Intensive and Critical Care Nursing (2016) 35, 66—73

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/iccn

ORIGINAL ARTICLE

Variable cost of ICU care, a micro-costing analysis

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Accepted 11 January 2016

KEYWORDS
Bottom-up cost analysis;
Cost;
Costing methodologies;
Intensive care;
Top-down cost analysis;
Variable cost

Summary Intensive care unit (ICU) costs account for a great part of a hospital's expenses. The objective of the present study was to measure the patient-specific cost of ICU treatment, to identify the most important cost drivers in ICU and to examine the role of various contributing factors in cost configuration. A retrospective cost analysis of all ICU patients who were admitted during 2011 in a Greek General, seven-bed ICU and stayed for at least 24 hours was performed, by applying bottom-up analysis. Data collected included demographics and the exact cost of every single material used for patients' care. Prices were yielded from the hospital's purchasing costs and from the national price list of the imaging and laboratory tests, which was provided by the Ministry of Health. A total of 138 patients were included. Variable cost per ICU day was €573.18. A substantial cost variation was found in the total costs obtained for individual patients (median: €3443, range: €243.70—€116,355). Medicines were responsible for more than half of the cost and antibiotics accounted for the largest part of it, followed by blood products and cardiovascular drugs. Medical cause of admission, severe illness and increased length of stay, mechanical ventilation and dialysis were the factors associated with cost escalation. ICU variable cost is patient-specific, varies according to each patient's needs and is influenced by several factors. The exact estimation of variable cost is a pre-requisite in order to control ICU expenses.

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http://dx.doi.org/10.1016/j.iccn.2016.01.001
0964-3397/

Implications for Clinical Practice

- ICU variable cost is patient-specific and is influenced by several factors.
- Medicines are responsible for more than half of the cost and antibiotics account for the largest part of it.
- Severe illness and increased length of stay, mechanical ventilation and dialysis are the factors associated with cost escalation.
- Knowledge of the cost of what we prescribe is the only way to control expenses without limiting quality.

Introduction

The enormous growth of tertiary healthcare during recent years has resulted in a significant cost rise for the National Health Systems. Intensive Care Units' (ICU) costs have been estimated to represent up to one third of all hospital costs (Halpern et al., 2004). The high ICU cost is attributed mainly to an ageing population and to the need for highly trained staff, high-technology equipment and extensive use of diagnostic tests, medication and supplies (Cooke, 2012).

In an era of increased need for resources, the evaluation of ICU cost is of paramount importance. Medical cost is divided into two distinct parts, fixed cost and variable cost. Fixed cost is the one that remains stable regardless of the amount of production output and is actually the running cost of the department and the cost of equipment. Fixed cost is determined by staff salaries, capital and maintenance costs. Variable cost, on the other hand, is designated by the activities necessary for each patient's treatment and it includes the cost of medication, consumables (catheters, drainages, dressings and so on) and diagnostic tests (imaging such as X-ray scan and computed tomography scan, laboratory testing and microbiological analysis) (Jegers et al., 2002; Tan et al., 2009). It has been established from previous studies that fixed cost accounts for the highest part of ICU cost and that staff salaries account for the largest part of fixed cost (Seidel et al., 2006). Even though fixed cost is the most important part concerning absolute numerical values, variable cost is crucial in terms of rationalising and re-distributing the limited recourses. Variable cost is patient-specific since it depends on individual therapeutic and diagnostic needs and shows great variation. The estimation of variable cost enables the identification of cost drivers (i.e., expensive therapies or approaches that initiate other therapeutic interventions, thereby driving costs) and is the basis of cost-effectiveness studies (Seidel et al., 2006; Wunsch et al., 2012).

Cost is actually an outcome measure and in spite of its importance, only a few economic studies have been conducted for the critically ill patient (Pines et al., 2002). This fact may in part reflect the difficulty in collecting patient-related costs. Classically, the two main costing methodologies are described as top-down and bottom-up cost analysis. The top-down approach calculates the average cost per patient or per patient-day, by dividing the total annual budget for the entire ICU by the number of patients or patient-days. It usually distributes costs to a case-mix category to produce an estimated cost for specific diagnosis — related groups. Calculating cost in this way is easy but has the disadvantage of being very inaccurate at the individual patient level. It is unsuitable for certain types of evaluations, as it assumes that cost is the same for all patients. For example, no comparisons of patients with different treatments or variable illness severity scores can be accomplished by applying the top-down cost approach. Alternatively, the bottom-up cost method adds up costs of all material used for each patient. Applying this method, the quantity of material that has been used for each patient is measured and a unit cost is attached to each of the resources (e.g., the cost of a syringe, the cost of an antibiotic per ml multiplied by the total amount used by the patient). This method facilitates economic evaluation of ICU resources but is time-consuming and laborious, since it requires extensive data recording and accurate data-to-money conversion (Reis Miranda and Jegers, 2012, Tan et al., 2012).

Methods

Objective

The aims of this study were to determine the patient-specific direct cost of ICU treatment using bottom-up cost analysis, to identify the most important cost drivers in ICU and to investigate factors that may contribute to cost configuration.

Design

The present observational study was conducted in the seven-bed General ICU of ''Agioi Anargiroi Hospital'' during 2011, the first year of the Department's function. The Hospital is public and is responsible for about 200,000—300,000 inhabitants. Funding is covered mainly by health insurance and to a smaller extent by direct payment. The study included all patients who stayed for at least 24 hours. Patients readmitted to the ICU during the same or a subsequent hospitalisation, were included in the study as separate admissions. Patients' files were retrospectively reviewed and data collected included demographics (age, gender, admission diagnosis, length of ICU stay [LOS] and ICU mortality), severity of illness according to the Acute Physiology and Chronic Health Evaluation (APACHE) II score for the initial 24 hours after admission to the ICU and meticulous resource use for the whole duration of ICU stay. The study protocol was approved by the Hospital Ethical Committee. Informed consent was waived due to the observational nature of the study.

We formed a recording sheet where the cost for each single patient was divided into three headings: