

# Efficacy and disposal of drugs after the expiry date

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Every drug manufacturer is legally bound to display the date of expiry on all pharmaceutical products. Excluding certain medicines such as nitroglycerin, insulin, epinephrine, and tetracycline, most medicines stored under reasonable conditions retain at least 70–80% of their original potency for at least 1–2 years after the expiration date, even after the container has been opened. The drug is likely to lose some potency after the expiration date, but it is not clear how much potency is lost over a certain period of time past expiration dates. Placing medication in a cool place, such as a refrigerator, will help it remain potent for many years. Even though both the American Medical Association and the Food and Drug Administration do not recommend the dosing of expired pharmaceuticals at this time, discussion of the issue is warranted in order to understand the potential behind some expired drugs. This review article studies the financial implications and reason for stock piling of unused and expired pharmaceuticals, health hazards, common and ideal ways of disposal of unused and expiry medications and the way forward.

### Keywords:

disposal of expired pharmaceuticals, drug potency, expiration date, expired drugs, shelf life

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## Introduction

Drug expiration is the date after which a drug might not be suitable for use as manufactured. Consumers can determine the shelf life for a drug by checking its pharmaceutical packaging for an expiration date. Excluding certain medicines such as nitroglycerin, insulin, epinephrine, and tetracycline, most medicines stored under reasonable conditions retain at least 70–80% of their original potency for at least 1–2 years after the expiration date, even after the container has been opened. Most of what is known about drug expiration dates comes from a study conducted by the Food and Drug Administration at the request of the military, which revealed that 90% of more than 100 drugs, both prescription and over-the-counter, were perfectly good to use even 15 years after the expiration date, indicating that expiry date is not just a point at which the medication is no longer effective or has become unsafe to use.

## Discussion

### Significance of expiry date written on drugs

According to Dr Rohr, there is no scientific evidence to suggest that expired medications can be toxic or make you sick the way rotten food can. The drug is likely to lose some potency after the expiration date, but it is not clear how much potency is lost over a specific time-frame past expiration dates. The expiration date on creams is really the date at which point the manufacturer is willing to guarantee that their product is at least 90% potent.

### Study by the Food and Drug Administration

Most of what is known about drug expiration dates comes from an investigation directed by the Food and Drug Administration in line with the military. With a large and expensive stockpile of drugs, the military faced tossing out and replacing its drugs every few years. What they found from the study was that 90% of more than 100 drugs, both prescription and over-the-counter, were superbly great to utilize even 15 years after the lapse date, demonstrating that expiry date is not only a time when the prescription is never again successful or has turned out to be risky to utilize.

### Storage of medicines

Medicines are costly, and it is exorbitant to frequently replace expired but unused medications. It has been studied that expired medicine is safe to take, even those that expired years ago. A rare exception to this may be tetracycline, the consumption of which after expiry may cause renal damage, but the report on this is controversial among researchers. Barring nitroglycerin, insulin, and liquid antibiotics, most medications are as enduring as the ones tested by the military. Placing medication in a cool place, such as a refrigerator, will help it remain potent for many years.

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### Expiry versus cent percent effective

The efficacy of medicines is affected even by psychological factors; therefore, it is important to underscore that the quality and adequacy of medicines are demonstrated to be steady by the date of expiry [1]. Despite the fact that both the American Medical Association and the Food and Drug Administration do not prescribe the dosing of terminated pharmaceuticals as of now, a discourse of the issue is justified so as to comprehend the potential behind some lapsed medications and to support further research [2]. Sandford-Smith [3] cannot help contradicting the explanation that 'out-dated medications ought to be discarded' in light of the fact that, in a developing country, the choice to out-dated medicine is no medicine at all. The reality is that medicines do not expire: patients expire [3]. Medicines, like old soldiers, just fade away, usually very, very slowly [3]. It would be vastly improved for all concerned if medicines were instead labeled in a manner such as 'after xxx [date] this drug can no longer be guaranteed to be 100% effective, especially if it has been stored in hot or very bright conditions [3].

### Financial implications

A study carried out in Vienna, Austria, analyzed medicines drawn from household garbage and attempted to evaluate conceivable budgetary ramifications for citizens. It was uncovered that 18% of these medicines were full packs, 36% of the medicines wasted had not yet expired and nearly two out of three medicines wasted were prescription-only medicines. The lion's share were medicines related to the 'alimentary tract and metabolism,' the 'nervous system,' and the 'respiratory system.' Furthermore, they had an all-out estimation of &z.euro;1965, &z.euro;2987, and &z.euro;4207, expressed at exfactory, reimbursement, and pharmacy retail price levels, respectively [4].

