



**Effect of patient's own medication management on medication waste
in an orthopaedic inpatient population**

Master Thesis Pharmacy

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Abstract

Background: Medication wastage has detrimental effects on both the environment and rising healthcare costs. Patient's own medication (POM) use combined with self-administration of medication (SAM) during hospitalisation might reduce medication wastage.

Objective: To determine if POM use and SAM reduce the volume of medication waste during hospitalisation. As secondary objectives the monetary value of the medication waste and the views of both patients and hospital staff on medication wastage in relation to POM use and SAM were determined.

Methods: A prospective pre- post intervention study was conducted at the Elisabeth-Tweesteden Hospital, Tilburg, The Netherlands. All patients admitted to the orthopaedic ward at location TweeSteden between the 8th of March 2022 and the 28th of May 2022 were included. Data on medication waste was collected in volume of medicines (in pieces) and in monetary value (in €). A 5-point Likert scale survey was conducted to get insight into the views of patients and hospital staff on medication wastage. All data were analysed using descriptive statistics in SPSS.

Results: The volume of wasted medicines decreased with 44.3% from 477 to 331 pieces per 100 inpatient days. The monetary value in hospital purchase price of wasted medicines decreased with 151.8% from €283.80 to €112.70 per 100 inpatient days. Based on the national pharmacy purchase price, the decrease was 382.4% from €549.90 to €114.00 per 100 inpatient days. Overall, both the patients and hospital staff were positive towards POM use and SAM as means to reduce medication wastage.

Conclusion: The implementation of POM use and SAM during hospitalisation seems to have the potential to reduce medication waste and concomitant costs at an orthopaedic ward.

Keywords: medication wastage, patient's own medication, self-administration of medication, hospitalisation, orthopaedics

Introduction

In the Netherlands it is estimated that €100 million of unused medicines are wasted every year [1]. Wasting medication contributes to maintaining rising healthcare costs [2]. Besides increasing costs, medication wastage also has detrimental effects on the environment. Unused medicines negatively affect the environment because of their unnecessary production, transport and processing, e.g. leading to CO₂ emission [3].

A review has shown that several factors contribute to medication wastage, including pharmacotherapeutic changes, excessive stock at patients' home, expired medicines and the death of patients [4]. During hospitalisation pharmacotherapeutic changes are most common. This is mainly because about 30% of medication used at home is substituted by the hospital [5]. As a result, patients admitted to the hospital are provided with medication from the hospital pharmacy. These substituted medicines are resubstituted to the patient's home medication at discharge. The latter is a factor for in-hospital medication waste, because (opened) packages of medication are disposed of when not used for the patient [6]. In addition, short hospital stays contribute to medication wastage, such as at an orthopaedics ward. The average hospital stay on such a ward is 24-48 hours. On the day of admission, the required home medication is ordered by hospital staff. Delivery of this medication to the ward is the next day, while the patient has often been discharged already. This results in a waste of medicines and concomitant costs.

According to a review of Lummis et al., patient's own medication (POM) use has a beneficial impact on reducing costs including decreased medication waste [7]. POM use means that patients bring their own prescription and non-prescription medicines into the hospital for use during their admission. A Dutch multi-centre study of the Radboud UMC also concluded that the implementation of POM use is a solution to reduce wastage. This study showed a reduction of 28,3% of medication waste costs during hospitalisation. In addition, it was calculated that POM use could save €15 million each year in the Netherlands alone [8]. In contrast to the reduction in costs, the average medication volume wastage in pieces increased with 13,1% [6].

POM use can be combined with self-administration of medication (SAM). SAM allows capable patients to manage their medication regimen throughout hospitalisation. It is not clear how the combination of POM use and SAM affects the medication waste. Furthermore, both patients and hospital staff play a major role in medication management during hospitalisation. Their handling of medication may affect the amount of medicines wasted. In addition, the awareness of their role may also have impact. Therefore, it is necessary to investigate the view of patients and hospital staff on (their role in) medication wastage.

The primary objective of this study was to determine if POM use and SAM reduce the volume of medication waste (in pieces) during hospitalisation in an orthopaedic inpatient population. The secondary objectives of this study were to quantify the effect of POM use and SAM on the monetary value of the medication waste (in €) and to investigate the views of both patients and hospital staff on medication wastage in relation to POM use and SAM.

Methods

Study design

This was a mono-centre prospective pre-post intervention study conducted from February to July 2022 and performed in the Elisabeth Tweesteden Hospital (ETH) in Tilburg, The Netherlands. The ETH is a large, specialised clinical care teaching hospital with an extensive range of specialist healthcare. The hospital has about 940 clinical beds spread over two locations: Elisabeth and Tweesteden (TS). The pre-intervention study period was from 8 March 2022 until 7 April 2022 and the post-intervention study period was from 26 April 2022 until 27 May 2022.

Study Population

The study population consisted of all patients admitted to the orthopaedic ward at location TS between the 8th of March 2022 and the 28th of May 2022. This population mainly concerns ASA 1 and ASA 2 patients according to the American Society of Anaesthesiologist classification (ASA). ASA 1 is defined as a healthy patient without any medication and ASA 2 as a patient with a (mild) disease, which does not affect the quality of life (e.g. high blood pressure for which medication is required), respectively [9]. All patients at ETH not admitted to the orthopaedic ward at TS were excluded.

Pre-intervention: Standard care

The hospital medication process generally begins with medication reconciliation by a pharmacy technician or physician at admission. Physicians order medication based on this pharmacotherapeutic information, using the hospital's formulary [6]. If home medication is non-formulary, it is substituted by the hospital pharmacy. Logistic employees and pharmacy technicians provide the wards with the required medicines. Several times a day, during medication rounds, nurses prepare and administer the required medication. At discharge, the medication is resubstituted to patients' original medication.

