Cost Comparison between Repackaging Bulk Oral Solid Medicines at Provincial Pharmaceutical Depots and Purchasing Manufacturer-Prepared Patient-ready Packs Available on the National Contracts in South Africa

Abahamye, A: MPharm¹, Burton, SF: PhD¹ & Putter, SJ: BPharm²

¹Department of Pharmacy, Faculty of Health Sciences, Nelson Mandela Metropolitan University (NMMU). PO BOX 77000 Port Elizabeth, 6031. South Africa. ²Systems for Improved Access to Pharmaceuticals and Services/Management Sciences for Health (SIAPS/MSH)

Abstract

Background: Patient-ready packs (PRPs) are convenient medicine package sizes to be dispensed to patients. In South Africa, some manufacturer-prepared PRPs are available for procurement by provincial medicine depots on National Contracts. However, when PRPs are not available, bulk medicines must be repackaged into PRPs at the repackaging units of provincial pharmaceutical depots. This research was aimed at determining the less costly method of obtaining PRPs for primary healthcare (PHC) facilities in South Africa.

Method: Site visits to the repackaging units of four depots were conducted to evaluate the repackaging processes and determine all associated costs. These costs were then reduced to represent cost per unit PRP for each medicine line being repackaged. These were then compared with the cost of purchasing manufacturer-prepared equivalent PRPs available on National Contracts.

Results: Overall, four depots were repackaging 96 PRP lines meant for primary healthcare (PHC) facilities. Of these, only 61 (63.5%; n= 96) were available on National Contracts in equivalent pack sizes. The cost of packaging 35 (57.4%; n= 61) of the PRPs by the depots was less than the cost of equivalent pack sizes available on National Contracts. Only 35 (36.5%; n= 96) lines were targeted at the required PRP lines not available on National Contracts.

Conclusion: There is no statistically significant difference between the cost of Manufacturer-prepared PRPs available on National Contracts and equivalent pack sizes made through repackaging at provincial pharmaceutical depots in South Africa.

Key words: Repackaging; cost-comparison; patient-ready pack; provincial pharmaceutical depot; South Africa.

Declaration of conflict of interest

This work was partially funded by the Nelson Mandela Metropolitan University (NMMU). None of the authors is an employee of (or has commercial interests in) any of the pharmaceutical companies contracted by the National Department of Health of South Africa to supply pharmaceutical products.

Acknowledgements

I acknowledge the contribution of the following people and organisations towards successful completion of this study: Sue Burton (Senior Lecturer, Pharmacy Department, NMMU), Sue Putter (Manager, Monitoring and Evaluation: MSH/SIAPS), Corry Van der Walt, Millidhashni Reddy (Senior Technical Advisor, Essential Medicines Selection & Pharmacoeconomic Evaluations: MSH/SIAPS), Provincial Heads of Pharmaceutical services, Managers of the depots that participated in the study, and the NMMU postgraduate research scholarship (PGRS) scheme.

Introduction

Pharmacists’ workloads and the quality and speed of the dispensing service are currently a matter of concern world-wide.¹ In South Africa, the public health sector serves approximately 80% of the population² through approximately 4 244 government-owned PHC clinics³⁴ and 388 public hospitals.⁴ In terms of dispensing, these facilities are being serviced by, among other healthcare professionals, 2 966 (24.3%) of the 12 218 registered pharmacists⁵ and approximately 212 806 registered nurses.⁶ A small number of pharmacists leads to a low pharmacist-to-patient ratio which may result in longer waiting times for patients to have their prescriptions filled, and could lead to low patient satisfaction and low efficiency of hospital pharmacies.

Patient-ready packs (PRPs) are convenient medicine package sizes to be dispensed to patients. Research has indicated that use of PRPs saves time during dispensing,¹ allows more time for communication with patients,⁷ improves adherence to prescribed medicines,⁷ minimizes dispensing errors⁸ and improves efficiency
of stock control at dispensing facilities. In South Africa, some manufacturer-prepared PRPs are available for procurement by provincial pharmaceutical deports through National Contracts. However, when PRPs are not available, bulk medicines must be repackaged into PRPs at repackaging units at the provincial pharmaceutical deports. Most provincial pharmaceutical deports in South Africa have a repackaging unit.

