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DRUG DISPOSAL VIGILANCE (A REVIEW ARTICLE)

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ABSTRACT
Knowledge regarding the safe disposal of pharmaceutical products has not been sufficiently addressed yet. Safe disposal of drugs is discarding them in a way to prevent the abuse and misuse of drugs. This vigilance is important to reduce the medication waste generated from the production factories, from overprescribing of drugs by healthcare providers, expired drugs, opened drug containers and partially used medication. Patients usually dispose of unused drugs that remain after the end of medical treatment in the trash. Throwing them is often not the safest way and flushing may contaminate the water supply. Thus, inappropriate disposal of drugs can cause drug pollution. Almost all medicines, except those on the FDA Flush List, can be thrown into your household trash by suitable ways. For disposal of drugs in large amounts, organizations might choose to return them to the manufacturer, putting them in landfills, using incineration (medium and high temperatures) or dumping the drugs into sewers. The U.S. Food and Drug Administration (FDA) tells us which medicines should be flushed when they are no longer needed. Also, particular attention must be given to the disposal of controlled substances, anti-cancer drugs, antiseptics, and disinfectants. World Health Organization (WHO), European Union (EU), and FDA have developed guidelines for safe disposal of pharmaceuticals. The National Association of Drug Diversion Investigators (NADDI) sponsors a website to locate Rx Drug Drop Boxes for safe medication disposal.

KEYWORDS: Safe disposal, FDA Flush List, Drug drop boxes.

I. INTRODUCTION
Every year, thousands of drugs are used to treat diseases and to improve the health of the increasing population of India. But when these drugs are no longer required, their disposal becomes necessary for every drug is a chemical and once it expires it will end up being a toxic agent.[18] A study demonstrated that more than 50% of the medications are inappropriately prescribed and merely half of the patients take their prescriptions rationally. Medication adherence is even lower in developing countries. This leads to piling up of unused and expired medicines in homes, ending up in landfills, sewers, and water supplies. Prescription medicines often aggregate in households due to patient non-compliance, change in prescription by a prescriber, improvement in clinical manifestation and medication discontinuation due to change in dose, adverse effect or drug expiration. However, self-discontinuation by people holds the leading cause behind the increase in unused and expired medicines.

The initial idea of having unwanted or unused medicines at home was foreseeing its use in the future, followed by the expiration of medicines and self-discontinuation whereas the change in prescription was the least possible reason.[2] In clinical practice, it is required to adjust drug therapy as per the patient's response which may need switching from one drug to another, leading to a portion of the first drug being wasted. A report stated that the majority (85.4%) of discarded medicines are scheduled drugs and roughly 44% of them remain within their expiry dates. Poor adherence adds to suboptimal clinical benefits pointing to the therapeutic complexities of the disease, reduced quality of life, and waste of healthcare resources. These outcomes weaken the ability of healthcare systems to achieve community health goals.[12]

Typically patients read and store medicines as per the storage directions on the label and 88% of them check the expiry date before taking medicines.[2] Pharmaceutical industry guarantees the potency and

safety of medicines until the expiry date. The expiry date for medicines is commonly 2-5 years from the date of production. If the medicines are stored under optimal conditions, drugs may hold 90% of their potency even after the expiry date. In the case of antibiotics, consuming expired medicines can further add to increased resistance and treatment failures. Hence, the expired drugs can't be advised for human consumption since there will be no legal help for compensation of any type of adverse effect happened as the manufacturer cannot be blamed for it.[1]

Interestingly, some people claim that once their disease condition improves, the unused drugs are stored for later use. On storing medicines at home, many people do not know how to properly dispose of them and ultimately become expire or unusable. Throwing drugs in the garbage is the most obvious means of disposal. Flushing drugs in the sink or toilet is another way to get rid of them. Few incinerate in homes. Others not confident of what to do with such drugs keep them in homes and even give to others who require similar medications.[19]

India continues to have the difficulty in disposing of expired, unused and unwanted medicines due to lack of clear rules.[1-2] While unused drugs may develop self-medication tendencies and the risk for paediatric toxicity due to storage in improper places, expired drugs pose toxicity risk and threaten environment health due to inappropriate disposal practices.[8] The municipal organizations taking care of the waste have not been sensitized to it and the community is faraway to take up this issue.[1] The widely used techniques for throwing drugs in India are garbage and sink.[3] Ultimately, it can prompt a direct effect on public safety and environmental hazard.[2] Regardless of being such a big consumer country, regulatory guidelines for safe disposal of medications in India are yet missing, and drug take-back programs are not exactly effective.[3]

II. WHY IS SAFE DISPOSAL NECESSARY?

The abundance of modern medicines let people live longer and healthier lives. In 2014, more than 4 billion prescription drugs were recorded by drugstores in the U.S. These privileges come with concerns: When a drug is no longer needed, or useful, how do users get rid of them safely? Some may challenge- why should I get rid of medicines that I have paid for? What if I need them someday? The solution is simple that unneeded drugs cause risk to the people who own them, their loved ones, and their society. Also, the proper disposal of drugs is essential as some of them carry strong chemicals that are used unintentionally, leading to overdoses. Some can be misused deliberately to get high. Others can harm the ecosystem. In brief, just as prescription drugs are prescribed precisely, they must be disposed of precisely.[11]

Undesirable prescription medication misuse, overstocking, self-medication, unintended overdose, and even death are the serious effects of improper drug disposal. Patients keep medicines because they don't want to waste them, they don't know how to read and check the expiry date, or they don't know the proper way of disposing drugs.[5] The medicine cupboards at home are an origin that adds to prescription drug abuse and drug overdose epidemic.[2] The American Association of Poison Control Centres (AAPCC) and the National Poison Data System (NDPS) in 2010 expressed that 30% of the overdose and death were because of unintentional ingestion of preparation or over-the-counter medications.[2,5]

A. Accidental Use

Medicines stored at home have health risks to the susceptible population of children, elders, and pets. Drug overdoses are normal among children less than 5 years old.[14] In 2009, 824 U.S. children died and an additional 116,000 were operated in the hospital emergency ward due to poisoning.[11] This is partially due to unsupervised ingestion of acetaminophen, cough and cold medications, non-steroidal anti-inflammatory drugs, and antidepressants.[11,14] So, all medicines should be safeguarded. A major component of safeguarding is getting rid of them when no longer needed.

B. Intentional Misuse

Prescriptions, particularly controlled substances, can be intentionally abused to get high. Drug usage by teens is mainly concerning as it can lead to the development of persistent substance use disorder. In 2013, Prescription Attitude Tracking Study told that one in four teens has abused or misused a prescription drug at least once in their life. Teen's initiation source for the medicines they abuse isn't a drug dealer- it is their friends, their home medicine cabinet or their friends' home medicine cabinet.

C. Health Risks

Storing drugs in the home beyond the time of need poses health risks. Expired drugs may not only be ineffective but can also be dangerous to the consumer. Sharing drugs can cause serious health outcomes. For example, if a person has a prescription for the similar medicine you planned to share; their doctor may have them on another dose or medication plan. Besides, when a medicine is shared, the user cannot validate its safety.

D. Safety Risk

The presence of prescription medicines can target your home for burglary or home invasion. A study stated that 50% of the burglars when questioned said that they look out for prescription drugs inside homes.

E. Environmental Damage

Drugs enter the environment have an adverse effect, particularly on fish and amphibians which can affect other species. Most wastewater treatment plants cannot separate medicines.[11] In 2014, Environmental Pollution assessed the concentration of 56 active pharmaceutical

ingredients over 50 large wastewater treatment plants and marked that hydrochlorothiazide, a diuretic that manages hypertension, was in every sample. Other antihypertensives (e.g. metoprolol and atenolol) and carbamazepine, the mood stabilizer was found in more than 90% of the specimens. Even trace quantities can cause deleterious health impacts such as antibiotic resistance and abnormal hormonal effects among adolescents.[20]

It is a traditional practice in India that whenever a strip of tablet is unused or expired and if not needed anymore, then the person will throw it into dustbin or may burn it along with other waste and if it is a liquid preparation, they will flush it into sink or toilet by assuming that they are clearing home from unwanted waste. In reality, they aren't clearing their homes rather are polluting the entire environment. Such methods are prevalent in every household of India. The population of India is crossing 135 crores and if every house begins to dispose of the drugs by throwing, burning or flushing, then one day, it will be difficult to treat even a single disease due to resistance problem and public health will worsen due to constant susceptibility to toxic substances.[18]