Intervention: POM use and SAM during hospitalisation

In April 2022 POM use and SAM were implemented at the orthopaedics ward at hospital location TS. As in standard care the hospital medication process begins with medication reconciliation. Contrary to standard care, home medication is not substituted using the hospital's formulary, because patients bring their own medication, including both prescription and over the counter medication, into the hospital. If patients need medication, e.g. because they forgot to bring it, don't have enough, or start a new therapy, it is ordered from the outpatient pharmacy. When capable, patients self-manage their medication regimen, including storage and administration, during hospitalisation. During standard medication rounds, nurses check with the patients whether they have taken their medication and document the self-administrations on the electronic medication administration record. Daily, a physician or nurse evaluates whether the patient is (still) capable of SAM. However, not all forms of administration are suitable for self-administration, e.g. intravenous administration is done by nurses.

Inhospital waste management

Unused medicines during hospitalisation are collected by nurses in the ward's medicine room. After transport to hospital pharmacy, the collected medicines are divided into two groups. The first group consists of medicines that can be disposed of immediately and the second group consists of medicines that can be re-used. In order to re-use medicines, the medicines must comply with two conditions. Namely, the expiration date must be further away than 3 months and tablet strips must consist of a remaining minimum of 5 pieces. However, there is an exception for the single tablet packages from the hospital pharmacy. If the shelf life allows it, they may be returned. Furthermore, refrigerator products can be re-used when the product relocates from refrigerator to refrigerator. If a medicine does not comply with these conditions, it is disposed of immediately.

Outcomes

The primary study parameter was the volume of medication waste in pieces per 100 inpatient days during the pre- and post-intervention period. The secondary study parameters were the monetary value of the medication waste in € per 100 inpatient days during the pre- and post-intervention period and the view of patients and hospital staff on medication wastage in percentage terms of total responses.

Data collection

Patient data

The data of hospitalised patients were collected from the Electronic Health Record system (EHR, Epic®, Epic Systems, Verona, USA). The following patient characteristics were collected: age, gender, total length of stay, length of stay during study period, the reason for hospitalisation and the number of home medicines including over the counter products such as vitamins. The patients were categorized as polypharmacy patient if they used 5 or more home medicines. In addition, it was registered whether the patient was selected for SAM, POM, both or none. This data was encoded.

Data on volume of medication waste

The waste-related data was obtained by counting the medicines that were collected in the medicine room of the orthopaedics ward twice a week. Both returned and disposed of medicines were identified and quantified per single piece. If the identity of a medicine could not be determined it was counted, but documented as unknown.

Data on monetary value of medication waste

The monetary value per counted medicine was calculated in two ways: based on the national pharmacy purchase price (PPP) in € per medicinal product and based on the local hospital purchase price (HPP). National PPP and local HPP can differ due to contracted price agreements between the hospital and the wholesaler or manufacturer. The prices were obtained using the national unique identification code, named the ZI-number from the Z-index [10]. Both the national PPP and the local HPP were obtained using the ZAGIS report of 11-03-2022. ZAGIS is a tailor-made system for purchasing any medicine registered in the Netherlands for hospital pharmacies. Not all medicines are registered in the ZAGIS report. The monetary value of these medicines was obtained using the national PPP reported in the G-standard. The G-standard is a Dutch pharmaceutical database that supports prescribing, dispensing, ordering, declaring and reimbursing of healthcare products [11].

Survey

A survey was conducted in parallel with the pre-post intervention periods. This survey's aim was to get insight into the views of patients and hospital staff on medication wastage and their expectations of the effects of POM and SAM on medication wastage. The used survey has previously been used in a comparable study by West et al. [12]. The survey was translated to Dutch and consisted of 5-point Likert scale statements covering the following domains: 1. Awareness of medication wastage, 2. Interest in medication wastage, 3. Contribution to medication wastage and 4. Expected impact of POM use and SAM on medication wastage. In total there were 20 statements, 5 per domain. Answer options were strongly agree, agree, neutral, disagree, strongly disagree and no opinion. Furthermore, patients were asked to report their demographics (gender, age, educational level), their work experience in healthcare sector, location of hospitalisation, type of operation and number of medicines in use at home. Hospital staff was asked to report their demographics (gender, age, educational level), function and number of years of work experience in healthcare sector. See appendix A for the details of the survey (in Dutch). The survey for patients was available via the 'Patient Journey' app (Interactive Studios B.V., Rosmalen, The Netherlands). Patients at the orthopaedic ward use this app for online information about their hospitalisation [13]. The survey was distributed to hospital staff via e-mail to team leaders of the following employees: pharmacists, pharmacy technicians, logistics staff, orthopaedists and nurses. The team leaders then forwarded the survey to their teams. After 11 days a reminder was sent to both team leaders and their teams.

All data were collected in Excel-reports (Microsoft office professional plus Excel 2016).

Data analysis

The primary outcome was calculated as number of medicines in pieces per 100 inpatient days per study period (pre- versus post-implementation). Descriptive statistics were used to compare the pre- and post-intervention periods to analyse whether POM and SAM affected the volume of medication waste.

The secondary outcome was calculated as the monetary value of the medication wastage, 1. the national PPP per piece in € and 2. the local HPP per piece in € was used. By adding all monetary waste, the total monetary value of the medication waste was calculated per 100 inpatient days per period (pre- versus post-implementation). Unknown medicines were excluded from this analysis, as it was not possible to determine the monetary value of these medicines.

Survey data were collected from March till May 2022. Only those participants who had fully completed the survey were included. The survey data was analysed using descriptive statistics and results were calculated as numbers with corresponding percentage. If responses concerned agree or totally agree the respondents were considered as positive towards the statement and if responses concerned disagree or totally disagree the respondents were considered as negative towards the statement. The answers of patients at hospital location Elisabeth and missing data were excluded from data analysis. To test the survey's reliability a Cronbach's Alpha was calculated. An alpha of more than 0.70 was considered valid.

Data are expressed as mean +/- standard deviation or as numbers with percentages. For discrete variables chi-square test was used for comparison, for continuous variables t-test or Mann-Whitney U test. In all our analyses a p-value of less than 0.05 was considered significant. All statistical analyses were conducted using SPSS Statistics for Windows (Version 24.0, Armonk, NY: IDM Corp).

