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ORIGINAL ARTICLE

Medication Wastage and its Disposal Amongst Patients at Suri Seri Begawan Hospital in Brunei Darussalam

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ABSTRAK

Pembaziran ubat menimbulkan beban kewangan kepada ekonomi negara dan juga, implikasi alam sekitar yang berkaitan dengan pelupusan pembaziran. Kajian ini dijalankan di sebuah hospital awam di Brunei dan bertujuan untuk mengukur tahap pembaziran ubat-ubatan dan pelupusannya. Ia adalah satu kajian rentas/silang bahagian yang menggunakan soal selidik direka sendiri untuk para pesakit mengunjungi farmasi pesakit luar di hospital Suri Seri Begawan (SSB); seramai 253 pesakit mengambil bahagian dalam tempoh dua minggu. Terdapat kriteria pengecualian, iaitu pesakit di bawah usia 18 tahun, pesakit mengunjungi Jabatan Kemalangan dan Kecemasan, dan pesakit yang dimasukkan ke hospital. Majoriti peserta dilaporkan mempunyai ubat yang tidak digunakan di rumah (75.1%, n=189). Hampir separuh (54.2%) mempunyai ubat-ubatan yang tidak digunakan dan ia adalah disebabkan oleh peningkatan dalam keadaan perubatan mereka. Kebanyakkan peserta (70.8%) tidak diberi nasihat yang bersesuaian mengenai cara untuk melupuskan ubat-ubatan mereka dengan cara yang betul. Kebanyakkan mereka membuang ubat-ubatan yang tidak digunakan ke dalam tong sampah di rumah (70%), walaupun 50.2% (n=189) mengetahui bahawa membuang ubat-ubatan dalam tong sampah boleh menyebabkan kesan buruk kepada alam sekitar. Selain itu, didapati bahawa 47.7% daripada peserta akan mengembalikan ubat-ubatan yang tidak digunakan ke farmasi, tetapi secara praktikal, hanya 18.6% telah melakukannya. Tiada hubungan yang signifikan antara mengetahui kesan-kesan memudaratkan perubatan ke atas alam sekitar dan mengembalikan ubat mereka ke farmasi (p=0.065). Kajian ini menunjukkan bahawa wujud pembaziran ubat

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di hospital SSB dan pengetahuan serta amalan pesakit terhadap pelupusan yang betul adalah agak lemah. Oleh itu, penggubal dasar kesihatan perlu dimaklumkan mengenainya agar dapat melaksanakan strategi pengurangan pembaziran.

Kata kunci: kesedaran, Brunei, hospital, pengetahuan, pelupusan sisa perubatan

ABSTRACT

Medication wastage poses a financial burden on the nation's economy, as well as, environmental implications associated with wastage disposal. This study was conducted in a public hospital in Brunei and aimed to measure the extent of medication wastage and its disposal. This cross-sectional study used a self-designed questionnaire for patients attending outpatient pharmacy at the Suri Seri Begawan (SSB) hospital in which 253 patients participated over a period of two weeks. Exclusion criteria were: i) patients below 18 yrs, ii) patients visiting the Accident and Emergency Department and iii) patients admitted to the hospital. Majority of the participants were reported to have unused medication at home (75.1%, n=189). Nearly half (54.2%) had unused medicines and this was due to improvements in their medical conditions. Most of the participants (70.8%) were not given necessary advice on how to dispose their medicines in a proper manner. Majority disposed their unused medicines in the household garbage (70%), despite 50.2% (n=189) knowing that disposing of medicines in the garbage can cause detrimental effects on the environment. It was found that 47.7% of the participants would return their unused medicines back to the pharmacy, but in practice, only 18.6% did such. There was no significant association between knowing detrimental effects of medicine on the environment and returning their medicines to the pharmacy (p=0.065). Results showed that medication wastage exists in SSB hospital and patients' knowledge and practices on its proper disposal was relatively poor. Health policy makers should be informed to implement wastage reduction strategies.

