs can cause environmental pollution, 34 (14.8%) did not know about it. This clearly states, that most of the pharmacists knows about the drugs can causeenvironmental pollution. The current study results were similar to Siva Shree Rajgopalan Suresh babu et.al.[19]

6. Out of 231 pharmacists, 114 (49.3%) received information about how to dispose unused and unwanted medicines, 68 (29.4%) did not receive any information, 49 (21.2%) don't know about it. In the post intervention, 44 (19.2%) received information, 184 (80.3%) did not receive information about it, 1 (0.43%) don't know about it.

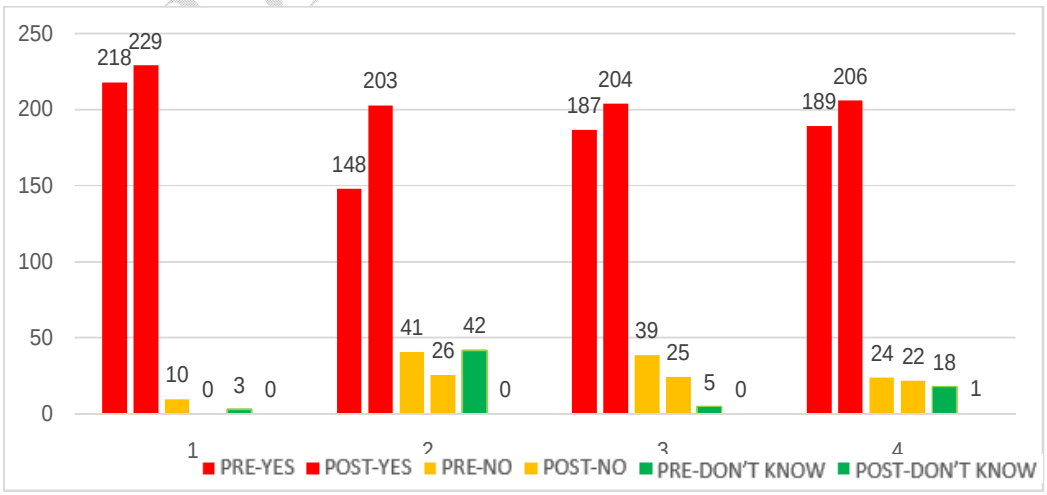
7. Out of 231 pharmacists, 153 (66.2%) dispose left over medicines monthly, 59 (25.5%) don't dispose of medicines monthly, 19 (8.22%) don't know about it. In the Post-intervention, 42 18.3% dispose left over medicines monthly, 187 (81.6%) don't dispose of medicines monthly. In the intervention, we got to know that, the pharmacists dispose of the medicines for every 2-3 months.

8. Out of 231 pharmacists, 109 (47.1%) know different guidelines for safe disposal of drugs, 71 (30.7%) said they did not know about it and 51 (22.07%) did not know anything about it. In the Post-intervention, 41 (17.9%) know different guidelines for disposal of drugs, 188 (82.09%) did not now different guidelines.

TABLE NO. 6 DETAILS OF ATTITUDE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE TEST GROUP

SL. NO	QUESTIONNAIRES	PRE-INTERVENTION			POST-INTERVENTION		
		YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
1	Is a program to gather medications from pharmacies necessary, in your opinion?	218	10	3	229	0	0
	PERCENTAGE (%)	94.3	4.32	1.29	100	0	0
2	Do you have any suggestions to improve the awareness of consumers regarding the safe disposal of medicines?	148	41	42	203	26	0
	PERCENTAGE (%)	64.06	17.7	18.18	88.6	11.3	0
3	Do you agree that improper dispensing of expired and unused medicines can pose hazards to public safety?	187	39	5	204	25	0
	PERCENTAGE (%)	80.9	16.8	2.16	89.08	10.9	0
4	Is the development of antibiotic resistance a real possibility due to improperly discarded medications?	189	24	18	206	22	1
	PERCENTAGE (%)	81.8	10.3	7.79	89.9	9.60	0.43