III. THE ENVIRONMENTAL IMPACT

Management of the ecosystem lifecycle of products is a prime focus for companies ranging from computers to automobiles. Historically, the concern of the lifecycle of prescription drugs ended with the dispensing of a prescription to the patient, with slight consideration given to unwanted/unused drugs.[14] Pharmaceuticals enter into the environment through human activity via waste discharge, bathing, and by direct disposal of unused medications to sewers, or trash. Pharmaceutical products dissolve quickly in water and do not evaporate at regular temperatures, and end up in earth and water bodies.[1]

A study in Ethiopia exhibited that 89.1% of medicines purchased by consumers are never really used.[3] Many unwanted and expired medicines are disposed into general waste which ends up in landfills and hence pollute the environment. They may be found by children and animals, thus increasing the chance of poisonings, misuse, or abuse. Other medicines drained by sinks and toilets not only enter waterways but also penetrate the water table thereby affecting human, animal and marine life.[12]

In the case of cancer patients, the wards don't have a separate sewage system. Untreated radioactive waste from hospitals with cancer patients straight goes in the municipal drains and may permeate to the soil, thereby spoiling the water sources which further pollute the landmass and pass to the food chain.

Detectable amounts of chemicals were observed in 80% of streams in the US. The pharmaceuticals detected were antibiotics, analgesics, anti-inflammatory, lipid regulators, beta-blockers, anticonvulsants, and steroid hormones at low concentrations. An analysis led in Taiwan Rivers also recognized the presence of Ecstasy, ketamine, caffeine, and acetaminophen. Apart from the personal contribution, there is additional pollution from pharmaceuticals used in farming. The wastewater treatment plants are not meant to manage the pharmaceutical deposits passed in the water. Improper waste disposal and ineffective treatment of wastewater pollute the freshwater that pollutes the environment.[1]

The significance of pharmaceutical waste in the environment increased after the diclofenac disaster.[6] Non-steroidal anti-inflammatory drug (NSAID) diclofenac induced kidney failure in vultures after the ingestion of carrion from cattle treated with this drug.[7] Pharmaceutical residues may also hinder reproduction and growth of aquatic life.[20] Estradiol concentrations in surface water may induce vitellogenin production and anatomical changes of sex organs in fishes and other species like frogs, alligators, and molluscs. Propanolol was perceived to cause a notable decrease in egg production in Medaka fish. Gemfibrozil brought down the blood levels of testosterone in fish. Fluoxetine impaired swimming activity in shellfish.

In India, the bacteria resistant to ciprofloxacin has been detected downstream of a pharmaceutical factory, genes for multiresistant antimicrobial have been found in drinking water, and multiresistant Salmonella has been identified in water sprayed on vegetables. The tetracyclines and quinolones aren't metabolized in the human body and can be lethal to other animals. Some broad-spectrum antibiotics were witnessed in concentrations harmful to microbes, animals, and plants. Certain pharmaceuticals have been seen in goat, cow, and human milk. Bio-accumulation of pharmaceutical products in aquatic animals, plants, and animals significantly affects human life in turn.

Hence, proper treatment of drugs (to be disposed of) should be done with a minimal impact on the environment. Water treatment should limit or eliminate the amount of these pollutants. Another process followed is biodegradation by microorganisms where bacteria feed on to break down these pollutants.[1] Declines in inappropriate disposal methods will, in turn, lead to a diminished presence of drugs in the water supply and thus reduced destruction to the environment.[20] Otherwise, the environment persists to suffer and will end with higher complexity of human life and the earth.

IV. RULES AND REGULATIONS

The consequence of drugs on the environment will outline the importance of the legislative structure in preserving the aquatic habitat and human health. The disposal habits of the individuals and the waste management committee have to be lawfully monitored. To overcome the environmental pollution generated by pharmaceuticals, there should be an administrative body

to frame rules and regulations about the disposal of products based on their chemical properties. The EU has developed disposal practices since 2004. Incineration is practiced in Germany, Luxembourg considers the unused or expired pharmaceuticals as hazardous waste; in France, the take-back program empowers individuals to bring back unused or expired pharmaceuticals back to the pharmacies.