Keywords: awareness, Brunei, hospital, knowledge, medical waste disposal

INTRODUCTION

Medication wastage, as defined by the Delphi technique, amongst a wide range of experts, refers to any medication, which expires or remains unused throughout the whole medicine supply chain. It also refers to the unnecessary consumption of medications by patients, or the unjustified non-adherence to treatment guidelines by healthcare professionals (West et al. 2015). The extent of medication wastage was studied and documented by various countries with quantities ranging from 65 unused medication items gathered from 73 households (Kiyingi & Lauwo 1993) to 20,304 medications packages collected from 100 community pharmacies (Ekedahl et al. 2003). Medication

wastage poses a financial burden on the nation's economy, as well as, environmental implications associated with its disposal. At present, Brunei Darussalam has a universal healthcare system run by the government with its services and funding provided, mainly, by the government. The citizens pay a very minimal amount for their medicines when treated in a government hospital or health centre and, thus, there would be financial implications to the government as a result of medication wastage. In 2009, the Department of Health in the United Kingdom explored the scale and cost of medication wastage, whereby, the direct cost of unused prescription medication to the National Health Services (NHS) amounted to £300 million annually (Trueman et al. 2010).

In 2006, the Department of Pharmaceutical Services, Ministry of Health Brunei (MOH), has implemented the 'Return Your Medicines' Programme. Through this programme, patients either from home or in the wards can return their unused medicines for safe disposal or recycling of medicines by MOH. The medicines being recycled will be evaluated and assessed using a set of protocol developed by the pharmacists from MOH. Many factors have contributed towards this excessive medicines storage, amongst them are patients died; non-adherence to their medications; change or cessation of treatment regime; and polypharmacy according to the Ministry of Health Malaysia (MOH 2013). An earlier study indicated that patients were afraid that their medications will be unavailable when they need them. Consequently, they tend to stock up on their medications (West et al. 2015).

Medication wastage also continues to compromise public health in terms of safety and the environment. The extent of the problem of unused medication in Brunei Darussalam was not yet known. This study aimed to investigate methods of disposing excess or unused medications and discussed the practices and attitudes of the participants towards unused medication.

MATERIALS AND METHODS

This cross-sectional study was done at SSB hospital was designed to elicit information on the patients' knowledge of attitudes towards and practices on the disposal of unused medicines, by means of a self-administered anonymous questionnaire survey. This study was conducted in the second largest public hospital in Brunei (183 beds). The population size (N) of patients at the outpatient pharmacy in the hospital was around 9,744 per month on average (SSB pharmacy 2012 statistics). The expected prevalence (p) of the study was 80%. Using the calculation formula by Naing et al. (2006), the sample size (n) was found to be 246 patients, who, were later selected using systematic sampling. In October 2013, over a period of two weeks, patients from outpatient pharmacy were asked to fill in the questionnaire to identify the following objectives; i) to find out the participants' demography; ii) to identify the number of participants who were given advice on medicine disposal by medical/health practitioners; iii) to explore the participants' knowledge

and attitudes towards the methods of disposing unused medicines; v) to find out the participants' preferred disposal practices of unused medicine; and vi) to discover the factors that caused them to keep the unused medications.

Written consent was attained from all the participants and permission was granted from the Director General of Medical Services in Ministry of Health to perform this study. Ethical approval was also granted by the Medical and Health Research Ethics Committee (MHREC) from the Ministry of Health, Brunei Darussalam. Patients could also refuse to participate (the number of participants who refused to take part was not recorded).

The questionnaire was designed to meet the study's objectives and was produced in Malay and in English depending on the preference of respondents. Similar studies were done in Serbia and New Zealand (Braund et al. 2009; Kusturica et al. 2012; Seehusen & Edwards 2006) and their methods were considered and some parts of the questionnaire were utilised in this study. The author agreed for their questionnaire to be reproduced and used. The questionnaire consisted of three parts and thirteen questions altogether. The first part probed their socio-demographic characteristics (gender, age, education and occupation). The second part of the questionnaire focused on patients' knowledge about medication disposal. The third part of the questionnaire queried the patients' medication disposal attitudes and practices. This section focused on determining the factors, which cause them to stock unused medications. The survey questionnaire was adapted from Seehusen and Edwards (2006) and it was pilot tested for 20 participants and modified accordingly for validity.