FIGURE NO. 2ATTITUDE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE TEST GROUP



1. In the Pre-Intervention, out of 231, 218 (94.3%) agreed that, there is a need for a program to collect medicines from pharmacy, 10 (4.32 %) said that there is no need for a program to collect medicines from pharmacy and 3 (1.29 %) did not agree with anything. In Post-Intervention, out of 229, everyone agreed that, there is a need for a program to collect medicines from pharmacy. This signifies, that all pharmacists are ready to collect the medicines from the pharmacy.

2. In Pre-Intervention, out of 231, 148 (64.06%) had suggestions to improve awareness of consumers regarding safe disposal of medicines, 41 (17.7%) did not have any suggestions, 42 (18.18 %) did not know anything about it. In Post-Intervention, out of 229, 203 (88.6%) had suggestions to improve awareness of consumers regarding safe disposal of medicines, 26 (11.3%) did not have any suggestions. This signifies that after educating the pharmacists about the need of awareness, they had multiple suggestions.

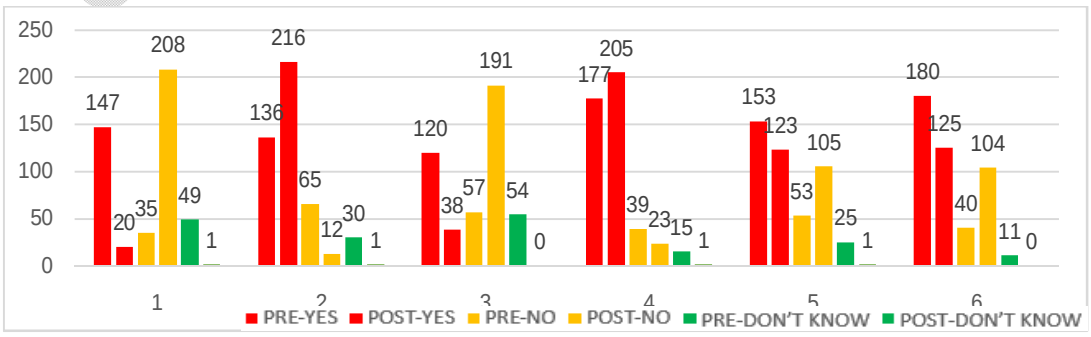
3. In Pre-Intervention, out of 231, 187 (80.9%) agreed that improper dispensing of expired and unused medicines can pose hazards to public safety, 39 (16.8%) disagreed that improper dispensing do not pose any hazards and 5 (2.16%) did not know about it. In Post-Intervention, out of 229, 204 (89.08%) agreed that improper dispensing can pose hazards, 25 (10.9%) disagreed that improper disposing do not pose any hazards. This shows that, after education pharmacists understood that improper dispensing of unused and expired medicines can pose hazards to public safety. The current study results were similar to Binu K.M et.al.[20]

4. In Pre-Intervention, out of 231, 189 (81.8%) agreed that unsafe disposed drugs can lead to antibiotic resistance, 24 (10.3%) disagreed that unsafe disposed drugs can lead to antibiotic resistance, 18 (7.79%) did not had anything to say about it. In Post-Intervention, out of 229, 206 (89.9%) agreed that unsafe disposed dugs can lead to antibiotic resistance, 22 (9.60%) disagreed and 1 (0.43%) did not say anything about it. This signifies that pharmacists knew that unsafe disposed drugs can lead to antibiotic resistance.