Besides providing PRPs that may not be available from the manufacturers, the decision to repackage medicines at these units is based on the assumption that they could be repackaged at a lower price than the PRPs available from the manufacturers. However, there are no available studies which include detailed measurements of the costs of all inputs during the repackaging process to support this decision. Early in the 1990s, it was common practice to obtain medicines in bulk quantities at a considerably reduced price. Over the years, however, patents of many branded medicines have expired and many generic equivalents of originator medicines are now available on the market at lower prices. Given this change in market dynamics it is not clear if the initial benefit of minimising costs through repackaging at provincial pharmaceutical deports is still valid.

Background

Repackaging is defined in the Pharmacy Act, Act 53 of 1974 as amended (Pharmacy Act), as the action of removing a medicine from its original container and placing it into another, called a patient-ready pack. A patient-ready pack (PRP), also called a “unit-of-use” pack, is defined as the package of medicines that contains prescription medication in a quantity designated and to be dispensed directly to a patient without modification, except for the addition of a prescription label by a dispensing pharmacist.

Chapter VI of the Regulations Relating to the Practice of Pharmacy published in terms of the Pharmacy Act authorises four categories of pharmacies (manufacturing, institutional or hospital, community and state-controlled/owned wholesale pharmacies) to carry out repackaging. This Act, does not make it clear whether repackaging falls within the domain of manufacturing or not, and whether or not a manufacturer’s licence is therefore necessary for facilities in which repackaging of medicines is carried out. According to the Pharmaceutical Society of South Africa (PSSA), the Medicines Control Council (MCC) proposed that all repackaging facilities obtain a manufacturer’s licence but explicit legal clarity has not yet been established.

Regulation 33 of the General Regulations published in terms of the Medicines Act outlines the conditions under which repackaging must be carried out. One of these is that repackaging may only be carried out by a pharmacist or under the supervision of a pharmacist or any other authorised person in terms of Section 29 (4) of the Pharmacy Act. It also states that a batch numbering system, which contains all the information relating to the ingredients and procedures used during preparation of PRPs, must be employed. The repackaging must be carried out under the required temperature and humidity conditions in an area or premises used solely for repackaging.

Section 2.19 (a) of the Good Pharmacy Practice requirements emphasizes that repackaging “must be performed according to the terms of the provisions of the Medicines Act and in accordance with Good Manufacturing and Distribution Practices as determined by the Medicines Control Council (MCC).” The rest of this section of the Good Pharmacy Practice (GPP) outlines the minimum standards for carrying out the repackaging process. Carrying out repackaging requires input costs which may include, among other expenses: repackaging equipment, consumable materials, human resources, storage space, building and equipment maintenance, and overhead costs, and if carried out according to the provisions of Good Manufacturing Practice (GMP) guidelines, further input costs are needed, in order to implement quality assurance (QA) and quality control (QC) in the repackaging unit.

According to the US Food and Drug Administration (FDA), repackaging is part of production and packaging, and both should be controlled by similar guidelines. Swarbrick suggests that there is only a small difference between operations of repackaging and those of manufacturing, suggesting further that the major difference is in the manufacturing process, where there is control of the components and in-process materials and that the manufacturer has more information about the quality and storage conditions of the drug product compared to the repacker.

There are three levels of production in pharmaceutical manufacturing: primary, secondary and tertiary. Primary production involves processing of raw materials which are used to create active pharmaceutical ingredients (APIs) and also the inactive pharmaceutical ingredients used in pharmaceutical formulations. Secondary production involves large-scale processing of finished dosage forms, e.g. tablets or capsules. Tertiary production deals with packaging and labelling of finished products from primary and secondary processes into bulk packs and smaller dispensing packs such as patient-ready packs.