The inclusion criteria were: i) patients aged 18 yrs and ii) who visited the outpatient pharmacy at SSB hospital during the study period. The study excluded all patients visiting the Extended Accident and Emergency Dispensary Services EA&E, patients admitted to the hospital (i.e. inpatients) and those who could not write or read. All data were coded and entered into the IBM Statistical Package for Social Sciences Results IBM (SPSS Version 20) for statistical analysis. Chi-squared test was performed where appropriate and the level of significance was taken with a p value of less than 0.05 ($p<0.05$).

RESULTS

The number of patients who came to the pharmacy waiting room, during the two-week data collection period, was around 3402. Out of the 3402 patients, 253 participants were systematically sampled and included for the study.

FACTORS CONTRIBUTING TO KEEPING UNUSED MEDICINES AT HOME

Figure 1 showed the frequency against the reason for keeping unused medicines at home, which, could lead to wastage. A total of 54.2% (n= 137) of the participants still kept their unused medicines because their medical condition had improved or had totally resolved. The second and third main reasons for having unused medicines were due to the side effects

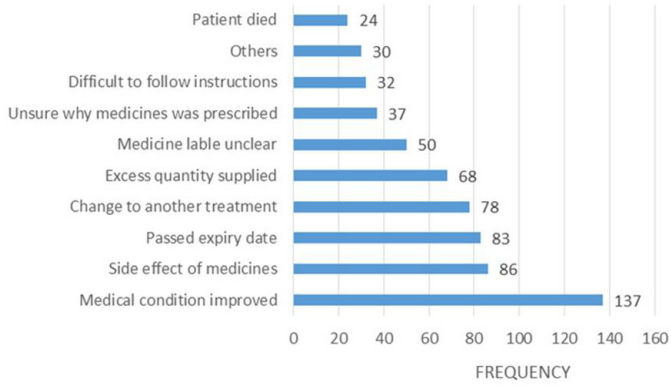

Figure 1: Factors contributing to keeping the unused medicines at home (n = 253)

Table 1: Participant's demography and the number of medicines kept at home

Variable	n	Freq. (%)
Gender	253	
Male		143 (56.5)
Female		110 (43.5)
Age	253	
18-30		84 (33.2)
31-40		79 (31.2)
41-49		49 (19.4)
50-59		32 (12.6)
60 or more		9 (3.6)
Education	252	
No schooling		29 (11.5)
Primary school		31 (12.3)
Secondary school		107 (42.3)
Undergraduate level & more		85 (33.6)
Occupation	253	
Employed		158 (62.5)
Self-employed		56 (22.1)
Retired		17 (6.2)
Student		22 (8.7)
Current number of medicines at home	252	
0		63 (24.9)
1 to 5		119 (47.0)
6 to 10		48 (19.0)
11 to 25		8 (3.2)
26 or more		14 (5.5)

Freq. = Frequency

Table 2: Participant's knowledge on "Return your medicine" programme and disposal methods

Variable	n	Freq. (%)
Have you ever been advised by medical/health practitioners on medicine disposal?	245	
Yes		74 (29.2)
No		171 (67.6)
Do you know throwing medicines in garbage; toilet or sink has detrimental effect on environment?	251	
Yes		127 (50.2)
No		32 (12.6)
Not sure		92 (36.4)
What is the acceptable way to throw your unused/expired medicines?	253	
throw in garbage		177 (70.0)
throw in sink		26 (10.3)
burn		14 (5.5)
return to pharmacy		47 (18.6)
give to a friend		11 (4.3)
store in house		36 (14.2)

Freq. = Frequency

of the medication (n = 86, 34%) and due to the medicine which expired (n = 78, 30.8%). Only 68 patients (26.9%) mentioned that excess medicines were supplied to them. Patients who were deceased had the least amount of unused medicines at home (n = 24, 9.5%).

THE EXTENT OF MEDICATION WASTAGE AND PATIENT'S DEMOGRAPHY

Almost equal number of men and women participated in this study. A total of 75.1% (n = 189) admitted to having unused medicines in their households. Majority of them were employed (n = 158, 62.5%). A total of 42.3% of them were educated at secondary level and 33.6% were educated at a minimum undergraduate level. It was noted that their ages were mainly within the working-age group population (18 yrs to 59 yrs). Only 3.6% (n= 9) of the participants were above 60 yrs. Almost half (47%, n = 119) of the participants admitted to keeping at least one to five medications in their households (Table 1). The types and costs of medications were not questioned in this study.