TABLE NO. 7 DETAILS OF PRACTICE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE TEST GROUP

SL. NO	QUESTIONNAIRES	PRE-INTERVENTION			POST-INTERVENTION		
		YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
1	Do you know about national take-back programs in other countries for the return of medications from pharmacies?	147	35	49	20	208	1
	PERCENTAGE (%)	63.6	15.15	21.2	8.73	90.82	0.43
2	Do you agree with the opinion of having your pharmacy take back leftover or expired medicines?	136	65	30	216	12	1
	PERCENTAGE (%)	58.8	28.1	12.9	94.32	5.24	0.43
3	If a patient brings to you some leftover medicines or expired medications for safe disposal. Would you accept it?	120	57	54	38	191	0
	PERCENTAGE (%)	51.94	24.6	23.3	16.59	83.40	0
4	Do you agree that it is your professional responsibility to be concerned about the safety of humans and other living species on the earth?	177	39	15	205	23	1
	PERCENTAGE (%)	76.6	16.8	6.49	89.51	10.04	0.43
5	Are there any medication safety posters up in your pharmacy?	153	53	25	123	105	1
	PERCENTAGE (%)	66.2	22.9	10.8	53.711	45.85	0.43
6	If there is a course on the take-back program, would you be interested in taking part in it?	180	40	11	125	104	0
	PERCENTAGE (%)	77.9	17.3	4.76	54.58	45.41	0

FIGURE NO. 3PRACTICE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE TEST GROUP



1. In Pre-Intervention, out of 231, 147 (63.6 %) knows, about the take back programmes in other countries for return of medications from pharmacies, 35 (15.15%) does not know about the take back programmes, 49 (21.2%) did not know anything about it. In Post-Intervention, out of 229, 20 knows, about the take back programmes and 208 (90.82 %) does not know about the take back programmes, 1 (0.43%) did not know anything about it. This signifies that pharmacists were not aware of the take back programmes in the other countries.

2. In Pre-Intervention, out of 231, 136 (58.8%) agreed with the opinion of having take back of left over or expired medicines in their pharmacies, 65 (28.1%) disagreed with the opinion, 30 (12.9%) did not had anything to say. In Post-Intervention, out of 229, 216 (94.32%) agreed with the opinion, 12 (5.24%) disagreed with the opinion, 1 (0.43%) still had no idea about it. This signifies that pharmacists were ready to accept the left over or expired medicines in their pharmacies.

3. In Pre-Intervention, out of 231, 120 (51.94%) said that they will accept, if any patient gets some left over or expired medications for safe disposal, 57 (24.6%) said they will not accept, 54 (23.3 %) had no idea about it. In Post-Intervention, out of 229, 38 (16.59%) said that they will accept, 191 (83.40%) said they will not accept it. This shows that the pharmacists are not willing to accept the left over or expired medicines from patients for safe disposal.

4. In Pre-Intervention, out of 231, 177 (76.6 %) agreed that, it is professional responsibility to be concerned about the safety towards human and other living species on the earth, 39 (16.8 %) disagreed with it, 15 (6.49 %) said that, they don't know about it. In Post-Intervention, out of 229, 205 (89.51 %) agreed that, it is professional responsibility, 23 (10.04 %) disagreed to it, 1 (0.43 %) said they don't know about it. This shows that the pharmacists were concerned about the safety of humans and other living species.