According to this argument, repackaging is a manufacturing process and therefore, it must be done under strict controls reflecting Good Manufacturing Practices (GMPs). Following GMP guidelines is costly as it requires input costs such as salaries for qualified personnel, buildings or rental space, equipment, power and water supply, security, documentation quality control and quality assurance.

Motivation

There are insufficient pharmacists in the public health care facilities, especially in the rural areas and most of the dispensing work is performed by nurses, who do not receive training in the field of dispensing to the extent that pharmacists do. However, amendments to the Nursing Act 50 of 1978 (published in 1984) allow registered nurses to dispense medicines which are in their original or in a repacked form. Therefore, all medicines available to the PHC facilities should be available in PRPs.
Currently, some of the medicines procured for state use are available in PRP form from manufacturers. However, many lines are repackaged from bulk medicines packs into PRPs by the repackaging units at provincial pharmaceutical depots. The primary aim of setting up repackaging units was to ensure that medicines are available in PRPs for dispensing, thus, minimising the time spent dispensing prescriptions. The establishment of repackaging units was also aimed at minimising costs of medicines, since medicines were procured in bulk packs at potentially lower prices compared to PRPs. The cost-minimising strategy, however, has never been proven quantitatively.

Aims and objectives
The primary aim of this research was to determine the cost of PRPs of solid oral medicines prepared by repackaging bulk medicine packs by four provincial pharmaceutical depots and to compare this with the cost of manufacturer-prepared PRPs procured through National Department of Health Contracts.18,19,20 The objectives of the study were therefore to: (1) identify processes involved in repackaging, (2) determine cost of repackaging bulk medicines including both direct and indirect costs, (3) determine PRPs required at PHC level in South Africa (through review of the Standard Treatment Guidelines and Essential Medicines List (STG & EML)), (4) determine availability of manufacturer-prepared PRPs required at PHC level in South Africa and (5) compare cost of repackaged PRPs with the cost of manufacturer-prepared PRPs.

Methodology
We performed a cost comparison between repackaging oral bulk solid medicines at provincial pharmaceutical depots and purchasing manufacturer-prepared patient-ready packs available on the National Contracts in South Africa. All costs were measured from the perspective of the National Department of Health. An investigatory approach was used. Approval was sought from relevant authorities. Site visits to the repackaging units of four depots were then conducted to evaluate the repackaging processes and determine associated costs. Data was analysed to determine the average cost of producing each PRP. Where necessary, costs were adjusted to account for differences in timing. The National Contracts were then reviewed to determine the available PRPs and compare their costs with the costs of depot-prepared PRPs. The STG & EML (2008 Edition)21 was also reviewed to quantify pack sizes required by the PHC facilities. The required pack sizes (quantified from the review of STG & EML) were then compared to the PRPs made available (a) through repackaging at the provincial pharmaceutical depots and (b) on the National Contracts. A paired t-test was used to test the cost difference per drug between the depot and the National Contracts. Only prices of comparable pack sizes were included in the statistical analysis. A sensitivity analysis was conducted by reducing the unit cost of repackaged PRPs by units of 5% until the average cost difference between repackaged PRPs and National Contract PRPs was significantly different from zero.

Input costs
Running a repackaging facility requires input costs for expenses such as buildings or rental space, personnel, water, power supplies, repackaging equipment, stationery, insurance and others such as practice management and administration costs. In pharmaco-economics terms each of these costs can be grouped as fixed costs, semi-fixed costs, variable costs and annualised costs.

