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The Hospital Pharmacist and an Experimental Model for Inventory Management of Drugs to Minimize the Risk of Missed Doses and to Reduce Waste

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Authors' contributions

This work was carried out in collaboration between all authors. Author AC designed the study, wrote the protocol, and wrote the first draft of the manuscript and managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The inventory management of drugs and medical devices is a necessary precondition to ensure there is a consistent approach to drugs management in all wards to minimize the risk of missed doses and to reduce waste. In the majority of drug supply systems, the simple models work as well as the complex models.

Aim: To test a simple experimental method for inventory management of drugs and medical devices ensuring there is a consistent approach to drugs management in all wards to minimize the risk of missed doses and to reduce waste.

Results: The monthly number of urgent requests has been progressively reduced. The monthly number of expired drugs has been progressively reduced. We have used a simple mathematical model for a correct inventory management of the drugs supply system. Preliminary results have shown that the inclusion of the hospital pharmacist in the ward's therapeutic team, with the important collaboration of the nursing staff, can improve the safety of patients and prevent waste of financial resources, or shortages of essential drugs. Our experimental model for the inventory management of drugs was shown to be an important step forward in the drugs supply system.

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1. INTRODUCTION

The hospital Pharmacist of a ward/department identifies and recognizes specific practice areas where there are regular interactions with doctors and other healthcare professionals, and ensures the appropriateness, effectiveness, and patients' safety in the use of drugs, contributing to improving coordination of care [1].

The inventory management of drugs and medical devices is a necessary precondition to ensure there is a consistent approach to drugs management in all wards to minimize the risk of missed doses and to reduce waste. [2] High inventory levels increase the probability of losses caused by spoilage, expiry, obsolescence, and theft. Models and mathematical formulas have been use to set stock levels in the ward: Minimum and maximum levels and reordering point [3].

In the majority of drug supply systems, the simple models work virtually as effective as the complex models.

Aim/Purpose

To test a simple experimental method for inventory management of drugs and medical devices ensuring there is a consistent approach to drugs management in all wards to minimize the risk of missed doses and to reduce waste.

2. MATERIALS AND METHODS

In our region the drugs and medical devices are provided to hospital wards from a regional warehouse. In the hospital pharmacy there is a reduced stock (buffer) of drugs for any urgent therapeutic needs.

Each hospital ward forwards the request to the regional warehouse of drugs and devices in accordance with a schedule established by the hospital organization and twice a week receives a minimum stock top-up service from the regional warehouse. To order more ward stock than the amount foreseen, the ward can order using the application process "*urgent request*". The need to apply this procedure demonstrates a sudden shortage of drugs and therefore the risk of missed doses.

This work was carried out in the ward of General Surgery at the Hospital University of Udine from April to December 2013. The ward has 40 beds with an average annual occupancy of 80%.

Our inventory control model has been used for these objectives:

1. Ward therapeutic handbook;
2. Safety stock to reduce the frequency of urgent orders for higher quantities than those foreseen by the plan;
3. Reorder point (safety point to ensure the minimum stock level) which has a major influence on stock levels and costs, as well as on risk of missed doses;
4. Reorder quantity to reduce waste.

In our experimental model, we have reformulated the ward therapeutic handbook by reducing the amount of drugs, from 213 to 183, for lack of use for at least one year.

The ward stock (WS) consists of two components:

- The average working stock (AWS)
- The safety stock (SS)

$$WS = SS + AWS$$

The average working stock (average daily use) was calculated by analyzing the overall consumption of supplies for 6 months and establishing the values of the minimum and maximum stock.

The minimum stock was defined as the duration (number of days) of therapy to ensure in case there are any delays.

Minimum stock (MS) = average daily use *7;

We have chosen the term of 7 days for an average daily consumption of each type of medication which must be available from the pharmaceutical industry:

- To prevent any delay in delivery
- Respond appropriately to increases in demand
- To prevent errors in the assessment of needs
- Prevent missed deliveries

For minimum values calculated (under 1 unit) daily dosage was taken as the average daily consumption.