PARTICIPANTS' KNOWLEDGE ON "RETURN YOUR MEDICINE" PROGRAMME AND DISPOSAL METHODS

Table 2 showed the participants' responses on medicine disposal. A total of 67.6% of them had not been given proper advice on disposal of medication. Significantly, 50.2% (n = 127) of participants seemed to know that throwing medication in the household garbage, toilet or sink would have detrimental effects on the environment

Table 3: Participant's knowledge on improper disposal to have detrimental effect to environment versus their practices to return to the Pharmacy.

	Variable	Participants practiced returning unused medicine to the Pharmacy				
		n	Yes	No	c2 statistics*	P value
			Freq. (%)	Freq. (%)	(df)	
Throwing medicines in garbage, toilet, sink has detrimental effects on environment and public health	Yes	127	31 (24.4)	96 (75.6)		
	No	32	4 (12.5)	28 (87.5)	5.46 (2)	0.065
	Unsure	92	12 (13.0)	80 (87.0)		

*Chi-square test for independence
Freq.= Frequency

or/and public health. When participants were asked to rank the acceptable ways to deal with unused or expired medications, majority (70%, n = 177) of them agreed that garbage disposal was an acceptable method. This was followed by returning the medicines to the pharmacy, storing and keeping them within the household, throwing them into the sink/toilet, burning them off and lastly, by giving to their friends (Table 2).

KNOWLEDGE VERSUS ATTITUDES AND PRACTICES OF DISPOSAL OF UNUSED MEDICINE

Table 3 showed the extent to which the participants' knowledge has influenced them to return unused medication to the pharmacy (p= 0.065). Apparently, there was no significant association between knowing medicine effects on the environment and returning their unused medicine to the pharmacy. In other words, this knowledge did not influence participants to avoid throwing unused medicine in the garbage, sink or toilet.

In Table 2, over 29.2% (n = 74*)* of participants indicated that they had been given advice by a medical provider on ways to dispose expired or unused medication. Referring to Table 4, the prevalence (proportion) of practicing proper disposal methods between participants who had been given proper advice on disposal and those who have not was found to be insignificant for all variables (i.e. p values range from 0.305 to 0.798). Therefore, there was no significant association between getting a disposal advice by medical/healthcare providers and practicing 'acceptable' disposal methods.

Table 5 compared the influence of educational background and their preferred method when disposing unused medicines. There was no significant association seen for all practices except the practice of burning (p =0.046). There was a significant association between education level and medicine disposal practice by burning.

DISCUSSION

GENERAL FINDINGS

This study found that 75.1% of participants have kept their unused medicines at home and 65.5% kept between one to ten unused medicines.

Table 4: Influence of knowledge on proper disposal by a medical/healthcare professionals versus the responses to acceptable methods of disposal

	Variable	Previously given advice on medication disposal by a Medical / Healthcare professional				
		n	Yes Freq. (%)	No Freq. (%)	c2 statistics* (df)	P value
Is it acceptable to dispose of unused or expired medicines by:						
throwing in garbage						
	Yes	146	41 (28.1)	105 (71.9)		
	No	61	19(31.1)	42 (68.9)	1.13 (2)	0.568
	Unsure	38	14 (36.8)	24 (36.2)		
throwing in the sink						
	Yes	38	11 (28.9)	27 (71.1)		
	No	158	46 (29.1)	112 (70.9)	0.58(2)	0.746
	Unsure	49	17 (34.7)	32 (65.3)		
burning						
	Yes	38	12 (31.6)	26 (68.4)		
	No	133	35 (26.3)	98 (73.7)	2.37 (2)	0.305
	Unsure	74	27 (36.5)	47 (63.5)		
returning to pharmacy						
	Yes	117	37 (31.6)	80 (68.4)		
	No	64	20 (31.2)	44 (68.8)	4.52 (2)	0.798
	Unsure	63	17 (27.0)	46 (73.0)		
giving to a friend						
	Yes	23	10 (43.5)	13 (56.5)		
	No	179	51 (28.5)	128 (71.5)	2.17 (2)	0.338
	Unsure	43	13(30.2)	30 (69.8)		
storing in the house						
	Yes	40	12 (30.0)	28 (70.0)		
	No	140	39 (27.9)	101 (72.1)	1.19 (2)	0.550
	Unsure	65	23 (35.4)	42 (64.6)		

**Chi-square test for independence*
Freq.= Frequency

The rate was considered high since the study was only done within two weeks. The main factor was due to improvement in their medical condition. When asked about their knowledge on medicine disposal, 50.2% (n = 127) of participants seemed to know that throwing medication in the garbage, toilet or sink has a detrimental effect on the environment and/or public health. There was a significant association between educational background and the practice of burning of unused medicines.