(1) Fixed Costs: Capital Assets and Related Expenses
Capital assets include building costs and the cost of the repackaging equipment, used for both direct and indirect roles.

a. Building costs
The buildings are owned by the Ministry of Public Works. The depot management, reportedly, do not pay rental fees. Therefore, to determine how much the province would spend on the building, the floor area of each of the repackaging units was measured. The prevailing market rate of renting similar warehouse space in a region where the depot is situated was obtained from rental property consultants. At some of the depots, the management had previously intended to procure some additional space at a certain quote. Such a quote was used in the calculations.

b. Repackaging equipment costs
Some of the equipment that is directly used in repackaging units includes: tablet counting machines, shrink wrap heat sealers, foot-operated heat sealers, label printers, weighing scales and label re-winders. Some of these were procured many years ago, at such a time when the repackaging units opened. There was a tablet counting machine in each of the repackaging rooms. On average, there were eight rooms at each of the repackaging units. For some, the actual price that was used to acquire the equipment at the time of purchase was available. This price was then adjusted to estimate the current value of the remaining equipment. For others, the actual cost price was not available. The value of such equipment was estimated from how much it would cost the depot to replace such equipment, in the event the equipment is written off, using the prevailing market prices of such equipment.

However, equipment depreciates over the years and therefore, the current replacement cost would not reflect the true current value of the remaining equipment. Every year, the depreciation value of a fixed asset is equivalent to the difference between its value in that year and the next. Using the discount equation $PV = \frac{FV}{(1+r)^n}$ (where $PV$ = present value of the equipment, $FV$ = fixed/purchase value, $r$ = discount rate and $n$ = number of years the equipment has been in use), the value of each of the fixed assets in the years 2012 and 2013 were obtained. The difference between these values was charged to the depots as the annual cost of using such equipment for the year 2012 (focus year). This is the value of a fixed asset that is written off. An average annual inflation rate ($r$) of 5.00% was considered.22
There is other equipment that is used indirectly in the repackaging process. Their costs are also capital in nature. This equipment includes: desktop computers (and software installation thereof), office printers/photocopiers, staplers, paper punchers, tape dispensers and box files. These were purchased recently and their respective current values were also obtained and used in the calculations of expenses. If equipment was rented, the annual rental cost was also calculated.

(2) Semi-fixed Costs: Labour

The Medicines Control Council of South Africa requires all personnel directly involved in manufacturing of pharmaceutical products to be skilled. Medicines Sciences for Health supports this requirement. The Pharmacy Act requires these personnel to be registered appropriately with the South African Pharmacy Council (SAPC) and lists various categories in which such personnel may register with the Council (SAPC). The categories include Pharmacist and Pharmacist’s Assistant [Learner Basic, Basic Qualified, Learner Post Basic and Post Basic Qualified]. Table 1 shows the number of personnel working at each of the repackaging units and the respective categories in which they are registered with the SAPC.

Table 1: Number of persons working in each unit and their respective registrations with the SAPC

<table>
<thead>
<tr>
<th>Registration Category</th>
<th>Depot A</th>
<th>Depot B</th>
<th>Depot C</th>
<th>Depot D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacist</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Pharmacist’s Assistant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post Basic Qualified</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Learner Post Basic</td>
<td>3</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Basic Qualified</td>
<td></td>
<td>14</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Learner Basic</td>
<td>11</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Not registered/qualified</td>
<td>31</td>
<td>4</td>
<td>17</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>34</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

(3) Variable Costs

Variables are the materials that are consumed during the repackaging process. Their consumption rate increases with increase in the level of the repackaging activity. Variable costs include the cost of consumables such as: (1) protective clothing (e.g. gloves, masks, head caps, aprons and white coats) and uniforms for staff and cleaners, (2) communication costs (e.g. landline telephone and fax costs), (3) printing and stationery expenses (e.g. costs for containers such as cartons, plastic bags, strip-form bags, plastic vials, plastic bottles, paper bags, printing paper, staples, thermal transfer ribbons, labels and toners for printers), (4) short-term building and equipment expenses (e.g. building repairs and maintenance, equipment repairs and maintenance, electricity and water, contract cleaning services, security services, pest control and hygiene), (5) sundry expenses which include the amount paid for laundry services to clean white dispensing jackets and other protective clothes used during repackaging.

