PRACTICAL IMPLICATIONS IN SHELF-LIFE EXTENSION OF ANTICANCER ADMIXTURES

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INTRODUCTION

Throughout the years, cytotoxic compounding units in Malta have registered an exponential rise in the number of anticancer parenteral doses prepared annually. An upsurge from 6,231 in 2001 to 22,366 in 2014 was recorded for the total number of compounded sterile preparations (CSPs), at two national cancer care centres. Such trends are universal and have driven oncology treatment hubs worldwide to devise novel approaches in the compounding process to maximise drug utilisation and enhance efficiency. Units in Malta are assigned a 24-hour restrictive shelf-life for anticancer admixtures, resulting in economic loss due to wastage of partly used vials. Extending stability timeframes with the use of special access devices enables the advanced preparation of anticancer parenteral doses.

AIMS

- To perform cost analyses of captured and retrospective cytotoxic waste data.
- To determine the economic impact of drug losses and identify plausible agents for shelf-life extension as a waste minimisation strategy.
- To estimate potential cost savings for the proposed advanced grouped preparation using the top drug contributor to the wastage sum as a case study.
- To consult literature and quality assurance (QA) pharmacists regarding the risks and benefits associated with compounding methods that employ a shelf-life extension approach.

METHOD

Phase 1: The Observational Model

Following grant of the necessary consents, fieldwork was conducted in a cross-sectional study at two public hospitals covering haematology and oncology care, which have cytotoxic units. Data was collected over a 16-day period in each setting over two consecutive months.

Cytotoxic waste data was recorded using validated data collection sheets (Figures 1 and 2). Volumetric values were translated to costs based on drug unit prices for October 2014, as obtained from the public procurement agency and all data was processed using spreadsheet.

Date	Dose Entry Number	Drug	Vial Concentration (mg/ml)	Vial Dose (mg)	Vial Volume (ml)	Dose Required (mg)	Number of Vials Required				Volume of Medicine Withdrawn (ml)		Waste Amount (ml)	Recovered Amount (ml)	Waste Amount (mg)	Recovered Amount (mg)
							New Vial(s)	Total Volume (ml)	Vial(s) with Residue	Total Volume (ml)	New Vial(s)	Vial(s) with Residue				

Figure 1: Data collection template used at the haematology unit

Date	Dose Entry Number	Drug	Vial Concentration (mg/ml)	Vial Dose (mg)	Vial Volume (ml)	Dose Required (mg)	Volume of Medicine Withdrawn (ml)	Diagnosis	Ward/ODW

Figure 2(a): Data collection template used at the oncology unit to capture dose characteristics

Date	Drug	Vial Concentration (mg/ml)	Waste Amount (ml)

Figure 2(b): Data collection template used at the oncology unit to log wastage

Phase 2: The Retrospective Model

Doses and vials consumed for every anticancer agent listed in the 2014 national formulary were obtained from databases and statistics files of both units and subsequently evaluated.

Phase 3: Economic Impact Assessment for 3 Preparation Scenarios

The economic impact of three distinct preparation scenarios, comprising individualised (scenario 1), same-day grouping (scenario 2) and weekly grouping of doses (scenario 3), was computed for the top drug contributor to the wastage sum. Literature and QA pharmacists were consulted to compile the risks and benefits associated with CSP shelf-life extension.

RESULTS

	Haematology	Oncology
Sample of Doses Recorded	N=320	N=743
Number of Drugs Prescribed	24	26
Observed Vial Wastage	€7,202	€3,177
Extrapolated Monthly Waste Cost*	€12,244 (August 2014)	€6,219 (September 2014)
Top Agent Contributing to Wastage	Bortezomib (42%, €3,042)	Trastuzumab (28%, €887)
Annual Waste Cost Projection	€220,000	

***Confidence limits of ±3.36% for the haematology unit and ±2.34% for oncology unit, both at 95% level of significance.**

Table 1: Comparative results between both units for Phase 1 (The Observational Model)

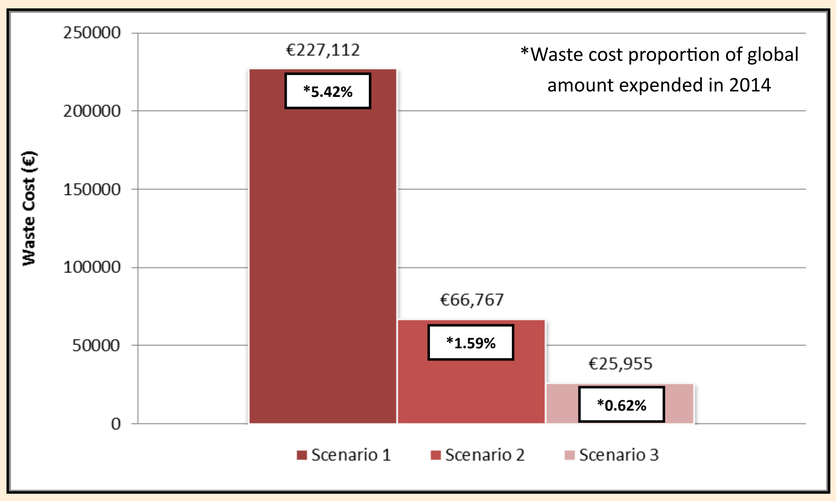

Figure 3: 2014 annual waste cost for each preparation scenario for bortezomib doses (N=516)

A total of 22,796 doses were evaluated in the Phase 2 retrospective analysis, consisting of 36 agents: cytotoxic (n=34) and biological (n=2) therapies. Retrospective waste cost was estimated at €301,138. This sum represents approximately 7.2% of the €4.2M annual expenditure on anticancer parenterals. Phase 3 assessment revealed financial savings of over €40,000 if a 7-day shelf-life is applied to bortezomib admixtures (the top drug contributor to wastage), when compared to the current same-day grouping sessions (Figure 3). Advanced preparation offers the additional advantages of streamlined workflow, diminished cytotoxic errors and reduced treatment delays. Reported barriers to this strategy are mostly related to concerns on stability, sterility and increased operator time.

CONCLUSION

The percentage waste cost of 7.2% from global budget surpassed those determined by other studies[1-3]. Cost containment strategies are required to face the challenge of soaring drug expenditures in cancer care. The top two contributors to global waste cost were bortezomib and trastuzumab and these agents qualify for a grouping strategy since they have a chemical stability extending to 35 days and 180 days respectively when diluted with sodium chloride 0.9%[4].

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