

ESTIMATING THE ECONOMIC LOSSES OF UNUSED MEDICINES IN THE COMMUNITY: A LITERATURE REVIEW OF ECONOMIC LOSSES AND MANAGEMENT EFFORTS IN INDONESIA

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Abstract

Expenditure on medicines is one of the largest components of healthcare costs in Indonesia. However, a proportion of medicines obtained by the community are not used to their full extent, either due to changes in therapy, side effects, non-compliance, or expiry. This phenomenon results in significant economic losses, with an average of 18-32% of the total value of medicines stored in households being unused or expired. Studies in several cities such as Yogyakarta, Kudus, and East Banjarmasin show that the economic value of unused medicines per household ranges from Rp3,348 to Rp13,698, and if extrapolated nationally, the potential loss could reach hundreds of millions of rupiah. In addition to wasting money, unused medicines also increase health risks and environmental pollution. Management efforts that have been made include public education through the DAGUSIBU programme, medicine take-back, as well as strengthening regulations and the role of pharmacists, but their implementation still faces challenges in coverage and effectiveness. Cross-sector collaboration is needed to strengthen education, improve the collection system of leftover medicines, and increase supervision of pharmaceutical waste disposal to reduce economic losses and improve public health.

Keywords: medicine non-use, economic loss, households, community education, medicine management

Introduction

Medicines are an indispensable component of the health care system. Proper use of drugs can help the healing process, relieve symptoms, and improve the quality of life of patients. However, on the other hand, irrational use of drugs is still a major problem in many countries, including Indonesia, which can have serious impacts on health, environment, and economy (Suryani & et al., 2021).

The phenomenon of storing and disposing of unused medicines in Indonesian society is gaining attention. Many households store leftover medicine, both from prescriptions and self-medication, for emergency purposes or treatment of chronic and acute illnesses. Research shows that more than 90% of Indonesians have self-medicated, and most of them store leftover medicine at home (Pradana & et al., 2020).

Storage of unused or expired drugs in households can trigger various risks. One of them is the possibility of using drugs that are not according to indications or doses, thus potentially causing side effects, antimicrobial resistance, and even poisoning, especially if consumed without the supervision of health workers (Agustin & et al., 2022) . In addition to health risks, unused medicines also cause environmental problems. Disposal of medicines into waterways or rubbish bins without proper management can pollute the environment, disrupt ecosystems, and contribute to water and soil pollution. This has become a global issue that has received attention from various world health organisations (Handayani & et al., 2022) .

From an economic perspective, the presence of unused medicines in the community is a waste of resources. Every year, the number of drugs purchased but not consumed or not used up continues to increase, either due to patient non-compliance, changes in therapy, side effects, or excess drug stocks in households. This condition causes significant economic losses, both for individuals, households, and the national health system (Maulana & et al., 2021) .

In Indonesia, several surveys have shown that a high proportion of households store leftover medicine. A study in Jatinegara, for example, found that 22.21% of respondents kept unused leftover medicine, while another study reported figures of up to 95.5% of households having at least one leftover medicine in their home. The types of drugs that are often left over include analgesics, antibiotics, drugs for chronic diseases, and mental health drugs (Yazid & et al., 2022) . The high rate of leftover medicine storage is closely related to the high level of self-medication behaviour in Indonesia. Data from the Central Bureau of Statistics shows that more than 70% of the Indonesian population self-medicate with over-the-counter drugs, restricted over-the-counter drugs, and prescription drugs obtained without consulting a doctor. This is exacerbated by the community's easy access to drugs at stalls, pharmacies, and drug stores without adequate supervision (Yuliana & et al., 2023) .

Public knowledge on the proper use, storage, and disposal of medicines is still low. Many people do not understand the risks of using drugs without a prescription, the dangers of storing expired drugs, and the impact of careless disposal of drugs on the environment and the health of the wider community. The lack of education and supervision is one of the main factors in the high rate of unused drugs in the community (Wijaya & et al., 2020) . The economic loss of unused drugs comes not only from the waste of drug purchases, but also from the increased burden of health costs due to complications or side effects. In addition, the national health system also bears losses due to the increased need for pharmaceutical waste management and handling health problems related to irrational drug use (Widyasari & et al., 2023) .