(4) Annualised costs

These are the costs paid per year for use of an asset or a service. Annualised cost incurred in repackaging units include (1) annual licensing fees of the premises to the SAPC and the Medicines Control Council (MCC) (2) malpractice insurance costs and (3) building insurance expenses (e.g. public liability insurance (PLI)). Only one of the depots paid the PLI. For the others, it was reported that the buildings are owned by the Ministry of Public Works and hence the depot management did not pay insurance for buildings and the repackaging equipment.

(5) Other (non-classified) costs

There are costs that may not be classified as fixed costs, semi-fixed costs, variable costs or annualised costs. With regard to repackaging, these may include expenses such as those incurred by product complaints and recalls and costs for reference materials. There were no product complaints during the focus time period of the study. In fact, none of the repackaged products have ever been recalled. The following reference materials were available in some of the repackaging units: South African Medicines Formulary (SAMF), Daily Drug Use (DDU), MIMS Desk Reference (MDR), MIMS, Goodman and Gilman’s “The Pharmacological Basis of Therapeutics,” The Martindale, and The Pharmaceutical Society of South Africa (PSSA) Compendium of Laws.

The acquisition costs of the above reference materials were not found in the records. The year in which they were purchased could also not be accurately obtained. A rough estimate of how long (number of years) they had been in use was obtained using their editions. It was assumed that each of the reference books was purchased during the year in which the edition of the book was published. Their respective current market prices were obtained from LexisNexis® online bookstore. The cost price of each of these reference materials was then calculated from the current market prices using the discount equation, at a discount rate of 5%. Again, the annual cost to the depot of using these reference materials for a year is equivalent to the difference between their net value in that year and the next. Hence, the annual cost of using these reference materials for the year 2012 was obtained from the difference between their net value in the years 2012 and 2013.

Cost per Unit of Output

All the costs were summed up and reduced to a daily expense that is required to run a repackaging unit. It was assumed that in a given day, only one product line is opened and repackaged in all the eight functional repackaging cubicles, in order to ensure that the daily expense is directed to that specific product. The daily cost of running the repackaging unit (known as the Conversion Cost) was then added to the total cost of all the bulk containers that were opened and repackaged on that particular day. The average cost of producing every PRP at each depot was then obtained by dividing the total daily cost by the total number of PRPs repackaged during that day (Total daily output) as shown in Figure 1.
Determination of the Required Patient-Ready Packs for Primary Healthcare Facilities

The ultimate aims of repackaging medicines in South Africa are: to minimise costs of medicines; and provide PRPs that may not be available on the National Contracts. If a required medicine pack size is available on the National Contract, it is not necessary to have it produced by the depots’ repackaging units, especially if the price on the National Contract is less than or equal to that of the same pack repackaged at the depot, except in situations when such a pack size is out of stock. We therefore aimed to establish the extent to which repackaging “fills in the missing gaps” by correlating repackaging in line with the required pack sizes of the product lines which are required at the Primary Healthcare facilities but not available on the National Contracts.

The National Treatment Guidelines and Essential Medicines List (EML); Primary Healthcare Level was reviewed in order to quantify the required pack sizes of medicines for Primary Healthcare facilities. The required pack size was obtained from the dose, frequency and duration of treatment. The National Contracts were then reviewed in order to determine the extent to which the required medication packages are available to service the needs of the primary healthcare facilities. Prices of the packs sizes available on the National Contracts were also extracted for comparison with the costs of similar packages that are repackaged at the depots.

Comparison of the Relevant Costs

The costs of the PRPs that are repackaged from the bulk packs at the depots were compared with the cost of similar PRPs that are available on the National Contracts. Costs of the lines of repackaged medicines that are not listed on the Standard Treatment Guidelines and the Essential Medicines List for Primary Health Care were not considered because this study focused on the medicines which are listed in the Essential Medicines List (EML) for Primary Healthcare.