Results

In total 297 patients were admitted to the orthopaedic ward at TS during the study period. Patient characteristics are described in Table 1. None of the characteristics differed significantly between the pre- and post-intervention periods. The distribution of patients among SAM, POM, both or none is shown in table 2. In the post-intervention period significantly more patients used their own medication during hospitalisation, self-administered their medication or both.

Table 1 Patient Characteristics

Characteristics	Pre-intervention	Post-intervention	P-value
Patients (n=297)	157	140	
<i>Gender</i>			
Male n (%)	67 (42.7)	52 (37.1)	0.331 ^a
Female n (%)	90 (57.3)	88 (62.9)	
Mean age (years +/- SD)	68.1 +/- 11.6	69.1 +/- 12.8	0.493 ^b
Length of stay (median in days (IQR))	1 (1)	1 (1)	0.165 ^c
Mean home medication (n +/- SD)	5.77 +/- 4.23	5.82 +/- 4.31	0.919 ^b
<i>Polypharmacy</i>			
Yes n (%)	81 (51.6)	76 (54.3)	0.643 ^a
No n (%)	76 (48.4)	64 (45.7)	
<i>Admission reason</i>			
THR n (%)	58 (36.9)	5 (36.4)	0.942 ^a
TKR n (%)	77 (49.0)	71 (50.7)	
Other n (%)	22 (14.0)	18 (12.9)	

THP= Total Hip Replacement, TKR= Total Knee Replacement, n = number, SD = Standard Deviation, IQR = Interquartile Range. a = Chi-square test, b = T-test, c = Mann-Whitney U test.

Table 2 POM use and SAM patient characteristics

Characteristics	Pre-intervention	Post-intervention	P-value
<i>SAM</i>			
Yes n (%)	0 (0)	72 (51.4)	0.000 ^{a*}
<i>POM</i>			
Yes n (%)	27 (17.2)	82 (58.6)	0.000 ^{a*}
<i>SAM + POM</i>			
Yes n (%)	0 (0)	62 (44.3)	0.000 ^{a*}

SAM=Self-Administration of Medication, POM= Patient's Own Medication use, *significant ($p < 0.05$). a = Chi-square test

Volume of medication waste

The total volume of wasted medicine was 1,281 and 1,356 pieces during the pre-intervention and post-intervention period respectively. Validation of the collected data exposed one striking outlier (see Appendix B for the statistical argumentation). This concerned a bag of home medication forgotten by a patient containing 280 pieces during the post-intervention period. Because this medication was non-hospital formulary and distorted the results, it was excluded from the analysis of the primary and secondary outcomes. Consequently, the total volume of wasted medicine in the post-intervention period used for analysis was 1,076 pieces.

Accordingly, the volume of wasted medicine was 477 pieces per 100 inpatient days during the pre-intervention period and 331 pieces per 100 inpatient days during the post-intervention period. This results in a decrease of 44.1% of the amount of wasted medicine after the implementation of POM use and SAM.

Of the total volume wasted medicine during the pre- and post-intervention period 45.9% and 25.1% respectively was returned to the hospital pharmacy for re-use; the remaining part was immediately disposed of. Figure 1 shows the distribution of medication waste in pieces during the pre- and post-intervention period. As shown in figure 1 relatively less medicines were returned for re-use (25.1%) and relatively more medicines were disposed of (74.9%) in the post-intervention period as compared to the pre-intervention period. The volume of medicine that was immediately disposed of was 258 pieces per 100 inpatient days during the pre-intervention period and 248 pieces per 100 inpatient days during the post-intervention period. This results in a decrease of 4.0% of the amount of immediately disposed of medicine after the implementation of POM use and SAM.

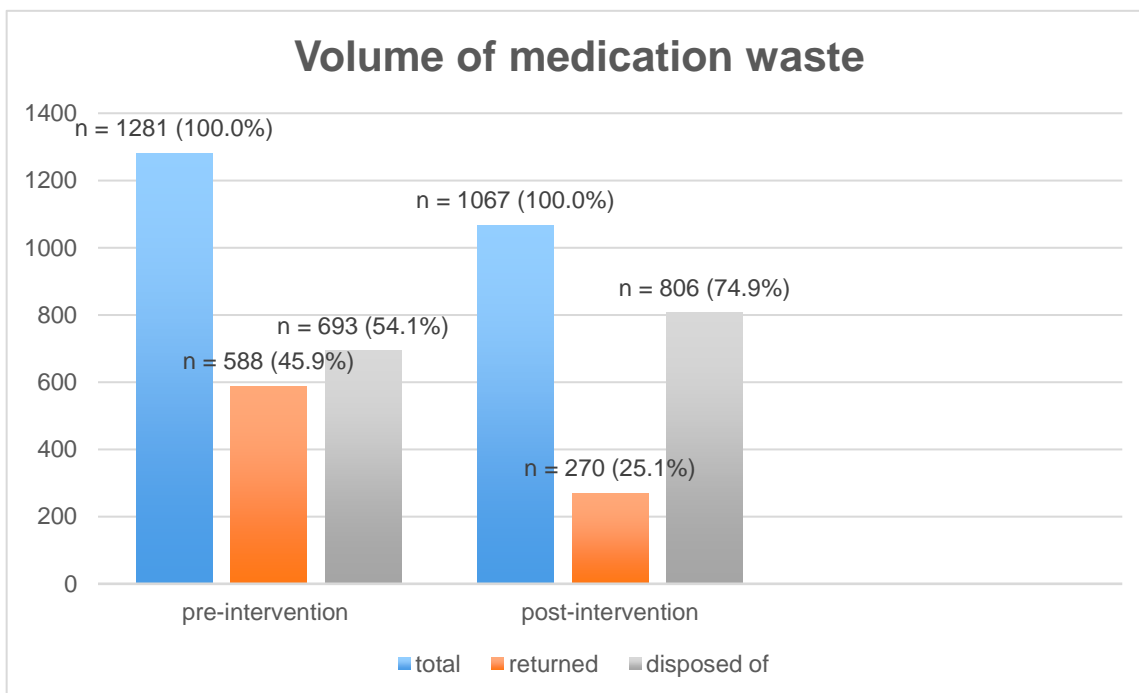


Figure 1 Distribution of medication waste in the pre- and post-intervention period.