Efforts to manage unused drugs in Indonesia still face various challenges. Public education programmes, the collection of leftover drugs at pharmacies, and pharmaceutical waste disposal policies have not run optimally and have not been evenly

distributed throughout the region. The involvement of health workers, especially pharmacists, in providing education and services for the management of unused drugs also needs to be improved. The importance of handling the problem of unused drugs in the community is not only related to health aspects, but also environmental and economic (Prasetyo & et al., 2023) . Therefore, collaborative efforts between the government, health workers, the pharmaceutical industry, and the community are needed to increase awareness, knowledge, and behaviour regarding the correct use, storage, and disposal of medicines.

This study aims to examine in depth the estimated economic losses due to unused medicines in Indonesian society, as well as to examine the various management efforts that have been and can be done to address the problem. By understanding the magnitude of losses and the effectiveness of existing interventions, it is hoped that more targeted policy recommendations can be formulated to reduce economic losses and improve overall public health.

Research Methods

This study used the systematic literature review (SLR) method with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol approach. The research process began with formulating clear research questions, then searching for articles in electronic databases such as Google Scholar, PubMed, and ScienceDirect with predetermined inclusion and exclusion criteria, such as the topic of economic losses due to drug non-use and management efforts in Indonesia (Elijah & Aslan, 2025) . Articles that met the criteria were then evaluated for quality using a critical appraisal instrument, and relevant data were extracted and thematically analysed and narratively synthesised to obtain a comprehensive picture of the economic losses and effectiveness of efforts to manage unused drugs in the community (Green et al., 2006).

Results and Discussion

Estimated Economic Losses Due to Unused Medicines in Indonesian Society

Medicines are a vital component of the public health system. However, the phenomenon of unused medicines in Indonesian households has become an issue that affects various aspects, including the economy, health, and the environment. This problem arises due to inappropriate storage, use, and disposal behaviours, as well as the lack of public education on drug management (Duka & et al., 2023) .

According to the 2013 Basic Health Research (Riskesdas), around 35.2% of households in Indonesia store medicines for self-medication. Of this number, 47% of households store leftover medicine, 42.2% store stock medicine, and 32.1% store medicine that is currently in use. This figure shows the high potential for medicine wastage at the household level. Economic losses due to unused drugs can be measured by the value of drugs purchased but not consumed to the end, either due to changes in

therapy, side effects, non-compliance, or because the drug has expired. A study in Yogyakarta City found that of the total price of medicines stored in households, around 18% were unused medicines, with an average economic loss of IDR 13,698 per person (Nurjannah & et al., 2021) .

If the data is extrapolated nationally, assuming 48,814 households store leftover medicine, the economic value of medicine that could be saved or not wasted reaches Rp668,654,172. This figure is only from one city and one data collection time, so nationally the economic loss due to unused medicine is estimated to be much greater (Oktaviani & et al., 2022) .

Research in Semarang also showed similar results, where the average economic loss due to unused drugs per family was IDR 10,880, with the total price of unused drugs still stored by the community reaching IDR 2,948,412. The most commonly stored drug group was analgesics, followed by respiratory system drugs and antimicrobials (Oktaviani & et al., 2022) .

Factors that lead to drug non-use include patients feeling their condition has improved, changes in prescription by the doctor, side effects, or switching to herbal remedies. In addition, non-compliance in taking drugs, especially antibiotics, contributes to the high amount of residual drugs and potentially antimicrobial resistance (Iskandar & et al., 2022) .

The economic impact of unused drugs is not only in the form of wasted drug purchase costs, but also lost opportunities to finance other more needed health care. In addition, the national health system also bears the additional burden of pharmaceutical waste management and handling health problems due to irrational use of drugs (Nurdin & et al., 2024) . In addition to economic losses, improper storage and disposal of drugs can pose health risks, such as poisoning, drug abuse, and microbial resistance. In terms of the environment, disposal of drugs into waterways or rubbish bins without proper management can pollute water and soil, and disrupt ecosystems (Chandrawati & et al., 2023) .