The Hypothesis

The null hypothesis was stated as: there is no difference between the unit cost of manufacturer-prepared PRPs of medicines that are procured on the National Contracts for use in the public sector and the total unit cost of same PRPs of medicines repackaged from bulk packs by the repackaging units at provincial medicine depots. \( H_0: \text{diff} = 0 \). The alternative hypothesis stated that there is a difference in the unit costs \( H_1: \text{diff} \neq 0 \).

Results and discussion

Operational Costs for Repackaging Units

The majority of the cost figures were obtained from the invoices that had been used to purchase the various equipment and all other related expenses such as maintenance. Fixed-cost equipment such as tablet counting machines at depots A, B, and C were purchased several years ago (more than 20 years) when the repackaging units at those depots started operating. Invoices for the purchases of such equipment were not available. Costs for using such equipment were obtained as described in the methodology. Other materials whose invoices were not available were the reference books. Fixed costs at Depot D were obtained from the invoices, and a service contract which was awarded to a private company to convert a portion of the existing warehouse into a repackaging unit in the year 2010. Fixed costs remain constant regardless of the rate of repackaging activity. Other costs which remain unchanged with respect to the rate of activity in the repackaging units included annualised costs, costs for reference materials and quality tests.

Semi-variable costs remained constant for the period of the study. However, these costs also change over a considerable length of time. This change depends on the projected rate of activity, which depends on how much of the repackaged items are requested by the Primary Healthcare (PHC) facilities (hospitals and clinics). Based on such projections, a decision is made whether or not to increase the number of people working in the repackaging unit. This is done at the beginning of a financial year and not at any other time during the year, since depots run on fixed budgets for a given financial year.

Variable costs varied greatly depending on the rate of activity. The rate of activity was largely dependent on the perceived demand for the repackaged PRPs from the orders that were placed by the clinics and hospitals. Units had written output rates that were displayed on the walls inside the repackaging area. These rates gave an idea of how many PRPs were expected from each cubicle which two workers had been assigned to manage. Adherence to this output rate depended on the presence of the Responsible Pharmacist (RP). One of the difficulties of the RP was to enforce the output rates; otherwise they were not strictly adhered to. This greatly affected the Cost per Unit of Output.

Fixed costs were constant at each depot but varied very much across the different depots. The variation in the space cost was dependent on the area where the depot is located. Rental space for depots which are situated in the middle of cities were much
higher than those of depots situated in rural areas far from big cities.

Depot B had the lowest rental space cost. Unlike other depots, space cost for Depot B was not estimated based on the prevailing market rates of similar space in the area. The Provincial Department of Health used R6 317 396.51 to refurbish a portion of the warehouse, to make it suitable for repackaging. Refurbishment also included installing equipment such as the air-handling unit, tablet counting machines, computers, etc. This expense was used to calculate costs for space and equipment during the focus year.

Only Depot C carried out extensive Quality Control (QC) tests that involved costs. The tests included: visual inspection, spectrophotometric analysis, chromatographic analysis, capillary electrophoresis analysis, chemical and physical analyses, and tests on packaging (strip-form bags): Print adhesion and permeability. Other depots only carried out visual inspection which did not require costs. Table 2 shows the total annual and daily costs for the various inputs of the repackaging process in the different provinces.
Availability of the Required Patient-Ready Packs for Primary Healthcare Facilities

One of the two main aims of repackaging is to provide pack sizes of medicines which are required in the Primary Healthcare (PHC) facilities but are not available on the National Contracts. The review of the Standard Treatment Guidelines and Essential Medicines List (STG & EML) revealed that; over 283 different pack sizes of medicines are required to service PHC facilities. Of these, 118 (41.7%; n=283) were available on the National Contracts. In total, four depots were repackaging 96 PRP lines meant for PHC facilities (i.e., listed in the STG & EML: PHC Level). Of the 96 lines, 61 (63.5%; n=96) were available on National Contracts in equivalent pack sizes. Hence, only 35 (36.5%; n=96) of the repackaged lines were targeted at the PRP lines which, while required at the PHC facilities, were not available on National Contracts.