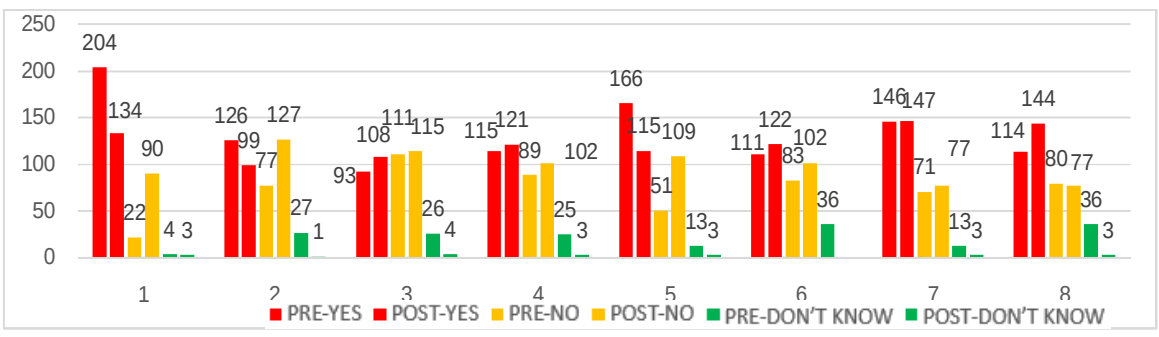
5. In Pre-Intervention, out of 231, 153 (66.2 %) said, they have posters about drug safety in their pharmacies, 53 (22.9 %) said, they don't have any posters about drug safety, 25 (10.8 %) said, they don't know about drug safety posters. In Post-Intervention, out of 229, 123 (53.41 %) said, they have posters about it, 105 (45.8 %) said, they don't have any posters about it, 1 (0.43 %) said, that they don't know about it. This shows that most of the pharmacists, did not display posters about drug safety in their pharmacies.

6. In Pre-Intervention, out of 231, 180 (77.9 %) agreed to participate in a educational course on take back program, 40 (17.3 %) disagreed to participate, 11 (4.76 %) said they don't know about it. In Post-Intervention, out of 229, 125 (54.58 %) agreed to participate, 104 (45.41 %) disagreed. This shows that, most of the pharmacists agreed to participate in the take back program.

TABLE NO. 8DETAILS OF KNOWLEDGE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE CONTROL GROUP

SL. NO	QUESTIONNAIRES	PRE-INTERVENTION			POST-INTERVENTION		
		YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
1	Do you check the expiry date of the medicines before purchasing?	204	22	4	134	90	3
	PERCENTAGE (%)	88.69	9.56	1.73	59.03	39.64	1.32
2	Do you know the procedure for disposing of nearly expired medicines?	126	77	27	99	127	1
	PERCENTAGE (%)	54.78	33.47	11.73	43.61	55.94	0.44
3	Are there any medications in your pharmacy that you aren't using right now?	93	111	26	108	115	4
	PERCENTAGE (%)	40.43	48.26	11.30	47.57	50.66	1.76
4	Do you know the average shelf life of the medicines?	115	91	25	121	103	3
	PERCENTAGE (%)	50	39.56	10.86	53.30	45.37	1.32
5	Do you know drugs can cause environmental pollution?	166	51	13	115	109	3
	PERCENTAGE (%)	72.17	22.17	5.65	50.66	48.01	1.32
6	Have you ever gotten instructions on what to do with old or unwanted medications?	111	83	36	122	102	3
	PERCENTAGE (%)	48.26	36.08	15.65	53.74	44.93	1.32
7	Do you dispose of leftover medicines monthly?	146	71	13	147	77	3
	PERCENTAGE (%)	63.47	30.86	5.65	64.75	33.92	1.32
8	Do you know different guidelines for the safe disposal of drugs?	114	80	36	174	77	3
	PERCENTAGE (%)	49.56	34.78	15.65	64.75	33.92	1.32

FIGURE NO. 4KNOWLEDGE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE CONTROL GROUP



- In the Control group, we had 230 pharmacists in the pre-intervention and in the post-intervention we had 227, 3 dropouts were seen in the control group.

1. In Kalaburagi city, out of 230 pharmacists about 204 (88.69%) of the pharmacists check the expiry date of the medicines before purchasing, 22 (9.56 %) do not check the expiry date of the medicines and about 4 (1.73 %) do not know about it, in Pre-intervention. In the Post-intervention, there were three dropouts, out of 227 pharmacists, about 134 (59.03%) check the expiry date of the medicines before purchasing, 90 (39.64%) did not check the expiry date, 3 (1.32 %) do not know about it.

