# The Cost-Saving Effect of a Centralized Unit for Anticancer Drugs Processing at the Oncology Department of Tirana

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## Abstract

The worldwide increase in cancer prevalence has led to a substantial cost rising in Medical Oncology. Of particular importance are highly expensive drugs used to treat various types of cancers in developing countries like Albania. Hence, pharmacoeconomics may play an important role in reducing the drug wastage and financial burden placed on patients, family and society in general; of course, without adversely impacting patient's health outcomes. Our aim was to calculate cost-savings effect of a centralized unit, which allows residual amounts of unused drugs to be reused by patients whose treatments are elaborated in the same working day. We calculated in a comprehensive manner the number of saved vials (flasks) for seven drugs generated from residual amounts of the same working day and, converted them into cost-saving monetary value. We did not take into account prescribed drug dosages that fitted exactly with doses contained in a vial. Over a six month period, there were: a total of 6558 prescriptions for a total of 1180 patients, a total of 1524 saved vials and, a total cost-saving of 134, 348 (•). The saved value represents 6.2 percent of the cytostatic drugs budget for 2005. Our experience confirms the economic benefit of waste reduction and cost-savings effect due to a centralized unit of anticancer drug processing. The centralized unit increases also the drug traceability from preparation to patient.

**Keywords**: centralized unit, anticancer drug processing, cost savings, drug traceability.

## Introduction

Cancer is intoxicating our environment due to its morbidity, mortality and the substantial increases of its treatment costs (Reeder & Gordon, 2006, 3-16**)**. The economic burden of cancer is more pronounced in developing countries where limited resources are insufficient to and do not meet public needs on the quantity and quality of medical services (Jufang & Huiyun, 2010, 240).

Cancer is becoming a major priority for health policies in Albania for two major reasons: the increase of mortality and morbidity rates for a number of cancers and the delays in diagnosis. The incidence of breast cancer in our country is about 24 -26 new cases per 100, 000 women. Furthermore, urban areas like Tirana, are affected 3 - 4 times more than rural ones. The Service of Oncology in University Hospital Centre "Mother Teresa" of Tirana is the only public health structure that offers multidisciplinary treatments for cancer patients in Albania.

Cancer will be one of the greatest health challenges for the next few years and it will require the use of a large amount of resources to support introduction of new antineoplastic agents and efforts toward disease prevention and early detection (Callahan, 1998). How patients and society will afford dramatically rising drug expenditures remains partly unanswered. The cost of one cycle of chemotherapy may range from 330 euro for doxorubicin 50 mg to 13116 euro for trastuzumab 150 mg, both delivered every three weeks (Ramsey, Clarke, Kamath & Lubeck, 2006, 472-478).

The advance in cancer knowledge and progresses on development of new molecules and treatment schedules offer our patients greater expectations in terms of response, prolonged

survival, or improved quality of life. On the other hand, these new tools are very expensive and the availability of resources is limited, so they should be used in an efficient and equitable manner (Baselga & Carrato, 2008, 135). Furthermore, current tendency suggests that the growing cost of cancer treatment will accelerate in the coming years due to the development of new, more expensive treatments, the ageing of the world's population, the increased life expectancy by improvements in therapeutic outcome, and more effective diagnostic procedures (Meropol et al., 2009, 74).

Several strategies have been suggested to contain the increasing expenditures and improving efficiency, such as the use of generic and biosimilar molecules (Niederwieser & Ludwig, 2008, 411-9), the outpatient management of cancer patients, and optimizing treatment selection based on pharmacogenetics (Danzon & Towse, 2002, 5-13).

Other approaches are directly related to the drug preparation process. We know that most anticancer drugs are individually dosed according to a patient's body surface and that pharmaceutical products do not exactly fit the dose required in a specific patient, generating residual amounts of unused drugs. The rational application of personalized dose principle may reduce the anticancer drug expenditures (Mertens & de Jongh, 2009,153).

Some other possible saving approaches have been proposed, such as dose rounding to the nearest vial size (Dooley, Singh & Michael, 2004, 653-6), dose standardisation of anticancer drugs (Pouliquen at al., 2011, 221-8) and, selecting the most convenient vial size.