Monetary value of medication waste

Of the total volume medication waste (in pieces) 11.7% and 31.1% was unknown during the pre- and post-intervention period, respectively, and were excluded from the analysis of the monetary value. The total monetary value in HPP of wasted medicines per 100 inpatient days was €283.80 and €112.70 during the pre- and post-intervention period respectively. For 17.6% and 19.1% of the wasted medicines the HPP was not known during the pre- and post-intervention respectively. Therefore, the PPP value was also used. The total monetary value in PPP of wasted medicines per 100 inpatient days was €549.90 and €114.00 during the pre- and post-intervention period respectively. Accordingly, the HPP decreased with 151,8% and the PPP decreased with 382.4% after implementation of POM use and SAM.

Survey reliability

The calculated Cronbach's Alpha was 0.792 ($\alpha > 0.7$) (n = 12). See Appendix C for more details.

Patients' and hospital staff's view on medication wastage

In total, 30 patients and 78 hospital staff members responded to the survey and were included in the analysis. The response rate for patients was 10.1% and for hospital staff 59.1%. Appendix D describes the demographic characteristics of the patients and hospital staff. Less than one third (27%, n = 8) of the patients had work experience in the healthcare sector and more than three quarters (87%, n = 68) of the staff had more than 5 years of experience in the healthcare sector. Figure 2 shows an overview of the results of the survey. A more detailed overview of the survey results is shown in Appendix E.

Awareness of medication wastage

Overall, of the patients 74.7% and of the hospital staff 76.0% was positive towards statements related to their awareness of medication wastage. Furthermore, of the patients 4.7% and of the hospital staff 14.9% was negative towards these statements.

Interest in medication wastage

Towards statements related to their interest in medication wastage 62.7% of the patients and 75.4% of the hospital staff was positive. A small number of the respondents was negative towards these statements: 3.3% of patients and 2.6% of hospital staff respectively.

Contribution to medication wastage

Almost half of the patients (n= 16, 53.3%) (totally) disagreed with the statement 'I feel that I contribute to wasting medication', in contrast to the hospital staff of whom more than half (n= 46, 59.0%) (totally) agreed with this statement. In general, of the patients 35.3% was positive and 22.7% was negative towards statements related to contribution to medication wastage. Contrary, of the hospital staff 65.9% was positive and 10.0% was negative towards these statements.

Expected impact of POM use and SAM on medication wastage

Of both patients and hospital staff, the majority was positive towards statements concerning the impact of POM use and SAM on medication wastage, 75.3% and 83.8% respectively. In addition, of the patients 6.7% and of the hospital staff 1.5% was negative towards these statements.

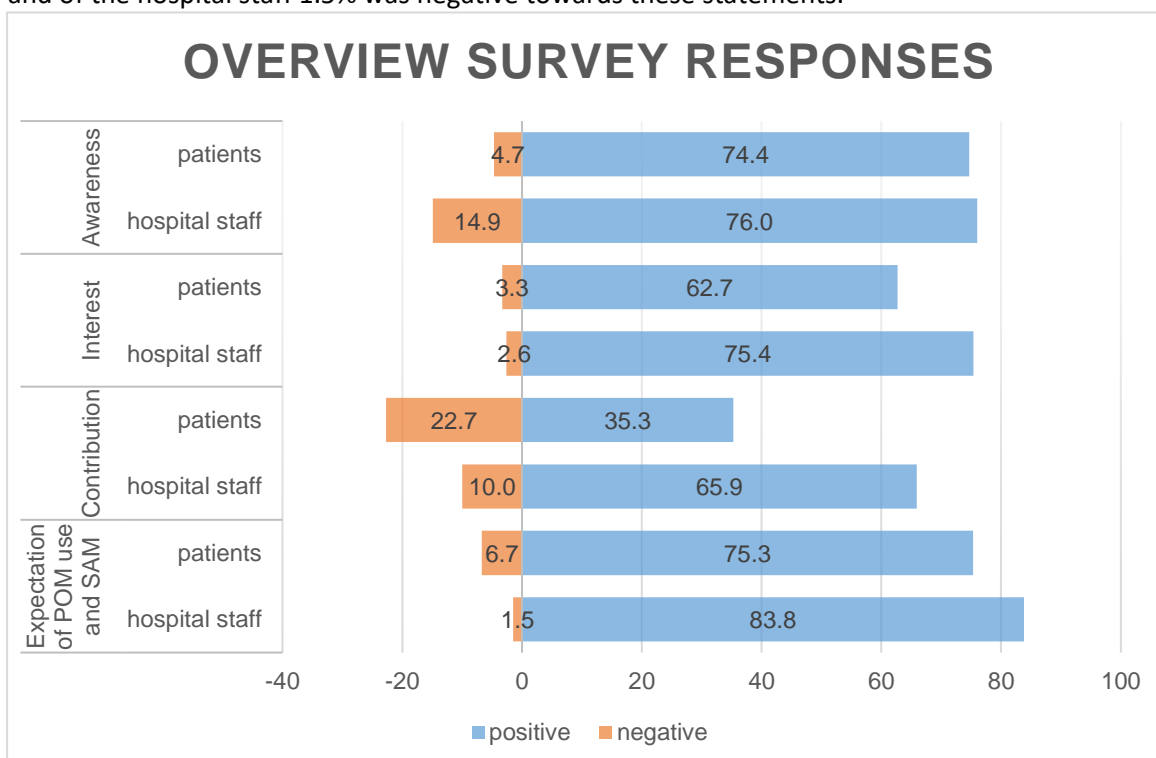


Figure 2 Overview results of patient and hospital staff respondents per domain in frequencies (%)

Discussion

POM use and SAM led to a reduction in both quantity and monetary value of medication waste at the orthopaedic ward. The quantity of wasted medicines decreased with 44.1% from 477 to 331 pieces per 100 inpatient days. The monetary value in HPP of wasted medicines decreased with 151.8% from €283.80 to €112.70 per 100 inpatient days. Based on the PPP, the decrease was 382.4% from €549.90 to €114.00 per 100 inpatient days. Furthermore, the majority of both patients and hospital staff had a positive expectation of the effect of POM use and SAM on medication wastage. Namely, of the patients 75.3% and of the hospital staff 83.8% (totally) agreed with the statements related to the reduction of medication wastage due to POM use and SAM.