2. Out of 230 pharmacists, In Pre- intervention, 126 (54.78 %) knew how to dispose of nearly expired medicines, 77 (33.47 %) did not know how to dispose of the nearly expired medicines and 27 (11.73 %) do not know about the disposal of nearly expired medicines.
In the Post-intervention, out of 227, 99 (43.61 %) knew how to dispose of nearly expired medicines, 127 (55.94 %) did not know how to dispose of the nearly expired medicines and 1 (0.44 %) do not know about it.

3. In Pre-intervention, 93 (40.43%) currently had unused medications stored at their pharmacies, 111 (48.26%) did not store any unused medications stored at their pharmacies and 26 (11.30%) do not know whether they stored any unused medications at their pharmacies. In Post-intervention, 108 (47.57 %) currently had unused medications stored at their pharmacies, 115 (50.66%) did not store any unused medications stored at their pharmacies and 4 (1.76%) do not know whether they stored any unused medications at their medications.

4. While interacting with the pharmacists, out of 230 in Pre-intervention, 115 (50 %) said they knew about average shelf life of the medicines, 91 (39.56%) did not know about the average shelf life, 13 (10.86 %) do not know about it. In the post-intervention, 121 (53.30%) knew about average shelf life of the medicines, 109 (10.3%) did not know about the average shelf life and 3 (1.32%) knew anything about it.

5. Out of 230 pharmacies, 166 (72.17%) of them, knew drugs can cause environmental pollution, 83 (22.17%) did not know about, 36 (5.65 %) do not know anything about the drug causing environmental pollution in the Pre-intervention. In the Post-intervention, 115 (50.66%) knew drugs can cause environmental pollution, 109 (48.01%) did not know about it, 3 (1.32 %) do not know anything about it.

6. Out of 230 pharmacists, 111 (48.26%) received information about how to dispose unused and unwanted medicines, 83 (36.08 %) did not receive any information, 36 (15.65 %) do not know about it. In the post intervention, 122 (53.74%) received information, 102 (44.93%) did not receive information about it, 3 (1.32%) do not know about it.

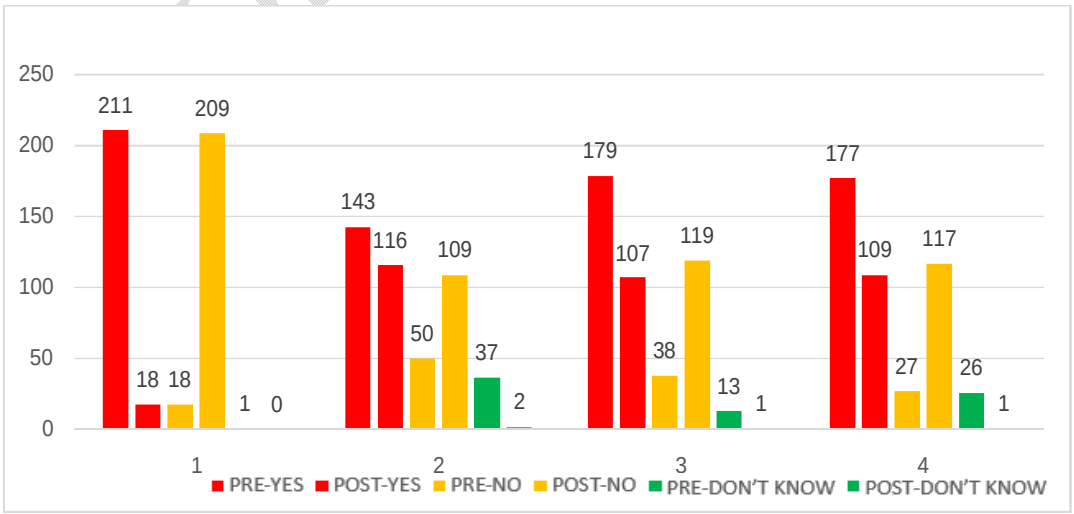
7. Out of 230 pharmacists, 146 (63.47%) dispose left over medicines monthly, 71 (30.86%) do not dispose of medicines monthly, 13 (5.65%) do not know about it. In the Post-intervention, 147 (64.75%) dispose left over medicines monthly, 77 (33.92%) do not dispose of medicines monthly, 3 (1.32 %) do not know anything about it. In the intervention, we got to know that, the pharmacists dispose of the medicines for every 2-3 months.