The maximum stock (MxS) was calculated considering the average daily consumption multiplied by 15 days added to the number of dosage units contained in each box.

Average daily use (AWS) *15 (days for an average daily consumption).

The safety stock (SS) was determined by examining the historical consumption (looking back at the past year) of drugs.

The reorder point (RP) is calculated by multiplying the value of the minimum stock by a factor of 1.5 corresponding to the number of product units needed to cover a 50% error in the time for reinstatement of drugs by the regional warehouse.

$$RP = MS * 1.5.$$

Inclusion criteria of monitoring are all drugs included in the ward therapeutic handbook.

Exclusion criteria of monitoring are all drugs not included in the ward therapeutic handbook.

In the case that it is necessary to order the patient's own drug not included in the ward therapeutic handbook, the ward will order it, will administer it for the length of the patient's stay and then will give it to the patient when discharged, if the patient should continue this therapy at home.

The application of the experimental model started in July 2013.

3. PRELIMINARY RESULTS

After 6 months of applying the model, from July to December 2013, there were no hazardous reductions in inventory. Conversely, urgent requests decreased and there were no losses due to expiry of drugs.

For monitoring the results of the experimental model we used as indicators of results the ratio between the monthly number of urgent requests and expired drugs (numerators) with respect to the number of drugs in ward therapeutic handbook (denominator). We didn't monitor any drugs not included in the ward therapeutic handbook.

The monthly number of urgent requests has been progressively reduced from 7 in April to 3 in July and to 0 in November and December (numerators) progressively moving from 3.8% to 1.6% in July to reach 0% in November and December (see Fig. 1).

The monthly number of expired drugs has been progressively reduced from 10 in April, to 5 in July and to 0 in December (numerators) progressively moving, if compared with denominator, from 5.4% to 2.7% in July to reach 0% in December (see Fig. 2).