This study focused on the effect of POM use combined with SAM on medication waste. In accordance with the study of Sorensen et al., POM use in combination with SAM may save more costs than SAM alone. The results of Sorensen et al. showed that SAM alone could save €2.70 of total costs per patient and an additional saving of €6.40 per patient may be realized if SAM was combined with POM use. These results were not significant. Nevertheless, it was concluded that from a hospital perspective, SAM combined with POM use can save more costs than SAM alone [14]. Our study did not compare POM use or SAM alone with the combination of both. Therefore it is not possible to conclude from our study that combining POM use with SAM may save more costs than either of them alone.

The study of van Herpen-Meeuwissen et al., examined the economic impact of POM use in Dutch hospitals [6]. They estimated not only the costs and quantity of medication waste, but also the costs of time spent by hospital staff. It was concluded that implementation of POM use could save more than €1,500 of medication waste per 100 inpatient days and €1,200 hospital staff's salary per 100 inpatient days. In our study, wastage in monetary value was limited to the value of the amount of wasted medicines during the study period. But it is expected that both salary and time may be saved too after the implementation of POM use and SAM. For example in the process of returning medicines for re-use. In this study it was shown that approximately 20% less medicines were returned for re-use. Consequently, this may lead to an additional saving, because pharmacy technicians need less time to process this medication. However, in this study, these kinds of savings were not quantified. On the other hand, it means that there was a shift towards relatively less medicines returned for re-use and more medicines that had to be disposed of. This may have been caused by non-formulary medication brought by patients for POM use during the post-intervention period, as non-formulary medication cannot be returned for re-use and has to be disposed of.

In accordance with a study by West et al. [12] the respondents were aware of their role and tended to be interested in medication waste. In relation to who contribute to medication wastage, only the patient respondents, not the hospital staff, corresponded well with the respondents in the study by West et al.: respondents mainly felt that others rather than they themselves contribute to medication wastage. However, West et al. studied a different population than we did: the general public as opposed to hospitalized patients and hospital staff. Another difference between West et al.'s and our study is that their statement related to potential impact of interventions on medication wastage did not directly focus on POM use and SAM. Their statement was related to the respondent's confidence in the ability of healthcare providers to have impact on medication wastage. Nonetheless, overall, there were similarities between awareness, interest, contribution and impact of interventions on medication wastage of respondents in both their study and ours.

This study has several limitations. First, POM use and SAM were a new way of working for the hospital staff. Therefore, no measurement took place during the first two weeks of POM use and SAM, to give the hospital staff time to adjust to the new process. Despite this interval, only 44% of the post-intervention study population had both POM use and SAM, which may have led to an underestimation of the effect of POM use and SAM on medication waste. Apparently, the habituation process took longer. Because this study was time

bound, it was not possible to prolong our data collection, but it would be useful to repeat the measurements when hospital staff has fully habituated to the new process. Secondly, due to the short study period, the focus of this study was to quantify the waste at the orthopaedic ward in volume and monetary value. As a result, not the total potential economic impact of POM use and SAM was studied, e.g. time spent on the total medication process and shifts in professional activities were not included. Furthermore, the results of this study are an overestimation of the amount of medicines that is actually disposed of in hospital, because a portion of the medication is returned to pharmacy for re-use: 45.8 % in the pre-intervention and 25.1% in the post-intervention respectively, as mentioned before. From a different perspective, the results of this study are an underestimation of medication waste, because several factors contribute to medication waste [4]. Medication is not only wasted during admission, but also at home, local pharmacies etc. Lastly, the survey aimed to obtain a general perspective of patients and hospital staff towards medication wastage. Therefore, it was not possible to show a potential difference in perspective between patients and hospital staff that had and had not experienced POM use and SAM respectively.

Due to the prospective nature, one of the strengths of this study is the validity of the data. The selection of an appropriate ward adds to the validity of the data. The orthopaedic ward was appropriate for the implementation of POM use and SAM due to the majority of admitted patients being capable of POM use and SAM, as well as the short length of stay on this ward, as was mentioned before. Additionally, the staff on this ward was motivated to implement POM use and SAM. This led to effective collaboration and implementation. Moreover, due to the short study duration, the working policies throughout the entire study period were comparable, with the exception of the implementation of POM use and SAM. Lastly, directly after implementation of POM use and SAM, this study included a two-week transition period in which no data were collected, to leave room for the healthcare providers' learning curve. As a result, the staff's adjustment to POM use and SAM had a minor impact on the outcomes.

All in all, POM use in combination with SAM has the potential to reduce medication waste, both in pieces and in monetary value, at an orthopaedic ward. The majority of both the patients and hospital staff were positive towards the potential of POM use and SAM to reduce medication wastage. Future studies could assess the long-term effects of POM use and SAM on medication waste, may include other outcomes such as time spent by hospital staff, and should include more than one ward with the aim to further understand and quantify the effects of POM use and SAM implementation in hospitals.