8. Out of 230 pharmacists, 114 (49.56 %) know different guidelines for safe disposal of drugs, 80 (34.78%) said they did not know about it and 36 (15.65%) did not know anything about it. In the Post-intervention, 174 (64.75%) aware of different guidelines for disposal of drugs, 77 (33.92%) did not now different guidelines, 3 (1.32 %) do not know anything about it. The current study results were similar to Siva Shree Rajgopalan Suresh Babu et.al.[19]

TABLE NO. 9 DETAILS OF ATTITUDE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE CONTROL GROUP.

SL. NO	QUESTIONNAIRES	PRE-INTERVENTION			POST-INTERVENTION		
		YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
1	What is your opinion on the need of a program to retrieve medications from pharmacies?	211	18	1	18	209	0
	PERCENTAGE (%)	91.73	7.82	0.43	7.92	92.07	0
2	Do you have any suggestions to improve the awareness of consumers regarding the safe disposal of medicines?	143	50	37	116	109	2
	PERCENTAGE (%)	62.17	21.73	16.08	51.10	48.01	0.88
3	Do you agree that improper dispensing of expired and unused medicines can pose hazards to public safety?	179	38	13	107	119	1
	PERCENTAGE (%)	77.82	16.52	5.65	47.13	52.42	0.44
4	In your opinion, can antibiotic resistance be caused by improperly disposed of drugs?	177	27	26	109	117	1
	PERCENTAGE (%)	76.95	11.73	11.30	48.01	51.54	0.44

FIGURE NO 5. ATTITUDE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE CONTROL GROUP



1. In the Pre-Intervention, out of 230, 211 (91.73%) agreed that, there is a need for a program to collect medicines from pharmacy, 18 (7.83 %) said that there is no need for a program to collect medicines from pharmacy and 1 (0.43 %) did not agree with anything. In Post-Intervention, out of 227, 18 (7.92%) agreed that, there is a need for a program to collect medicines from pharmacy, 209 (92.07%) disagreed with it.

2. In Pre-Intervention, out of 230, 143 (62.17%) had suggestions to improve awareness of consumers regarding safe disposal of medicines, 50 (21.73%) did not have any suggestions, 37(16.08 %) did not know anything about it. In Post-Intervention, out of 227, 116 (51.10%) had suggestions to improve awareness of consumers regarding safe disposal of medicines, 109 (48.01%) did not have any suggestions, 2 (0.88 %) do not know about it.

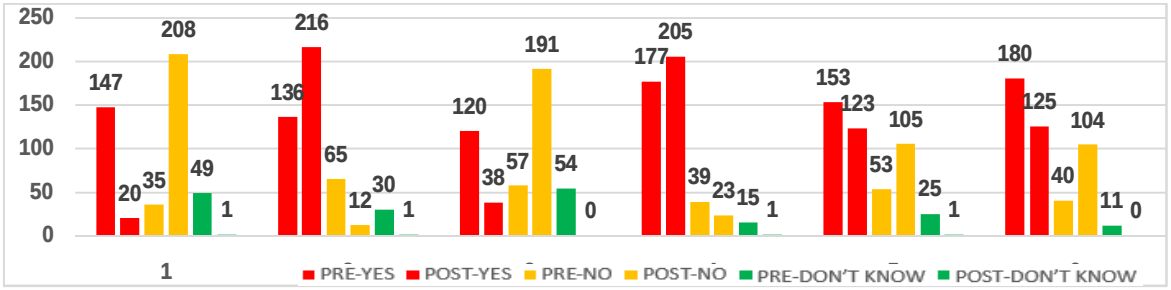
3. In Pre-Intervention, out of 230, 179 (77.82%) agreed that improper dispensing of expired and unused medicines can pose hazards to public safety, 38 (16.52%) disagreed that improper dispensing do not pose any hazards and 13 (5.65%) did not know about it. In Post-Intervention, out of 227, 107 (47.13%) agreed that improper dispensing can pose hazards, 119 (52.42%) not agreed that improper disposing do not pose any hazards, 1 (0.44 %) don't know about it.