In India, good manufacturing practices (GMPs) and requirements of premises, factory, and equipment for pharmaceutical products placed down in Schedule M of the Drugs and Cosmetic Rules, 1945, prescribe the terms for the disposal of waste including the rejected drugs.

A. The disposal of sewage and effluents (solid, liquid, and gas) from the manufacturing plant shall conform to the requirements of the environmental pollution control board.
B. All bio-medical waste (BMW) shall be destroyed as per the provisions of the BMW (management and handling) rules, 1996.
C. Additional precautions shall be taken for the storage and disposal of rejected drugs.
D. Provisions shall be made for the proper and safe storage of waste materials awaiting disposal. Hazardous, toxic substances and flammable materials shall be stored in suitably designed and segregated, enclosed areas in conformity with central and state legislations.
E. The licensees shall comply with the GMP terms recommended in Schedule M. State licensing authorities appointed are allowed to take action in case of any infringement of the earlier requirements.

The government has taken supervisory steps to restrict the misuse of antibiotics. However, no report/incidence of antimicrobial resistance of drugs due to the discharge of drugs and chemicals into the environment has been brought to the notice of this ministry.[1]

V. WHO IS INVOLVED IN SAFE DRUG DISPOSAL PROGRAMS?

Safe drug-disposal programs meet at the junction of the safety of public health, the environment, product safety, law enforcement, transportation, and others. Following governmental agencies control drug disposal:

A. Drug Enforcement Administration (DEA)

The DEA aims to enforce the controlled substances laws and regulations of the United States. It governs safe disposal programs to limit the abuse of controlled substances and to prevent the development of a substance use disorder, overdose, and illicit trafficking. Anybody that markets controlled substances- from manufacturers to prescribers to pharmacies must enrol with the DEA. DEA has further information at www.deadiversion.usdoj.gov/drug_disposal/

B. Food and Drug Administration (FDA)

FDA is the federal agency that is trusted with protecting the public health by ensuring the safety, efficacy, and security of human and veterinary drugs, biological products, medical devices, our nation's food supply, cosmetics, and products that emit radiation. FDA guidelines on drug disposal can be found at www.fda.gov/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/EnsuringSafeUseofMedicine/SafeDisposalofMedicine/default.htm

C. Environmental Protection Agency (EPA)

The objective of the EPA is to protect human health and the environment. It directs waste-disposal amenities, waste-treatment plans, and exerts other actions to preserve the environment. Guidance on drug-disposal programs at www.epa.gov/hwgenerators/collecting-and-disposing-unwanted-medicines[11]

VI. METHODS OF SAFE DRUG DISPOSAL

Disposal of waste is positively not a troublesome issue as long as the population is little and the land accessible for aggregation of waste is sufficient. The Bio-Medical Waste administration techniques target at avoiding the generation of waste or recovering as much as waste as could reasonably be expected, as opposed to disposing of. Henceforth, the waste ought to be tackled at the source rather than the "end of channel approach."[4]

A. Return to donor or manufacturer

The most environmentally safe disposal method for pharmaceutical products is community medicine take-back programs that get medicines at a focal area for proper and safe disposal.[1] Whenever possible the chance of returning unusable medicines for safe disposal by the manufacturer should be searched; especially medicines with disposal difficulties, such as anticancer. For unneeded, it may be reasonable to return them to the donor for disposal.[9] To retain the drugs out of the wrong hands, drugstores are the cornerstone for the return of unused drugs.[17]

B. Trash/Flush

If any drug take-back method is not available then the FDA advises these steps to avoid accidental poisoning. These are as follows:

1. Remove the medicines from their original boxes and merge them with something undesirable, such as used coffee grounds, dirt, or cat litter. This makes the drug less appealing to children and pets and unrecognizable to someone who might deliberately go through the trash looking for pills.
2. Place the mixture in something you can close (a re-sealable zipper storage bag, empty can, or extra container) to limit the drug from leaking or spilling out.
3. Throw the box in the trash. Scrape out your personal information on the empty medicine packaging to protect your identity and privacy. Throw the packaging away.[18]