In this framework, a project of drug waste reduction was designed and launched at the end of 2014. The project aimed at:

- estimating the resulting economic benefit and the relative influence of each drug
- measuring the cost-saving effect of reused leftovers while respecting drug stability

## Materials and Methods

The material for the study of this topic has been collected, over a period of six months (October 2014 – April 2015), from Day Hospital and the Chemotherapy Ward of Oncology Department, in University Hospital Center "Mother Teresa", Tirana, Albania where can be found date like: patient generalities, record number, diagnosis and

chemotherapy regimens. In order to protect the patient's anonymity the patient's name has not been revealed. As a study material were used folders and medical prescriptions of seven drugs selected by us (Table1).

| Generic Name | Commercial Name | Quantity Contained in a Vial (mg) | Price in Euro |
|---|---|---|---|
| Doxorubicin | Adryamicin | 50 | 12.92 |
| Docetaxel | Taxotere | 80 | 29.10 |
| Trastuzumab | Herceptin | 150 | 512.35 |
| Gemcitabin | Gemzar | 1000 | 22.07 |
| Rituximab | Mabthera | 500 | 1042.76 |
| Cisplatin | Platinol | 50 | 5.60 |
| Bevacizumab | Avastin | 400 | 1041.70 |

**Table 1. List of drugs included in the study**

The Hospital Pharmacy calculated the number of different vials needed to prepare the prescribed dose if vials are shared by patients whose treatments are elaborated in the same working day. After that, we found out the consequent cost-savings effect of reused residual amounts for each drug. Following we show a calculation sample for trastuzumab (Table 2).

**Table 2. Six month benefit evaluation for trastuzumab**

| | The amount of drug used during a cycle | Number of patients | The amount of drug saved in six months | Cost-savings in (€) |
|---|---|---|---|---|
| Chemotherapy Ward | 350 mg | 3 | 1800 mg or 12 fl | 6148.2 |
| | 360 mg | 3 | 1620 mg or 10.8 fl | 5533.38 |
| | 370 mg | 2 | 960 mg or 6.06 fl | 3104.8 |
| | 380 mg | 3 | 1260 mg or 8.4 fl | 4303.7 |
| | 390 mg | 3 | 1080 mg or 7.2 fl | 3688.92 |
| | 400 mg | 6 | 1800 mg or 12 fl | 6148.2 |
| | 470 mg | 2 | 240 mg or 1.6 fl | 819.76 |
| | 500 mg | 4 | 1200 mg or 8 fl | 4098.8 |
| | 520 mg | 1 | 420 mg or 2.8 fl | 1434.58 |
| | 540 mg | 2 | 1080 mg or 7.2 fl | 3688.92 |
| | 550 mg | 4 | 2400 mg or 1 6fl | 8197.6 |
| | 560 mg | 1 | 660 mg or 4.4 fl | 2254.34 |
| | 580 mg | 4 | 3120 mg or 20.8 fl | 10656.88 |
| | 600 mg | 9 | 0 | 0 |
| | 350 mg | 1 | 600 mg or 4 fl | 2049.4 |
| | 370 mg | 1 | 480 mg or 3.2 fl | 1639.52 |
| | 372 mg | 1 | 468 mg or 3.12 fl | 1598.53 |

| | | | | |
|---|---|---|---|---|
| Day Hospital | 376 mg | 1 | 444 mg or 2.96 fl | 1516.55 |
| | 380 mg | 2 | 840 mg or 5.6 fl | 2869.16 |
| | 390 mg | 1 | 360 mg or 2.4 fl | 1229.64 |
| | 400 mg | 2 | 600 mg or 4 fl | 2049.4 |
| | 430 mg | 2 | 240 mg or 1.6fl | 819.76 |
| | 444 mg | 1 | 36 mg or 0.24fl | 122.96 |
| | 450 mg | 15 | 0 | 0 |
| | 470 mg | 1 | 780 mg or 5.2fl | 2664.22 |
| | 480 mg | 1 | 720 mg or 4.8fl | 2459.28 |
| | 520 mg | 1 | 480 mg or 3.2fl | 1639.52 |
| | 550 mg | 3 | 900 mg or 6fl | 3074.10 |
| **Total savings for Trastuzumab** | | | **135.18 flasks** | **69259.4** |

In Table 3 we are representing the number of prescriptions, number of patients, number of vials saved and consequent cost-savings in Euros for each drug selected over a six month period.