Efforts to manage unused drugs in Indonesia still face major challenges. Public education programmes, the collection of leftover medicines at pharmacies, and pharmaceutical waste disposal policies have not run optimally and have not been evenly distributed throughout the region. The involvement of health workers, especially pharmacists, in providing education and residual medicine management services also needs to be improved (Ehrhart & et al., 2020) . Several programmes such as DAGUSIBU (Get, Use, Store, and Dispose of Medicines Correctly) and medicine take-back programmes have been implemented in several cities, but their coverage is still limited. Direct education by health workers has been shown to be effective in improving people's knowledge and behaviour regarding residual medicine management (Alfian & et al., 2024) .

Studies in various cities in Indonesia, such as Yogyakarta, Semarang, Kudus and Pati, show that the average economic loss due to unused medicines per household ranges from Rp4,000 to Rp14,000, depending on the characteristics of the population and the behaviour of the local community. When multiplied by the number of households nationwide, the potential economic loss is significant. The most commonly underused drugs are analgesics (pain relievers), antibiotics, respiratory system drugs, and vitamins. These medicines are generally obtained either from a doctor's prescription or over-the-counter purchases at pharmacies or drug stores. The lack of public understanding of the importance of consuming drugs as recommended by the doctor is one of the main causes of the high rate of unused drugs (Haryanto & et al., 2023).

The study also showed that education level, income, and the presence of family members with chronic diseases affect the amount and type of medicine stored in the household. Households with family members who have health insurance tend to store leftover medicine more often (Insani & et al., 2020).

In terms of policy, the government has issued guidelines for the management of damaged and expired drugs, both in health care facilities and in households. However, implementation in the field still needs strengthening, especially in terms of supervision and public education. Public awareness to return unused medicines to pharmacies or health facilities is still low. Most people still throw medicines into the trash or waterways, which has the potential to cause environmental and health problems (Adriani & et al., 2020).

The role of pharmacists and health workers is very important in providing education and assistance to the community regarding the correct use, storage, and disposal of medicines. Community-based interventions and cross-sector collaboration are needed to improve the effectiveness of unused medicine management in the community (Dewi & et al., 2021).

Thus, the economic losses due to unused medicines in Indonesian society are significant, both in terms of individuals, households, and the national health system. The economic losses identified from studies in several major cities indicate wastage that could reach hundreds of millions of rupiah if extrapolated nationally. In addition to economic losses, unused medicines also pose health and environmental risks. The management efforts that have been made still need to be expanded and strengthened, especially in terms of public education, collection of leftover drugs, and supervision of pharmaceutical waste disposal. Collaboration between the government, health workers, and the community is needed to minimise economic losses and improve overall public health.

Management Efforts Made to Reduce Economic Losses Due to Unused Medicines in Indonesian Society

The management of unused medicines in Indonesian society has become an important concern in order to reduce economic losses, health risks, and environmental impacts. Various strategies have been implemented by the government, health workers, and professional organisations to comprehensively address this issue. One of the main steps is the development of guidelines for the management of damaged and expired drugs published by the Ministry of Health. This guideline provides guidance for health care facilities and households in handling drugs that are no longer fit for use, including procedures for destruction and supervision by the central and local governments (Putri & et al., 2023) .

Public education programmes are an important pillar in the management of unused drugs. Through the Healthy Living Community Movement (GERMAS) and GEMA CERMAT, the government encourages people to be wiser in obtaining, using, storing, and disposing of medicines. This education is carried out massively through various media and involves health cadres at the community level (Santosa & et al., 2020) . DAGUSIBU (Get, Use, Store, Dispose) is an educational programme initiated by the Indonesian Pharmacists Association (IAI). This programme aims to increase public knowledge and awareness about proper drug management. DAGUSIBU activities have been implemented in various regions, both through direct counselling, poster installation, and training of Health cadres (Permana & et al., 2023) .