The exemptions are drugs that carry controlled substances, mentioned in the FDA Flush List, and should

not be tossed in the trash. These drugs should be disposed of by flushing as recommended by the FDA.[17]

C. Landfill

A landfill is a place where waste is directly dumped into a land disposal site without earlier processing. It is the oldest practiced method of disposing solid waste. Types are:

1. Open uncontrolled non-engineered dump

It is the general disposal method in developing nations. Untreated trash is released into an uncontrolled, non-engineered open landfill which doesn't protect the ecosystem. It is not recommended but serves as the last option. It should be noted that discarding with inadequate separation from the aquifer can lead to contamination, with the risk of drinking water contamination in the worst cases.

2. Engineered landfill

Dump of pharmaceuticals is the second most suitable method for releasing immobilized pharmaceutical waste into this landfill. It protects from the loss of chemicals into the aquifer.

3. Highly engineered sanitary landfill

This type of well constructed proper landfill is made of an evacuated hole separated from rivers and sanitary provisions which allow a comparatively safe disposal of waste pharmaceuticals. The topmost priority is the protection of the aquifer.

D. Encapsulation

It is immobilizing of the pharmaceuticals in a solid mass within a plastic or steel drum. The drums are loaded to 75% capacity with solid and semi-solid pharmaceuticals, and the leftover space is filled by pouring a medium like cement or cement/lime mixture, plastic foam or bituminous sand. Once the drums are loaded to 75% capacity, the blend of lime, cement, and water in the 15:15:5 is filled. Steel drum covers should be sealed and set at the base of the landfill and overlaid with municipal solid waste.

E. Inertization

It is an alternative of encapsulation and includes removing the packaging materials, paper, cardboard, and plastic from the pharmaceuticals. Tablets need to be separated from their blister packages. Pharmaceuticals are then ground and a mix of water, cement, and lime added to make a homogenous paste. This paste is then moved in the liquid state by a cement mixer truck to a landfill and emptied into urban waste. The paste sets as a solid mass scattered within the municipal solid waste. The method is comparably economical.

F. Sewer

Liquid pharmaceuticals, e.g. syrups, antiseptics, and intravenous (IV) solutions, can be diluted with water and flushed into the drains or fast-flowing watercourses in small amounts over time without any serious effect on public health or environment.

G. Burning in open containers

Pharmaceuticals shouldn't be destroyed by burning at low temperatures in open vessels, as toxic pollutants may be discharged into the atmosphere. Paper and cardboard packages may be burned but Polyvinyl chloride (PVC) plastic must not be incinerated. It is highly recommended that just very small portions of waste pharmaceuticals should be disposed of by this means.

H. Medium temperature incineration

There are no high temperatures, two-chamber incinerators intended to manage more than 1% halogenated compounds. These incinerators face stringent emission control criteria issued by the European Union. In emergencies, the government may grant to manage expired solid pharmaceuticals using a two-chamber incinerator that operates at the minimum temperature of 850 C, with a combustion retention interval of at least two seconds in the second chamber. It is suggested that pharmaceutical waste is mixed with large volumes of municipal waste (approximately 1:1000).

I. Novel high temperature incineration

Manufacturers which utilize high-temperature technology, such as cement kilns or coal-fired thermal power stations have furnaces that run at temperatures above 850C, with high combustion retention periods and disperse exhaust gases by tall chimneys. Many countries don't possess it and even can't maintain the economically expensive and complicated chemical waste disposal facilities. Cement kilns are exclusively suited for the disposal of expired pharmaceuticals, chemical waste, used oil, tyres, etc. During heating, the concrete raw substances attain temperatures of 1450C while the combustion gases give temperatures up to 2000C. The gas residence time at such high temperatures is several seconds. In such circumstances, all organic waste elements are destroyed and potentially lethal combustion products get adsorbed into the cement clinker product. Cement kilns generate 1,500 to 8,000 metric tons of cement per day and hence large portions of pharmaceuticals can be disposed of in a brief time. It is important to exclude the packaging and/or to crush the pharmaceuticals to avoid clogging and blockage of the fuel feed mechanisms.