**Table 3. The final results**

| Generic Name of Drug | Number of Prescriptions | Number of Patients | Number of Vials Saved | Cost-Savings in Euro ( €) |
|---|---|---|---|---|
| Doxorubicin | 2370 | 395 | 213 | **2754.54** |
| Docetaxel | 1170 | 295 | 772 | **22486.15** |
| Trastuzumab | 942 | 144 | 135 | **69259.40** |
| Gemcitabin | 750 | 125 | 257 | **5687.43** |
| Rituximab | 168 | 28 | 30 | **31908.45** |
| Cisplatin | 1080 | 180 | 105 | **590.01** |
| Bevacizumab | 78 | 13 | 9 | **9698.22** |

## Results

During the study period, vial consumption data were obtained, absolute savings expressed as number of vials and, the consequent cost-savings are also indicated using the trastuzumab sample calculations. All costs are expressed as euros (•). Taking into account the centralized unit price of 7,800 •, total savings for seven drugs were 134,348 (•). The saving value represents 6.2 percent of the cytostatic drugs budget for 2005. The greatest savings occurred with drugs such as trastuzumab, rituximab, bevacizumab, docetaxel and gemcitabine.

## Discussion

Our Department of Medical Oncology is a research-oriented academic unit with an admission capacity around 3. 500 new patients every year. Facilities include a ten-bed day-hospital service and a forty-bed- ward. Since September 2014, it was decided

to create a dedicated room within the pharmacy for the preparation of intravenous cytotoxic drugs, but it is not yet equipped with a computerized physician order entry (CPOE) system.

Before the installation of the centralized unit, the prescriptions of the chemotherapeutic agents were written in mg/kg/$m^2$ and number of vials correspondent to the dose needed, respectively in patient's record and pharmacist's chart. The remaining residual amounts of each patient were disposed immediately, causing a significant economic loss. On the other hand, the patient or his/her family members followed a path of taking the vials in the pharmacy room according to the physician prescription and following the pharmacist's orders. The dosage administration took place in the chemotherapy ward, day hospital or in an outpatient setting. Drug traceability was unfavorable in the last option.

The results of our research have confirmed that the use of the residual amounts of the vials while the drug remains stable decreases drug wastage and represents a considerable reduction in cancer treatment budget. Therefore, a change in the management process would minimize the overall health expenditure without adversely impacting patient's health outcomes. This is one of the biggest future challenges of health systems in the current economic environment (Sullivan et al., 2011, 933-80).

The leftover amount of the used drug depends on the number of patients attended, anthropometric characteristics, the time between patients who receive the same drug and the marketed vials (Fasola et al., 2008, 8:70).

In our study, results imply an overall cost savings for seven drugs around 6.2% of the cytostatic drugs budget, almost approximate with those previously described (Vandenbroucke & Robays, 2008, 37-42), who estimated potential savings around 7% and 15%. These findings demonstrate that this practice is economically advantageous, especially in large hospital centers.

There is a considerable level of control over the process. One of the options that needs to be further explored is the application of a citation system, matching the patients with the same treatment. However, this process could be hindered because of the available drug stock in the hospital pharmacy, treatment delays due to adverse effects and the fact that some patients cannot wait for their treatment.

Finally, we think that after the installation of the centralized unit, new working habits have been developed. The benefits of this change in paradigms into cooperation could be defined as a combination of reaching the goal of giving the right drug, with the right dosage, to the right patient, at the right time, at a more cost-efficient level.

## Conclusions

Our experience confirms the economic benefit of waste reduction and cost-savings effect due to a centralized unit of anticancer drug processing, especially when used in large centers. The centralized unit also increases the drug traceability from preparation to patient. We think that after the centralized unit installation we may reach the goal of "the right drug with the right dosage to the right patient at the right time at the right cost". We also recommend to extend this approach toward Pediatric

Onco-Haematologic Service and to initiate a centralization project at least in three other national urban centers.

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