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Appendices

APPENDIX A: Survey in Dutch

<p>Algemeen patiënten:</p> <p>Geslacht:</p> <ul style="list-style-type: none">- Man- Vrouw- Anders, namelijk: ... <p>Leeftijd: ...</p> <p>Ingreep:</p> <ul style="list-style-type: none">- Heup,- Knie,- Anders, namelijk: ... <p>Opname locatie:</p> <ul style="list-style-type: none">- TweeSteden- Elisabeth <p>Aantal thuismedicatie: ...</p> <p>Werkervaring in de zorg:</p> <ul style="list-style-type: none">- Ja- Nee- Weet ik niet <p>Opleidingsniveau</p> <ul style="list-style-type: none">- Basisonderwijs- VMBO- HAVO- VWO- MBO- HBO- WO- Anders, namelijk: ...	<p>Algemeen medewerkers:</p> <p>Geslacht:</p> <ul style="list-style-type: none">- Man- Vrouw- Anders, namelijk: ... <p>Leeftijd: ...</p> <p>Aantal jaar werkervaring in de zorg: ...</p> <p>Functie:</p> <ul style="list-style-type: none">- Verpleegkundige- Apothekersassistent- Apotheker- Arts- Logistiek medewerker- Anders, namelijk: ... (optie om in te vullen) <p>Opleidingsniveau</p> <ul style="list-style-type: none">- Basisonderwijs- VMBO- HAVO- VWO- MBO- HBO- WO- Anders, namelijk: ...
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Stellingen te beantwoorden met:

- Helemaal oneens
- Oneens
- Neutraal
- Eens
- Helemaal eens
- Geen mening

Bewustzijn

Deze stellingen gaan over uw bewustzijn met betrekking tot medicatieverspilling.

1. Ik ben mij volledig bewust van medicatieverspilling in het ziekenhuis.
2. Ik ben mij volledig bewust van de gevolgen van medicatieverspilling in het ziekenhuis.
3. Ik ben mij volledig bewust van de invloed van medicatieverspilling op de zorg.
4. Ik ben mij volledig bewust van de invloed van medicatieverspilling op de economie.
5. Ik ben mij volledig bewust van de invloed van medicatieverspilling op het milieu.

Interesse

Deze stellingen gaan over uw interesse in het onderwerp medicatieverspilling.

1. Ik vind medicatieverspilling interessant.
2. Ik vind de gevolgen van medicatieverspilling in het ziekenhuis interessant.
3. Ik vind de invloed van medicatieverspilling op de zorg interessant.
4. Ik vind de invloed van medicatieverspilling op de economie interessant.
5. Ik vind de invloed van medicatieverspilling op het milieu interessant.

Bijdrage

Deze stellingen gaan over wie een bijdrage heeft aan het verspillen van medicatie.

1. Ik heb het gevoel dat ik bijdraag aan medicatieverspilling.
2. Ik heb het gevoel dat patiënten bijdragen aan medicatieverspilling.
3. Ik heb het gevoel dat verpleegkundigen bijdragen aan medicatieverspilling.
4. Ik heb het gevoel dat artsen bijdragen aan medicatieverspilling.
5. Ik heb het gevoel dat apothekers en apothekersassistenten bijdragen aan medicatieverspilling.

Medicatie in eigen beheer en doorgebruik thuismedicatie

Deze stellingen gaan over de verwachting van het effect van medicatie in eigen beheer en doorgebruik thuis medicatie. Doorgebruik thuismedicatie wil zeggen dat u uw eigen medicatie meeneemt naar het ziekenhuis en doorgebruikt. U krijgt dus geen medicatie van de verpleegkundigen van het ziekenhuis meer.

1. Ik verwacht dat het doorgebruiken van thuismedicatie bij een ziekenhuisopname medicatieverspilling vermindert.
2. Ik verwacht dat als patiënten zelf medicatie toedienen bij een ziekenhuisopname medicatieverspilling afneemt.
3. Ik verwacht dat er minder medicijnen worden weggegooid in het ziekenhuis, als de patiënt thuismedicatie door gebruikt bij een ziekenhuisopname.
4. Ik verwacht dat er minder medicijnen besteld moeten worden voor patiënten in het ziekenhuis, als de patiënt thuismedicatie door gebruikt bij een ziekenhuisopname.
5. Ik verwacht dat patiënten minder medicijnen weggooien, als de patiënt thuismedicatie door gebruikt tijdens ziekenhuisopname.

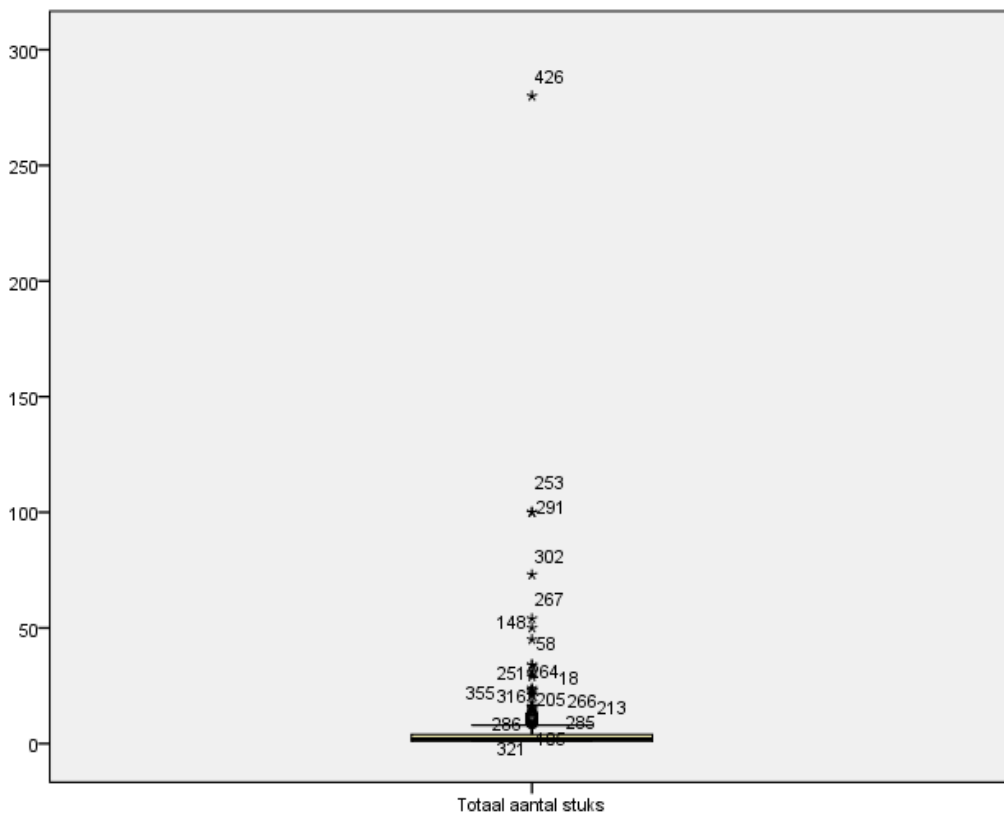
APPENDIX B: Patient's bag of home medication - Outlier