Comparison of the Relevant Costs

The second of the two major aims of repackaging medicines in South Africa is to minimise costs of medicines. Table 3 shows that of the pack sizes that could be compared, three out of eight (37.5%; n=8) pack sizes made at Depot A; 12 out of 21 (57.1%; n=21) from Depot B; and 11 out of 15 (73.3%; n=15) from Depot C, cost more than similar pack sizes that were available on the National Contracts. All 17 (100%; n=17) pack sizes made available from Depot D (which had their equivalents on the National Contracts) cost less than those equivalent pack sizes. In total, 35 (57.4%; n=61) of the lines repackaged at the depots cost less than their equivalents that were available on the National Contracts. Only 26 (42.6%; n=61) lines repackaged at depots cost more than their equivalents available on the National Contacts.

Summary of Statistical Analysis

**Depot A:** The average cost of manufacturer-prepared PRPs (mean = R20.29, 95%CI: 2.1 – 32.4) was less than the average cost of depot-prepared PRPs (mean 20.49: 95%CI: 7.2 – 33.8). The mean price difference was -0.19 (SD 2.9). The difference did not reach statistical significance, p = 0.2 hence there’s no evidence from this study of a price difference.

**Depot B:** The average cost of manufacturer-prepared PRPs (mean = R13.74, 95%CI: 5.2 – 22.2) is greater than the average cost of depot-prepared PRPs (mean: R13.2, 95%CI: 6.6 - 19.9). The mean price difference was 0.49 (SD 4.3). This difference did not reach statistical significance, p = 0.7. There is no evidence from this study of a price difference.

**Depot C:** The average cost of manufacturer-prepared PRPs (mean 13.74, 95%CI: 5.2 - 22.2) is greater than the average cost of depot-prepared PRPs (mean: R13.2, 95%CI: 6.6 - 19.9). The mean price difference was 0.49 (SD 4.3). This difference did not reach statistical significance, p = 0.2 hence there’s no evidence from this study of a price difference.

**Depot D:** The average cost of manufacturer-prepared PRPs (Mean R5.44, 95%CI: 2.3 - 8.6) was greater than the average cost of depot-prepared PRPs (mean R4.00, 95%CI 1.4-6.6). The mean price difference was 1.44 (SD 1.64). This difference was statistically significant, p = 0.002. Therefore on average, the cost of PRPs on the National Contracts is significantly higher than PRPs made available at depot in Province D.

Sensitivity Analysis

In order for repackaging at the provincial pharmaceutical depots to be preferred, the cost of the repackaged PRPs must be significantly different (lower) than that of the National Contracts. In the case of a marginal cost difference, switching to provincial repackaging would not be worthwhile. A sensitivity analysis was conducted by reducing the repackaged PRP unit cost by 5% until the average cost difference between repackaged PRPs and National contract PRPs was significantly different from zero. The percentage reductions required for this equivalence were found to be 11%, 40% and 25% for depots A B and C respectively as shown in Table 4. No price reduction was necessary for PRPs made at depot in province D since the PRPs made at this depot cost less than their equivalents on the National Contracts.

These price reductions can be achieved by either reducing the cost of production or by increasing the rate of production. Cost of production may be reduced by cutting down the daily operation costs; for example Depot A would need to cut down their average daily operation costs by at least R23 096.99 (currently operating at R22 671.31 per day), R14 293.13 for Depot B (currently operating at R19 738.57 per day) and R44 704.03 for Depot C (currently operating at R27 396.32 per day). These reductions are not

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**Table 4: Sensitivity Analysis**