J. Chemical decomposition

If an incinerator isn't possible, chemical decomposition can be used as an alternative, followed by a landfill. This process is not supported until chemical expertise is accessible. Chemical inactivation is slow and time-consuming. For the disposal of small quantity of antineoplastic drugs, this method may be useful. For large quantities, for instance, more than 50 kg of antineoplastics, chemical decomposition is not feasible,

as even small consignments need to be handled by recurred utilization of this process.[9]

K. Other methods

1. Mail-back: Mail-back programs allow consumers to put unwanted medications in a special package that is sent back to a DEA authorized collector, which then processes the destruction of the drugs on site.
2. Neutralization: It is the use of specially designed packages that a consumer can use to neutralize the drugs and render them non-retrievable. An advantage of this approach is that it can be implemented by consumers directly.[11]

Despite the recommended options, the most suitable option for the safe disposal of pharmaceutical waste is incineration which needs third party interference for the compilation of unwanted drugs. For example, in Australia, the return of unused drug service operates a drug collection and destruction service by community pharmacies that use high-temperature incineration means approved by the US Environmental Protection Agency. The Nebraska Medication Education for Disposal Strategies (MEDS) has proposed the "golden standard" for safe, legal, environmentally sound disposal, to put tamper-resistant boxes in pharmacies that will enable buyers to carry drugs back to knowledgeable pharmacists.[7]

VII. DRUG DISPOSAL PRACTICES IN INDIA

As indicated by the United States Food and Drug Administration (USFDA), some medicines can be discarded by flushing in a sink or toilet. Accidental exposure to these medicines could be harmful so flushing them removes the danger of holding the expired medicines at homes. The USFDA also suggests taking back expired and unused medicines from home.

The issue of unused or expired medicines may happen in homes, hospitals, distributors, retail drug stores, or at the manufacturing sites. In India, basic medicine disposal practices include direct disposal in the environment, in the landfill site or at an isolated place, or by burning. The unused and expired medicines are considered as municipal solid waste. Burning is viewed similar to the burning of plastic waste because of the physical appearance of its packaging. Most of the municipal corporations don't know this and thus lack medicine disposal facilities. People are unconscious of the outcomes of the unsafe disposal practice of medicines. Even health care professionals are unaware of the medicine disposal practices. In India, the drug disposal is under the narcotics department which is greatly worried about controlling the abuse of addiction causing compounds and medicine disposal does not appear to be their priority. Moreover, there is no administrative body, or working rules for the disposal of the expired medicines. Pharmacies incinerate unused and expired medicines, in the case of generic medicines. Branded medicines are reclaimed by the pharmaceutical companies from the sellers, the disposal of which then is the responsibility of the company.[1]

The USFDA initiated a 'drug take-back program' to prevent the entry of the drugs into the environment. Unfortunately in India, drug take-back programs are not working (although it is specified in Pharmaceuticals Export Promotion Council of India) and systems like mail drop and medicine drop box are also not practical. Though, provisions for the disposal of unused or expired drugs from the pharmaceutical industries are provided in Bio-Medical Waste Management Rules 2016. But there is no proper and effective outline for the disposal of the drug from each home and to instruct the people about safe disposal.[18]

VIII. FUTURE TRENDS

The information in concern to the potential damage from health care wastes is presently getting prominent to government, therapeutic professionals and community in many countries.[4] Many organizations came forward and developed guidelines for the safe disposal of pharmaceuticals including the World Health Organization (WHO), World Bank, European Union (EU) and FDA. There is a crucial need to create such proper disposal guidelines in India too, with a monitoring mechanism. Expired drug take-back programs should be started in India and should be promoted through public awareness.