In order to confirm that the bag with home medication of one patient (280 pieces) was on outlier, SPSS was used to validate the data.

The results showed that there were five outliers. However, four of them (i.e. number 2 up to 5 in the SPSS table with extreme values below) were equally distributed over the pre- and post-intervention period. As can be seen in the graph, the patients bag (case number 426) with 280 pieces is way above the others. For this reason the 280 pieces was considered an outlier and excluded from analysis.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Totaal aantal stuks	426	100,0%	0	0,0%	426	100,0%



Extreme Values

			Case Number	Value
Totaal aantal stuks	Highest	1	426	280
		2	253	100
		3	291	100
		4	302	73
		5	267	54
	Lowest	1	412	1
		2	411	1
		3	407	1
		4	405	1
		5	404	1 ^a

a. Only a partial list of cases with the value 1 are shown in the table of lower extremes.

Results of volume medication waste if the patient's bag was included in the analysis:

The total amount of volume wasted medicine during the pre-intervention period was 476.2 pieces per 100 inpatient days. During the post-intervention period 416.0 pieces per 100 inpatient days were wasted, which concerns a decrease in medication waste of 14.5% after the implementation of POM use and SAM.

Results of monetary value of medication waste if the patient's bag was included in the analysis:

The total monetary value in HPP of wasted medicines per 100 inpatient days was €283.80 and €116.27 during the pre- and post-intervention period respectively. For 17.6% and 19.1% of the wasted medicines the HPP was not known during the pre- and post-intervention respectively. Therefore, the PPP value is used. The total monetary value in PPP of wasted medicines per 100 inpatient days was €549.90 and €117.56 during the pre- and post-intervention period respectively. Accordingly, the PPP decreased with 367.7% and the HPP with 144,1% after implementation of POM use and SAM.

APPENDIX C: SPSS Cronbach's Alpha

Before the survey was distributed among patients and hospital staff, it was tested for reliability among 12 arbitrary persons from the inner circle of the researcher (AB). With this sample of 12 respondents the Cronbach's alpha was calculated.

Case Processing Summary

		N	%
Case s	Valid	12	100,0
	Exclude d ^a	0	,0
	Total	12	100,0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
,792	20

APPENDIX D: Patients and hospital staff characteristics

Patient characteristics

Characteristics	Number of respondents (%)
Total response	30 (100)
Gender	
Male	12 (40)
Female	18 (60)
Age (years)	
19 - 25	0 (0)
26 - 40	1 (3)
41 - 50	0 (0)
51 - 65	15 (50)
66 - 80	11 (37)
>80	3 (10)
Type of surgery	
Total knee replacement	17 (57)
Total hip replacement	11 (37)
Other	7 (2)
Number of home medication	
< 5	13 (43)
≥ 5	17 (57)
Work experience in the healthcare sector	
Yes	8 (27)
No	22 (73)
Highest level of education	
Basisonderwijs	1 (3)
VMBO	5 (17)
HAVO	3 (10)
VWO	5 (17)

MBO	8 (27)
HBO	2 (7)
WO	0 (0)
Other	6 (20)

Hospital staff characteristics

Characteristics	Number of respondents (%)
Total response	78 (100)
Gender	
Male	16 (20)
Female	60 (77)
Other	2 (3)
Age (years)	
19 - 25	5 (6)
26 - 40	38 (49)
41 - 50	17 (22)
51 - 65	18 (23)
66 - 80	0 (0)
>80	0 (0)
Work experience in healthcare (years)	
< 5	10 (13)
5 - 10	15 (19)
10 - 20	29 (37)
>20	24 (31)
Function	
Pharmacist	9 (12)
Physician	7 (9)
Logistic employee	8 (10)
Nurse	25 (32)
Pharmacy technician	20 (26)

Other	9 (12) <ul style="list-style-type: none"> - Physician technician 2 - Hospital pharmacist 1 - Pharmaceutical consultant 3 - Purchasing and assortment management (pharmacy technician) 1 - Manager 1 - Unknown 1
Highest level of education	
Basisonderwijs	0 (0)
VMBO	2 (3)
HAVO	1 (1)
VWO	0 (0)
MBO	32 (41)
HBO	22 (28)
WO	19 (24)
Other	2 (3)

APPENDIX E: Survey results

Patients' awareness of medication wastage

Statements	Totally agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Totally disagree n (%)	No opinion n (%)
I am fully aware of medication wastage in hospitals	12 (40)	8 (27)	7 (23)	2 (7)	0 (0)	1 (3)
I am fully aware of the consequences of wasting medication in hospitals.	9 (30)	13 (43)	4 (13)	3 (10)	0 (0)	1 (3)
I am fully aware of the impact of wasted medication on healthcare.	11 (37)	10 (33)	7 (23)	1 (3)	0 (0)	1 (3)
I am fully aware of the impact of wasted medication on the economy.	11 (37)	13 (43)	4 (13)	1 (3)	0 (0)	1 (3)
I am fully aware of the impact of wasted medication on the environment.	13 (43)	12 (40)	4 (13)	0 (0)	0 (0)	1 (3)