<table>
<thead>
<tr>
<th>n drugs costed</th>
<th>Depot-PRP Cost</th>
<th>Current cost</th>
<th>Estimated Cost for statistical significance</th>
<th>Difference between current and estimated</th>
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</thead>
<tbody>
<tr>
<td>Depot A</td>
<td>8</td>
<td>21.29</td>
<td>20.49</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>14.48</td>
<td>5.63</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>18.23</td>
<td>14.18</td>
<td></td>
</tr>
<tr>
<td>Depot B</td>
<td>22</td>
<td>4.58</td>
<td>5.52</td>
<td>40%</td>
</tr>
<tr>
<td></td>
<td>SD</td>
<td>4.46</td>
<td>5.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>3.31</td>
<td>3.23</td>
<td></td>
</tr>
<tr>
<td>Depot C</td>
<td>15</td>
<td>13.74</td>
<td>13.25</td>
<td>25%</td>
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<tr>
<td></td>
<td>SD</td>
<td>15.35</td>
<td>11.97</td>
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<td>Mean</td>
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<tr>
<td>Depot D</td>
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<td>5.44</td>
<td>4.00</td>
<td>no reduction required</td>
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<tr>
<td></td>
<td>SD</td>
<td>6.06</td>
<td>4.98</td>
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principles of evidence-informed medicine, pharmacoeconomics

Studies of this nature which emphasize the application of the alternative options, using the same resources. The results of this study have further enhanced the current knowledge base in terms of economic evaluations in the field of pharmaceutical services in South Africa and have provided knowledge on how to calculate the exact remaining value of a fixed asset after it has been in use for a long period of time. Most sources indicate that fixed assets should be written off after exceeding their economic value.

Conclusions

At the current market prices, PRPs from manufacturers/suppliers which are available on the National Contracts cost the same as those made available through repackaging at provincial medicine depots, on average. The study showed that costs of manufacturer-prepared PRPs were less than costs of similar PRPs made available through repackaging at two of the four depots, although the difference in prices was not statistically significant. Manufacturer-prepared PRPs were found to cost higher than similar PRPs from two of the depots, one of which was not statistically significant. The difference of costs was observed to be significantly higher at only one of the four depots included in the study.

This study was relevant within the field of pharmaceutical services. It emphasized the importance of using cost-analysis as a tool, especially where decisions must be made in terms of allocation of resources. Results of this study have provided the necessary evidence for decision-making, to the National Department of Health and the Provincial Departments of Health, regarding the cheaper method of obtaining medicines for the public sector in the required pack sizes.

The results of this study have further enhanced the current knowledge base in terms of economic evaluations in the field of pharmaceutical services in South Africa and have provided valuable information for decision-makers. The study provides a good example of how economic evaluations can be used to determine whether the outcomes of a certain programme are worth the resources spent within the programme, compared to alternative options, using the same resources.

Studies of this nature which emphasize the application of the principles of evidence-informed medicine, pharmacoeconomics and budget impact analysis are currently and increasingly being recognized and should serve as strong criteria in resource-allocation decision-making process, especially within the implementation of the National Health Insurance in South Africa.

Recommendations

The following are recommended: (1) if repackaging must be carried out, depots should target their repackaging efforts on lines that are not presently available through National Contracts; (2) a review of the new edition of the STG and EML to identify required pack sizes; (3) The National Department of Health should advertise bids for appropriate pack sizes so that the pharmaceutical industries pack and deliver the required pack sizes; (4) promotion of adherence to STGs and use of pack sizes available on the National Contracts. Cost-comparison studies of this nature need to be carried out in order to generate the necessary evidence for decision-making or to provide alternatives based on costs or inputs consumed. Evidence-based decision-making must be encouraged by the Department of Health prior to the implementation of health programmes.

Limitations

Three of the four depots did not pay space costs because the buildings they used belonged to the Ministry of Public Works. In this case, the space costs were estimated through quotations obtained from property consultants in the respective regions.

According to the perspective of the analysis, all the depots’ repackaging units are financed from the same source: the National Department of Health. Hence, it might seem that savings at one depot may be upset by losses at another. However, it was not possible to combine data from all the provinces in order to elucidate this idea because depots repackaged different medicines.

There was no current source of information on how to calculate the exact remaining value of a fixed asset after it has been in use for a long period of time. Most sources indicate that fixed assets should be written off after exceeding their economic value.

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