Since there aren't many medical activist pressure groups in the country, such issues don't find much space in the media. The ignorant population remained suffering because the monitoring agencies aren't careful. None wants any added work to manage the medicine disposal. Concern for public well-being is low, and the drug disposal methods need re-check. The government should take measures to reduce pharmaceuticals in the environment. The release of pharmaceuticals should be included in GMP, and the characterization of the chemical composition of drugs should be revealed along with the disposal practice so that environmentally safe disposal can be adopted. India needs to adapt the take-back policy of unused and expired products and then initiate the effective disposal through incineration or deep burial.[1]

A. Drug Take-Back Programs

To battle accidental exposure and the development of addiction, the U.S. DEA formed a drug disposal initiative called National Prescription Drug Take-Back Day.[10] It is a program intended to raise the safe, convenient and responsible way of disposal of pharmaceuticals and to reduce waste by returning unused and expired pharmaceuticals to community pharmacies or collection depots.[17,18] The drug take-back program educates the general public about how to safely dispose of unwanted medications and build awareness about prescription drug abuse.[10,18] Two dedicated take-back days happen every year, with temporary drug disposal sites.[10] In earlier

years, they have collected almost 200 pounds of unused drugs that might have otherwise disposed of inappropriately. Hence it helps to divert drugs from invading the environment.[18] Online resources enable patients to register their area and find drug disposal places near them, such as hospitals, community pharmacies, and police stations. Pharmacists can facilitate medication disposal by settling drug drop-off boxes for outpatient pharmacies.[10] These drug take-back programs have been for longer than a decade. Though, many were hindered by the inability of drugstores to receive the return of controlled substances, which have the potential for abuse. This law led the DEA to state rules and regulations that would promote communities to organize take-back events and more accessible for users to engage in these programs. Also called as safe drug disposal programs, they have 3 components.

1. Collection: medicines are delivered from the user to the DEA approved receiver;
2. Destruction: medicines are transferred from the DEA authorized collector to the destructor and are destroyed;
3. Promotion: societies are taught about the significance of drug disposal.[11]

B. Other Approaches

As medication experts, pharmacists play a vital role in the distribution of medications throughout a community; however, we have an equally relevant part to help in the removal of unwanted medications. Connecting with the local community empowers students to directly expand patient education experience. By instructing patients to remove unwanted medications, student pharmacists can enable patients to fight drug misuse and dependence before it starts.[10]

To create awareness among the common people about the harmful effects of improper drug disposal, events/programs must be organized. It is must to train people that, a simple and silly error (disposing of drugs inappropriately) can make serious repercussions on nature as well as on the public. It is the duty of pharmacists or healthcare providers to educate the patient about proper storage as well as proper disposal of drugs.[18] Accordingly, it is necessary for pharmacists that their understanding of proper medication disposal is current, comprehensive, and accurate. Currently, 20% of pharmacists studied medication disposal during graduation. In Taiwan, a pharmacist intervention booklet has been created to educate its patients on how to use and store the medicines properly. The government lacks focus on the drugs provided free at civil hospitals as the free availability of the drug is linked with greater drug waste. This matter is vital in terms of national policy development of drug supplies. Also, establishing nationwide policy and education of personnel is basic in successful pharmaceutical waste management. Furthermore, like healthcare professionals, community pharmacists are in a unique place to teach patients on drug disposal, therefore leveraging their experience through training programs.[7]

IX. CONCLUSION

Thus, we conclude that patients don't utilize all of the medicines available at homes because of side effects, dose changes, discontinuance of the medication, or expiry date.[3] Doctors must explain the possible risks of non-adherence, emphasizing the concept of completing prescribed courses of medicine and, if feasible, dispense the smallest quantities of medicines at the start of the treatment to avoid wastage.[12] Expired drugs need clear guidance about their safe disposal into the environment. If health care practitioners became aware and have the right mentality regarding safe drug disposal, and agree to practice rules, then they can teach the patients.[3] Moreover, directions given by a pharmacist can ease for the storage and disposal of the medicines correctly. Therefore, a medicine take-back program is a good approach to safely dispose of unwanted or unused and expired medicines from home.[2]

India’s pharmaceutical manufacturers are suffering around Rs 500 crore yearly on account of the destruction of expired drugs, knocking the bottom line of drug manufacturers, especially the small and medium ones. Although recycling medication may look like a risky idea, novel technologies may make it reasonably safe or at least more sustained.[16] The environmental impression of other medicines has not been studied as their disposal is not regulated. The monitoring of pharmaceutical effects on the environment has to be done on priority. If nothing is done, an enormous impact of the environmental consequences is waiting for us. Beware.[1]

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