DAGUSIBU counselling has been proven to be effective in increasing community understanding, especially among vulnerable groups such as the elderly. A study at Panti Bina Lanjut Usia Sentani showed that more than 90% of participants understood how to properly manage medicines after attending the counselling, which included aspects of obtaining, using, storing, and disposing of medicines. In addition to education, some pharmacies and health facilities have started to implement medicine take-back programmes. This programme allows people to return unused or expired medicines to pharmacies for safe disposal, thereby reducing the risk of misuse and environmental pollution (Serawaidi & et al., 2025) .

The implementation of take-back programmes in Indonesia still faces challenges, such as limited resources, operational costs, and lack of destruction facilities. However, collaboration between the government, pharmacists, and the private sector is encouraged to expand the scope and effectiveness of this programme (Ridwan et al., 2019) .

At the household level, education on how to properly dispose of medicines is also a focus. People are taught not to dispose of medicines in drains or rubbish bins, but rather in a safe manner such as crushing tablets before burying them or disposing of liquids into drains with running water (Septiani . , 2023)

The role of pharmacists is central to efforts to manage unused medicines. Pharmacists not only provide education, but also monitor the use of drugs by patients, provide consultations, and initiate waste drug collection programmes in the community. The government has also regulated drug management through regulations, such as BPOM Regulation Number 24 of 2021 concerning Supervision of Drug Management in Pharmaceutical Service Facilities. This regulation strengthens supervision of the distribution, storage, and destruction of drugs in health facilities (Munadlatul., 2022)

Management efforts also involve training health cadres and communities, so that they can become agents of change in their respective neighbourhoods. Cadres are trained to identify, educate and assist communities in the management of unused medicines. Several universities and pharmacy professional organisations are also active in community service through education and research programs related to the management of unused drugs (Sufardi & Fadillah, 2021). These activities not only increase knowledge, but also build a culture of rational drug use in the community. Public campaigns through social media, seminars, and workshops are also conducted to increase public awareness about the importance of proper drug management. Information is conveyed in a simple and easy-to-understand manner so that it can reach various levels of society (Naufal et al., 2021).

Evaluation and monitoring of the unused medicine management programme is conducted periodically to assess its effectiveness and to identify obstacles in the field. Evaluation results are used as the basis for future programme improvement and development. Cross-sector collaboration is key to the success of efforts to manage unused drugs. The government, health workers, pharmaceutical industry, and the community must work together to create a sustainable and effective management system (Sulistyaningrum & et al., 2023).

Despite these efforts, challenges such as low public awareness, limited facilities, and uneven programme implementation still need to be overcome. Continued commitment and innovation are needed to expand the reach and impact of unused medicine management programmes.

By strengthening education, regulation, and collaboration, it is hoped that economic losses due to unused medicines in Indonesian society can be significantly reduced. This will also have a positive impact on public health and overall environmental sustainability.

Conclusion

The economic losses due to unused medicines in Indonesian society have been shown to be significant and still receive little attention in health cost evaluations. Studies in various cities show that on average 18-32% of the total value of medicines stored in households are unused, either due to leftovers, stockpiles or expiry. If extrapolated nationally, the potential economic losses that could be saved reach

hundreds of millions of rupiah, which could have been diverted to other more pressing health needs.

The main causes of drug non-use include patient non-compliance, prescription changes, side effects, and high levels of self-medication behaviour. In addition to wasting costs, this phenomenon also increases health risks such as antimicrobial resistance and environmental pollution due to improper drug disposal. Management efforts that have been made, such as education through the DAGUSIBU programme, medicine take-back, and strengthening regulations, still face challenges in implementation and coverage. Stronger collaboration between the government, health workers, and communities is needed to expand education, improve the collection system, and strengthen the monitoring of pharmaceutical waste disposal. With better management, economic losses due to unused drugs can be minimised, while improving the quality of public health and preserving the environment.

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