Hospital staff's awareness of medication wastage

Statements	Totally agree % (n)	Agree % (n)	Neutral % (n)	Disagree % (n)	Totally disagree % (n)	No opinion % (n)
I am fully aware of medication wastage in hospitals	31 (40)	30 (38)	8 (10)	8 (10)	0 (0)	1 (1)
I am fully aware of the consequences of wasting medication in hospitals.	19 (24)	28 (36)	19 (24)	9 (12)	3 (4)	0 (0)
I am fully aware of the impact of wasted medication on healthcare.	21 (27)	32 (41)	11 (14)	11 (14)	2 (3)	1 (1)
I am fully aware of the impact of wasted medication on the economy.	25 (32)	24 (31)	15 (19)	13 (17)	1 (1)	0 (0)
I am fully aware of the impact of wasted medication on the environment.	29 (37)	27 (35)	11 (14)	9 (12)	2 (3)	0 (0)

Patients' interest in medication wastage

Statements	Totally agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Totally disagree n (%)	No opinion n (%)
I find medication wastage interesting.	1 (3)	18 (60)	8 (27)	2 (7)	0 (0)	1 (3)
I find the consequences of wasted medication in hospitals interesting.	0 (0)	17 (57)	10 (33)	1 (3)	0 (0)	2 (7)
I find the impact of wasted medication on healthcare interesting.	2 (7)	19 (63)	6 (20)	1 (3)	0 (0)	2 (7)
I find the impact of wasted medication on the economy interesting	1 (3)	17 (57)	9 (30)	1 (3)	0 (0)	2 (7)
I find the impact of wasted medication on the environment interesting	0 (0)	19 (63)	8 (27)	1 (3)	0 (0)	2 (7)

Hospital staffs' interest in medication wastage

Statements	Totally agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Totally disagree n (%)	No opinion n (%)
I find medication wastage interesting.	22 (28)	38 (49)	17 (22)	0 (0)	1 (1)	0 (0)
I find the consequences of wasted medication in hospitals interesting.	26 (33)	36 (46)	15 (19)	0 (0)	1 (1)	0 (0)
I find the impact of wasted medication on healthcare interesting.	26 (33)	37 (47)	13 (17)	0 (0)	1 (1)	1 (1)
I find the impact of wasted medication on the economy interesting	18 (23)	33 (42)	23 (29)	4 (5)	0 (0)	0 (0)
I find the impact of wasted medication on the environment interesting	22 (28)	36 (46)	17 (22)	2 (3)	1 (1)	0 (0)

Patients' view on contribution to medication wastage

Statements	Totally agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Totally disagree n (%)	No opinion n (%)
I feel that I contribute to wasting medication.	1 (3)	6 (20)	6 (20)	16 (53)	0 (0)	1 (3)
I feel that patients contribute to wasting medication.	3 (10)	8 (27)	13 (43)	5 (17)	0 (0)	1 (3)
I feel that nurses contribute to wasting medication.	4 (13)	8 (27)	13 (43)	4 (13)	0 (0)	1 (3)
I feel that doctors contribute to wasting medication.	4 (13)	6 (20)	12 (40)	5 (17)	0 (0)	3 (10)
I feel that pharmacists and pharmacy technicians contribute to wasting medication.	7 (23)	6 (20)	11 (37)	4 (13)	0 (0)	2 (7)

Hospital staffs' view on contribution to medication wastage

Statements	Totally agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Totally disagree n (%)	No opinion n (%)
I feel that I contribute to wasting medication.	7 (9)	39 (50)	15 (19)	11 (14)	4 (5)	2 (3)
I feel that patients contribute to wasting medication.	13 (17)	34 (44)	22 (28)	7 (9)	0 (0)	2 (3)
I feel that nurses contribute to wasting medication.	14 (18)	39 (50)	17 (22)	5 (6)	0 (0)	3 (4)
I feel that doctors contribute to wasting medication.	17 (22)	39 (50)	15 (19)	5 (6)	0 (0)	2 (3)
I feel that pharmacists and pharmacy technicians contribute to wasting medication.	15 (19)	40 (51)	14 (18)	5 (6)	2 (3)	2 (3)

Patients' expectations of POM use and SAM on medication wastage.

Statements	Totally agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Totally disagree n (%)	No opinion n (%)
I expect that POM use during hospitalisation will reduce medication wastage.	4 (13)	20 (67)	5 (17)	0 (0)	1 (3)	0 (0)
I expect that SAM during hospitalisation will reduce medication wastage.	4 (13)	14 (47)	6 (20)	1 (3)	3 (10)	2 (7)
I expect that POM use during hospitalisation less medication is disposed of in the hospital	6 (20)	16 (53)	5 (17)	2 (7)	1 (3)	0 (0)
I expect that with POM use during hospitalisation fewer medicines need to be ordered for patients.	5 (17)	19 (63)	5 (17)	0 (0)	1 (3)	0 (0)
I expect that with POM use during hospitalisation less medication is disposed of by patients.	5 (17)	20 (67)	3 (10)	0 (0)	1 (3)	1 (3)

Hospital staffs' expectations of POM use and SAM on medication wastage

Statements	Totally agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Totally disagree n (%)	No opinion n (%)
I expect that POM use during hospitalisation will reduce medication wastage.	39 (50)	31 (40)	7 (9)	0 (0)	0 (0)	1 (1)
I expect that SAM during hospitalisation will reduce medication wastage.	23 (29)	31 (40)	18 (23)	2 (3)	0 (0)	4 (5)
I expect that POM use during hospitalisation less medication is disposed of in the hospital	41 (53)	29 (37)	6 (8)	1 (1)	0 (0)	1 (1)
I expect that with POM use during hospitalisation fewer medicines need to be ordered for patients.	42 (54)	30 (38)	5 (6)	1 (1)	0 (0)	0 (0)
I expect that with POM use during hospitalisation less medication is disposed of by patients.	28 (36)	33 (42)	15 (19)	2 (3)	0 (0)	0 (0)