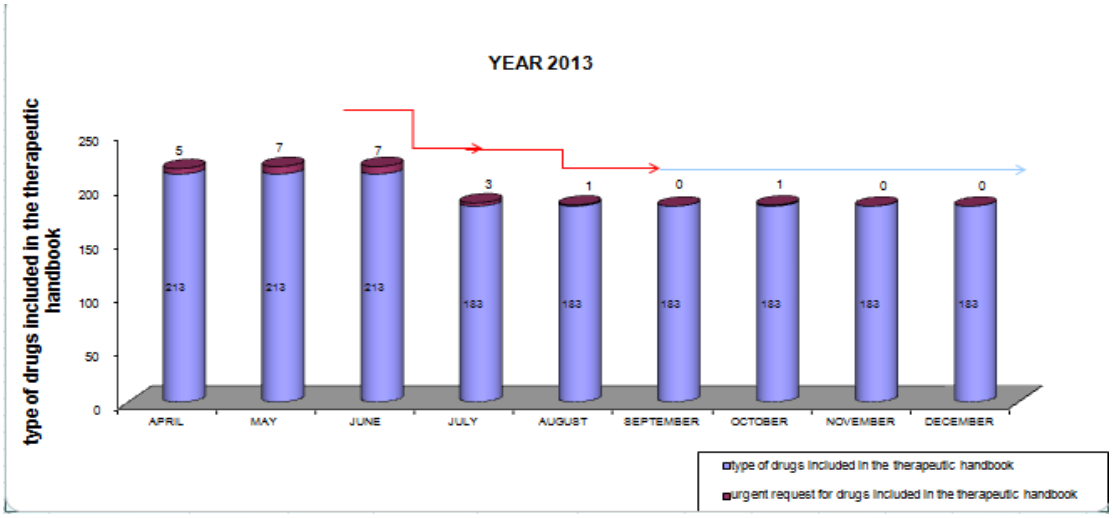

Fig. 1. Monthly number of urgent requests

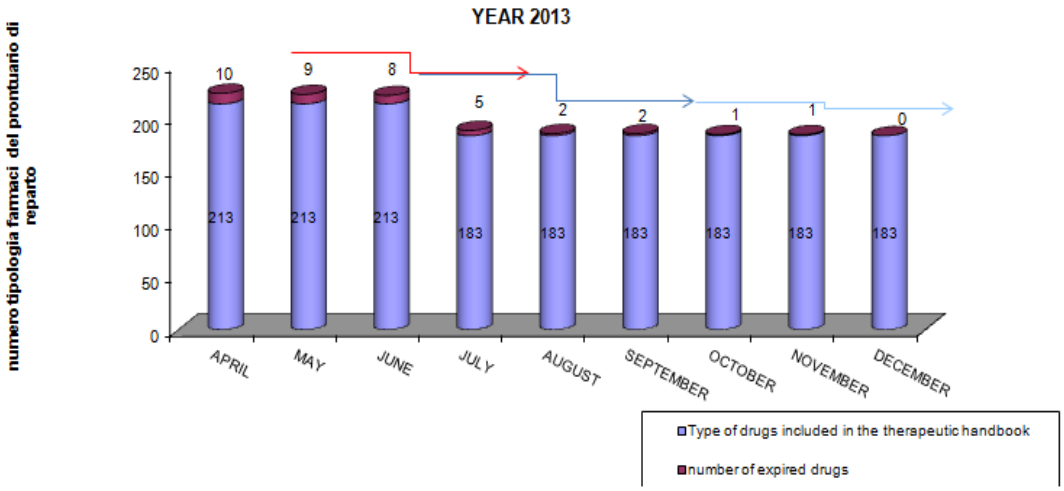

Fig. 2. Monthly number of expired drugs

4. DISCUSSION

The role of Hospital Pharmacist in the ward has evolved, and particularly over the last 40 years.

In the 60s the role of the hospital pharmacist originated in the USA [4] and later in the 90s spread in different ways to Europe. The role skewed towards a direct relationship with the patient, with greater responsibility for the security and prevention of medication errors.

Following the Noel Hall report in 1970, the Hospital Pharmacist has increasingly assumed consultative and management role to co-operate with medical and nursing staff in the most effective securing safe and economical use of drugs [5].

Noel Hall highlights the role of the hospital pharmacist in the most effective and economical use of drugs.

Our experimental model for the inventory management of drugs was shown to be an important step forward in the drugs supply system.

The purpose of this work was to enable nurses to acquire the knowledge of necessary procedures for proper management of wards inventory drugs. We established in the multidisciplinary work group of the ward that a fully developed inventory control system has the following key goals:

1. To obtain the right drugs and monitor their safety;
2. The Selection of items to be stocked; for this purpose the ward has designated a ward therapeutic handbook and stock of drugs;
3. A stock control system to monitor the flow of drugs within the ward; to ensure the appropriate list for the clinical area;
4. A performance monitoring system to check that the system is operating effectively;
5. To ensure availability: in the regional drug supply system, it is not possible to forecast demand with complete accuracy or to be certain about suppliers' performance;
6. To avoid shortage costs: if emergency orders are needed, the unit cost is likely to be much higher than for a regular order;
7. To minimize transport costs: when drugs are delivered less frequently.
8. To avoid any theft because everything is controlled and measured.

5. CONCLUSION

Preliminary results have shown that the inclusion of the hospital pharmacist in the ward's therapeutic team, with the important collaboration of the nursing staff, can improve the safety of patients and prevent waste of financial resources, or shortages of essential drugs. The improvement of patient safety comes from greater control over the doses of the drugs stored [6] and the increased empowerment of nurses in the management of wards inventory drugs [7,8].

6. LIMITATION

The limit of this study is the short monitoring time and only applied to drugs, not yet to medical devices. This is only a preliminary study but the monitoring is continuing in this ward, including the monitoring of medical devices using the same model, and it has also been transferred to other wards in the Surgery Department.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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