4. In Pre-Intervention, out of 230, 177 (76.95%) agreed that unsafe disposed drugs can lead to antibiotic resistance, 27 (11.73%) disagreed that unsafe disposed drugs can lead to antibiotic resistance, 26 (11.30%) did not had anything to say about it. In Post-Intervention, out of 227, 109 (48.01%) agreed that unsafe disposed dugs can lead to antibiotic resistance, 117 (51.54%) not agreed and 1 (0.44%) did not say anything about it.
   The current study results were similar to Siva Shree Rajgopalan Suresh Babu et.al.[19]

TABLE NO. 10 DETAILS OF PRACTICE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE CONTROL GROUP

SL NO	QUESTIONNAIRES	PRE-INTERVENTION			POST-INTERVENTION		
		YES	NO	DON'T KNOW	YES	NO	DON'T KNOW
1	Do you know about national take-back programs in other countries for the return of medications from pharmacies?	160	43	27	164	53	10
	PERCENTAGE (%)	69.56	18.69	11.73	72.24	23.34	4.40
2	Do you agree with the opinion of having your pharmacy take back leftover or expired medicines?	163	55	12	99	126	2
	PERCENTAGE (%)	70.86	23.91	5.21	43.61	55.50	0.88
3	If a patient brings to you some leftover medicines or expired medications for safe disposal. Would you accept it?	129	77	24	138	85	4
	PERCENTAGE (%)	56.08	33.47	10.43	60.79	37.44	1.76
4	Do you agree that it is your professional responsibility to be concerned about the safety of humans and other living species on the earth?	165	51	14	107	119	1
	PERCENTAGE (%)	71.73	22.17	6.08	47.13	52.42	0.44
5	Are there any medication safety posters displayed in your pharmacy?	159	60	11	139	86	2
	PERCENTAGE (%)	69.13	26.08	4.78	61.23	37.88	0.88
6	If there is a course on the take-back program, would you be interested in taking part in it?	170	42	18	128	92	7
	PERCENTAGE (%)	73.91	18.26	7.82	56.38	40.52	3.08

FIGURE NO. 6PRACTICE SCORES GIVEN BY THE PHARMACISTS TO QUESTIONNAIRES IN THE CONTROL GROUP



1. In Pre-Intervention, out of 230, 160 (69.56 %) knows, about the take back programs in other countries for return of medications from pharmacies, 43 (18.69%) does not know about the take back programs, 27 (11.73%) did not know anything about it. In Post-Intervention, out of 227, 164 (72.24%) knows, about the take back programs and 43 (18.69 %) does not know about the take back programs, 27 (11.73%) did not know anything about it.

2. In Pre-Intervention, out of 230, 163 (70.86%) agreed with the opinion of having take back of left over or expired medicines in their pharmacies, 55 (23.91%) disagreed with the opinion, 12 (5.21%) did not had anything to say. In Post-Intervention, out of 227, 99 (43.61%) agreed with the opinion, 126 (55.50%) disagreed with the opinion, 2 (0.88%) still had no idea about it.

3. In Pre-Intervention, out of 230, 129 (56.08%) said that they will accept, if any patient gets some left over or expired medications for safe disposal, 77 (33.47%) said they will not accept, 24 (10.43 %) had no idea about it. In Post-Intervention, out of 227, 138 (60.79%) said that they will accept, 85 (37.44%) said they will not accept it, 4 (1.76 %) said they don't know about it.