Table 5: Influence of educational level versus participants' disposal practices

How do you dispose unused or expired medicines?	Practices about Medication Disposal Between Different Education levels of Participants							
	Variable	n	No schooling	Primary school	Secondary School	Degree	c2 statistics*	P value
			Freq. (%)	Freq. (%)	Freq. (%)	Freq. (%)	(df)	
throwing in garbage	Yes	177	20(11.3)	22 (12.4)	70 (39.5)	65 (36.7)	2.79(3)	0.424
	No	75	9(12.0)	9 (12.0)	37 (49.3)	20 (26.7)		
throwing in the sink	Yes	26	2 (7.7)	5 (19.2)	8 (30.8)	11 (42.3)	3.06 (3)	0.382
	No	226	27 (11.9)	26 (11.5)	99 (43.8)	74 (32.7)		
Burning	Yes	14	3 (21.4)	2 (14.3)	9 (64.3)	0 (0.0)	7.97 (3)	0.046
	No	238	26 (10.9)	29 (12.2)	98 (41.2)	85 (35.7)		
Returning to Pharmacy	Yes	46	6 (13.0)	4 (8.7)	23 (50.0)	13 (28.3)	1.96 (3)	0.580
	No	206	23 (11.2)	27 (13.1)	84 (40.8)	72 (35.0)		
Giving to a Friend	Yes	11	1 (9.1)	1 (9.1)	4 (36.4)	5 (45.5)	0.72 (3)	0.867
	No	241	28(11.6)	30 (12.4)	103 (42.7)	80 (33.2)		
Storing in the House	Yes	36	4 (11.1)	8 (22.2)	9 (25.0)	15 (41.7)	7.16 (30	0.067
	No	216	25 (11.6)	23 (10.6)	98 (45.4)	70 (32.4)		
Others	Yes	8	1 (12.5)	1 (12.5)	3 (37.5)	3 (37.5)	0.90 (3)	0.993
	No	244	28 (11.5)	30 (12.3)	104 (42.6)	82 (33.6)		

**Chi-square test for independence*
Freq.= Frequency

COST SAVING FROM MEDICATION RECYCLING

Overall, 67.6% of the patients were not given proper advice by the medical/ healthcare professionals on safe practices when disposing medication. If they were aware about the "Return your medicines" program, the unused medicines could have been returned back to the pharmacy and be recycled. Redistributing the unused medications to those who need them may potentially reduce non-compliance and the associated healthcare costs. There was a pilot study on the feasibility of medication recycling, following certain protocols, as a solution to medication wastage conducted in Singapore (Toh & Chew 2016). This is a desirable practice and hospitals in Brunei have already practiced similar recycling through their in-patient pharmacies. In the current unpredicted economic situation, this practice is financially desirable, which, could lead to cost saving. In this study, however, the types of medicines being kept at homes and the actual cost of the medicines that can be recycled were not investigated.

FACTORS CONTRIBUTING TO MEDICINE WASTAGES

A number of factors have been attributed to medication wastage. Our findings were similar to other studies conducted in this subject matter (Braund et al. 2009; James et al. 2009; Langley et al. 2005); 54.2% (n = 137) of participants still kept their unused medicines because their medical conditions have improved or have totally resolved. The second and third main reason for having unused medicines were due to the side effects of medicines (n = 86, 34%) and the medicine being expired (n = 78, 30.8%). In this study, patient death was the least likely reason as to why unused medicines were hoarded, perhaps this was because, most of the respondents were mainly patients in the working group category, and most elderly patients refused to participate. Only 6 participants were above 60 yrs. In a recent study (West et al. 2015), the most prevalent factor that caused medication wastage was that "*patients are afraid that their medication will be unavailable when they need it*" and therefore they overstocked. Fortunately, it was not the case in this study, as the Pharmacy in MOH Brunei have a mechanism to avoid this, such as, repeat dispensing within a short period of time to avoid wastages. Only 68 patients (26.9%) mentioned that excess medicines were supplied to them.