### Reason for stock piling of expired medicines

Many health systems must choose the option to depend, at least to a limited extent, on drug donations from high-income countries and vertical supplies from development agencies [5]. During civil emergencies and periods of severe political instability, health systems may have to rely almost completely on drug donations [5]. Donated pharmaceuticals frequently jumble the pharmaceuticals that are required, albeit global rules necessitate that medication gifts are receptive to the wellbeing needs of the beneficiary nation and that the medications included have a time span of usability of, at any rate, 1 year on arrival [6]. However, drugs that are already

past their expiry dates have regularly been dumped in low-income or middle-income countries, and numerous past donations have been so huge or so undesirable that they could not be utilized completely before their expiry dates [7]. Poor determining of future demand, insufficiencies in the administration of a supply chain and poor coordination between a national supply system and the development accomplices offering to supply pharmaceuticals might be reasons for stocking up of lapsed pharmaceuticals [8]. Likewise, patients are not ready to utilize all the administered drugs because of adverse effects, alteration of dosage, feeling healthy or medications reaching the expiration date [9].

### Health hazard

The presence of unused and expired medications in cabinets and cupboards is a potential danger and can be harmful to humans, environment, and wildlife [10]. The presence of discarded medicines in waterways and drinking water is a serious and multifaceted issue that has gained national and international attention with the public, lawmakers, and regulators [11]. Diclofenac, an ordinarily utilized pain-relieving agent has appeared to incite renal failure in vultures following the ingestion of remains from cows treated with this drug [12]. The improper disposal of unused and expired medication challenges the environment; for example, in the USA, many drugs such as acetaminophen, verapamil, and estradiol are found in waterways [13]. Studies have shown that the presence of antibiotics in water may prompt antibiotic resistance [14].

### Disposal of expired medicines

An investigation by Tong *et al.* [15] uncovered that most individuals discarded the unused and expired drugs in the family trash. Hwang [16], in a Korean report, found that housewives in Busan city of Korea disposed unused medications using the standard garbage bag. Practice pursued by the general population in Kuwait, UK and USA for all the unused and expired medication was to flush it down the toilet/drain [17], which is better suited for liquid medications [15].

### The way forward

It is a community practice in Malaysia to return unused and expired pharmaceuticals to medical stores [18]. In Sweden, more individuals return unused medications to a drug store for right transfer, as they have understood the ecological concerns presented by lapsed medicines [19]. The Nebraska Medication Education for Disposal Strategies has suggested the 'golden standard' for safe, legal, environmentally sound

disposal, to put tamper-resistant boxes in pharmacies that will allow consumers to bring medicines back to proficient pharmacists [20]. Francisco's Safe Medicine Disposal program, Dispose a Med program, Chemical Control Program, Sharps Waste Disposal Program, Expired medications drop-off operation in California, USA [21], Medications Return Program or Take-back programs in Canada [22], and Meds Disposal in Europe [23] are taking a shot at safe transfer of unused and lapsed pharmaceuticals. Be that as it may, if a reclaim program is inaccessible, household trash is possible, as recommended by the White House Office of National Drug Control Policy. Prescription medicines along with the patient information should be removed from their original containers and blended with some undesirable substance, such as kitty litter, coffee grounds, or sawdust inside a sealable plastic bag container and disposed in the trash [24]. The American Pharmacists Association recommends that unwanted medications be squashed or broken down in water before blending and before mixing with the undesirable substance [25]. The best possible and best choice for the protected transfer of pharmaceutical waste is incineration [26]. In Australia, the return of unused medication service runs a medication collection and destruction service through community pharmacies, which utilize a high-temperature incineration method approved by the US Environmental Protection Agency [15].

### The pharmacist at the forefront

A noteworthy role can be played by community pharmacists being on the front line in managing and giving legitimate instruction and attention to the community on appropriate and standard disposal practices of unused and terminated medicines [27]. In Taiwan, an instructive drug specialist intercession booklet has been intended to show their clients how to utilize and store the prescriptions properly [28]. It is significant for the government to concentrate on the medicines provided free at public hospitals, as it has been demonstrated that free accessibility of drugs is related to higher medication wastage. This result is significant in terms of national policy development around medication supplies, and targeting medication wastage [29]. The government, pharmacist, and pharmaceutical industry are responsible for creating mindfulness for proper disposal of unused and expired medications.

### Conclusion

Most of the medicines, even after their expiry date, can be used for a reasonable period of time, although the

potency of the drug may reduce. Special mention of nitroglycerin, insulin, epinephrine, and tetracycline has been found in literature, which should not be used after their date of expiry. Placing medication in a cool place, such as a refrigerator, will help it remain potent for many years. Improper disposal of unused and expired medications is a potential threat and can be harmful to humans, environment, and wildlife. It is a good practice to return unused and expired pharmaceuticals to medical stores for correct disposal. Many countries have government-run Safe Medicine Disposal programs, Medications Return Program or Take-back programs, but the best option for the safe disposal of pharmaceutical waste is incineration. A significant role can be played by the community pharmacist being on the forefront in guiding and providing proper education and awareness to the community on proper and standard disposal practices of unused and expired medicines. The government should focus on the medicines provided free at public hospitals, as it has been shown that free availability of medicine is associated with higher medication wastage. The government, pharmacist, and pharmaceutical industry are responsible to create awareness for proper disposal of unused and expired medications.

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### Conflicts of interest

There are no conflicts of interest.

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