4. In Pre-Intervention, out of 230, 165 (71.73 %) agreed that, it is professional responsibility to be concerned about the safety towards human and other living species on the earth, 51 (22.17 %) disagreed with it, 14 (6.08 %) said that, they don't know about it.
In Post-Intervention, out of 227, 107 (47.13 %) agreed that, it is professional responsibility, 119 (52.42 %) disagreed to it, 1 (0.44 %) said they don't know about it.

5. In Pre-Intervention, out of 230, 159 (69.13 %) said, they have posters about drug safety in their pharmacies, 60 (26.08 %) said, they don't have any posters about drug safety, 11 (4.78 %) said, they don't know about drug safety posters.
In Post-Intervention, out of 227, 139 (61.23 %) said, they have posters about it, 86 (37.88 %) said, they don't have any posters about it, 2 (0.44 %) said, that they don't know about it.

6. In Pre-Intervention, out of 230, 170 (73.91 %) agreed to participate in an educational course on take back program, 42 (18.26 %) disagreed to participate, 18 (7.82 %) said they do not know about it. In Post-Intervention, out of 227, 128 (56.38 %) agreed to participate, 92 (40.52 %) disagreed, 7 (3.08%) do not know about it.

CONCLUSION

- The current KAP research of Kalaburagi city's chosen community pharmacists focuses on their understanding of, and approach to, proper medication disposal for unused and expired medications.
- A serious problem that need attention is the lack of knowledge about the consequences of incorrectly disposing of prescription items.
- When it comes to collecting and disposing of unneeded medications, the present procedures and techniques used by pharmacists are not up to par.
- The concerns are brought to light by highlighting the role of pharmacists.
- A combination of policies and initiatives may safeguard people and the environment by reducing potential dangers.
- Our research shows that in Kalaburagi city, community pharmacists outperform their government and hospital counterparts when it comes to understanding the need of safe medication disposal and taking measures to avoid it.
- We educated them on how to properly dispose of unneeded and expired medications, administered surveys, distributed pamphlets, and showed them movies and clips as part of our baseline research.
- Additionally, we find that pharmaceutical compounds are a class of new environmental pollutants in our research. Veterinary health is crucial since even minute concentrations pose a significant threat because to their persistent release into the environment and the damage they do to both people and ecosystems.
- Prior to the release of every new medication, it is now standard practice to conduct an environmental risk assessment. Pharmaceutical companies and universities should do research on eco-pharmacovigilance, and there should be rules and regulations about eco-pharmacovigilance rational medicine, drug tack-back programs, strengthened policies, and guidelines. The field known as "Eco-Pharmacovigilance" emerged as a result of this.
- With the country's pharmaceutical sector and medicine use on the rise, India has a duty to its own people, environment, and global ecosystem.

LIMITATIONS

1. Lack of knowledge regarding the safe disposal of medicines among some community pharmacies as well as among the general public.
2. Lack of government programs such as medicine take-back programs.
3. Time management problems, language, and communication barriers
4. Availability of participants and willingness to participate in the study.

FUTURE PERSPECTIVES

1. Based on the findings of the aforementioned research, it is clear that a worldwide system is required for the mandatory collecting of families' unused and expired medications.
2. In addition to the system, there has to be an awareness campaign to teach the public about safe disposal methods and the negative outcomes that might result from individuals not following these protocols.
3. Pharmacies should be educated regarding safe disposal of medicines and pharmaceutical products.
4. Drug take-back and other educational initiatives should be encouraged in our country.
5. Keeping a global EPV perspective.
6. A number of mass media platforms should be actively engaged in raising awareness.
7. It is important to establish appropriate channels that include drug regulatory agencies, population control boards, non-governmental organizations (NGOs), and civil society.

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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