PRACTICES OF UNUSED MEDICINES DISPOSAL

Referring to Table 2, most participants 50.2% (n = 127) knew that throwing unused medications in the garbage, toilet or sink has detrimental effects on the environment or/and public health. When participants were asked to rank the acceptable ways to deal with unused or expired medications, majority (70%, n = 177) agreed that throwing the medicine in the garbage is an acceptable disposal method. This was followed by returning medication to the pharmacy, storing medication in the house, throwing in the sink, burning and lastly, they would least likely give them to their friends. Such findings were similar to other studies that have been conducted (Braund et al. 2009; Kusturica et al. 2012). There was no significant association found between getting an advice on disposal method and the knowledge of acceptable disposal methods of unused medicines. In fact, a significant association was found between those who got advice on proper disposal and those who practice disposal 'in the garbage', 'return to a pharmacy' and 'storing medication in the house'. The education level had not resulted in any significant association with disposal practices, except for those who had primary education, where they actually practiced burning more. However, burning remains the least practiced disposal method.

In conclusion, participants had poor knowledge on the proper disposal methods for unused medicines and this was also reported in other studies (Seehusen & Edwards 2006). The USA study reported that less than 20% of the 301 participants received a medical provider advice on medication disposal compared to just less than 30% found in this study. Moreover, 35% of participants from the USA

study said it was acceptable to flush medication down the toilet and 66.7% believed it was acceptable to return the unused medication to a pharmacy. In this study, 15.8% of the participants accepted flushing down the toilet whilst 47.4% preferred to return medication to the pharmacy. These figures indicate that the majority of SSB hospitals patients know that returning of unused medicines to the pharmacy is probably safer than disposing it themselves.

The attitudes and practices of the SSB hospital patients was that the majority (70%, n = 177) of the patients throw their unused medicines in the garbage. One study reported in Serbia (Kusturica et al. 2012) indicate a relatively high rate of throwing unused medication in the garbage (the total of urban and rural families was 80.3%, n = 159). Another study conducted in Kuwait (Abahussain et al. 2006) also reported 76.5% (n = 230) for the same disposal method. In Sweden, however, throwing medicines in the garbage was very low (3%) and instead, storage of unused medicines (55%) and returning unused medicines to the pharmacy (43%) were the two most acceptable practices (Persson et al. 2009).

What was also interesting was that despite knowing that the unused medicines had a negative impact on the environment, this did not influence patients to correctly dispose their unused medicines. Perhaps, being aware of the issue does not necessarily mean that the patients appreciate the impact and quantify the true risks. The consequence of continuing such attitudes and practices is the potential presence of pharmaceuticals in groundwater, lakes, rivers and even drinking water. In the long run, the impact on the environment is huge and this would continue to grow with the population growth and the increase in amount of dispensed medication.

When designing the survey, similar study done in Serbia (Seehusen & Edwards 2006) was considered and adapted. The study sample was drawn from the patients of one hospital's outpatient pharmacy and the patients were mainly living in the Belait district (second largest district in Brunei). It was unclear how well these findings can be generalized for the entire Brunei population. Most of the elderly refused to participate in this study and the elderly were prone to have polypharmacy. This study did not explore the details of garbage disposal and whether the FDA standards were followed or not and there was no differentiation between the disposal of solid *versus* liquid medicines. It was highly likely that the liquid medicines were being flushed down sinks or toilets as reported in other studies (Braund et al. 2009). The exact type of medicines being kept at home and its relative costs were also not asked.

CONCLUSION

This study indicates that patients from this outpatient pharmacy have poor knowledge and practices on the proper disposal of their unused medicines. Patient education on the "Return your medicines" program could possibly lead to them returning their unused medicines to the pharmacy. Various strategies could be made to reduce

medication wastages. Health policy makers need to be aware of medication wastage and how preventing it can potentially reduce the cost of healthcare. Regarding the environmental effects due to poor practices of medicines disposal, education is again a key area to improve patients' practices and beliefs. Policy guidelines on reducing medication wastages and saving the environment need to be promoted. Future studies in this area can be done in a larger public hospital to identify the types of unused medication and their relative costs.

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