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The positive financial impact of using an Intensive Care Information System in a tertiary Intensive Care Unit

Eric Levesque[a,*], *Emir Hoti*[a,b], *Sofia de La Serna*[a], *Houssam Habouchi*[a], *Philippe Ichai*[a], *Faouzi Saliba*[a], *Didier Samuel*[a], *Daniel Azoulay*[a]

[a] *AP-HP Hôpital Paul Brousse, Centre Hépato-Biliaire, Villejuif, France*
[b] *Liver Transplant Unit, Saint Vincent's University Hospital, Elm Park, Dublin 4, Ireland*

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ABSTRACT

Introduction: In the French healthcare system, the intensive care budget allocated is directly dependent on the activity level of the center. To evaluate this activity level, it is necessary to code the medical diagnoses and procedures performed on Intensive Care Unit (ICU) patients. The aim of this study was to evaluate the effects of using an Intensive Care Information System (ICIS) on the incidence of coding errors and its impact on the ICU budget allocated.
Patients and methods: Since 2005, the documentation on and monitoring of every patient admitted to our ICU has been carried out using an ICIS. However, the coding process was performed manually until 2008. This study focused on two periods: the period of manual coding (year 2007) and the period of computerized coding (year 2008) which covered a total of 1403 ICU patients. The time spent on the coding process, the rate of coding errors (defined as patients missed/not coded or wrongly identified as undergoing major procedure/s) and the financial impact were evaluated for these two periods.
Results: With computerized coding, the time per admission decreased significantly (from 6.8 ± 2.8 min in 2007 to 3.6 ± 1.9 min in 2008, $p < 0.001$). Similarly, a reduction in coding errors was observed (7.9% vs. 2.2%, $p < 0.001$). This decrease in coding errors resulted in a reduced difference between the potential and real ICU financial supplements obtained in the respective years (€194,139 loss in 2007 vs. a €1628 loss in 2008).
Conclusion: Using specific computer programs improves the intensive process of manual coding by shortening the time required as well as reducing errors, which in turn positively impacts the ICU budget allocation.

1. Introduction

The activity of an Intensive Care Unit (ICU) accounts for approximately 5% of all hospital admissions but absorbs between 15% and 20% of the hospital's financial resources [1–3]. In the French healthcare system since 2004, it has become mandatory to ensure the administrative coding of all medical diagnoses and procedures to enable the accurate calculation of medical reimbursements to hospitals. The budget of an ICU depends not only on the annual budget it is allocated (based on the number of medical diagnoses) but also on supplementary grants that are calculated as a function of the severity of the conditions treated and the number and type

* *Corresponding author at*: Hôpital Paul Brousse, Centre Hépato-Biliaire, 12 Avenue Paul-Vaillant-Couturier, 94804 Villejuif, France. Tel.: +33 1 45 59 65 66; fax: +33 1 45 59 38 57.
E-mail address: eric.levesque@pbr.aphp.fr (E. Levesque).
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of procedures performed on patients while they are receiving intensive care. The task of coding or categorizing diagnoses is carried out manually by designated medical staff. Currently, the coded medical procedures and Simplified Acute Physiology Score (SAPS II) values are collected by the Department of Medical Information (DMI), which in turn transmits the data to the 'Caisse Nationale d'Assurance Maladie', the national health insurance system that determines the amounts to be reimbursed to public hospitals [4].

The use of Intensive Care Information Systems (ICIS) in ICUs has become exponential during the past ten years. Numerous advantages with their use have been described. For example, these systems facilitate the development of various databases, reduce the administrative workload [5,6], improve interdisciplinary communication [7] and they have been associated with significantly lower mortality and less ventilator use in critically ill patients [8]. However, in a recent European study that evaluated the use of ICIS, the authors reported that the main drawback to purchasing an ICIS was the substantial financial cost associated with its initial implementation [9].

During this study, we evaluated the effects of the use of a bedside ICIS on the labor intensive process of manual coding and on the incidence of coding-associated errors. In addition, although we acknowledge that implementing such a system has a cost, we hope that by reducing the incidence of errors we will enhance ICU resources, thus limiting the financial cost of ICIS implementation.

2. Methods

2.1. *Patients*

This observational study was performed in the Liver Intensive Care Unit at Paul Brousse University Hospital. This is a 15-bed closed ICU to which approximately 750 patients are admitted each year. This is an ICU specialized in medical and surgical liver diseases [10,11]. The medical staff has sole direct supervisory responsibility for patients admitted to the unit. The staff includes four permanent intensivists and two fellows. The nursing staff consists of 52 nurses working in eight-hours shifts, with a patient-to-nurse ratio of 2.5:1 but that can vary with the severity of the patient's illness. We included all patients (men and women ≥18 years of age) admitted to the ICU (for at least 24 h) between January 2007 and December 2008, although patients admitted and discharged from ICU on the same day and patients transferred to other ICUs were excluded from the study. The need for informed consent was waived as this study was solely observational and no other intervention was required. However, the study was approved by the Ethics Committee for the hospital.

2.2. *Intensive Care Information System (ICIS)*

From April 2005, our ICU was equipped with a bedside computerized information system (ICIS, Metavision®, iMDSoft, Israel, and Medi-Lan®, France). Each ICU room (all single), the central monitoring desk and the physician's office were equipped with ICIS workstations. The staffs (medical and nursing) used the ICIS to complete all patient's charts and documentations, so that no information had paper as its primary storage mechanism. Thus, all patient's documentations (nursing, medical, physiotherapist) and managements were carried out via the ICIS.

Our ICIS system allows monitoring patients (medical management and data collection). This system captures data every minute and is connected to the bedside monitor (Spacelab Healthcare®, Creteil, France), the ventilator (Engtrom ventilator®, Datex-Ohmeda, GE Healthcare, France or Taema® Horus, Bonneuil-sur-Marne, France) and the dialysis monitor (Prisma® and Prismaflex®, Hospal, Meyzieu, France). Thus, vital signs (hemodynamic and respiratory parameters), fluid intakes (perfusion, drugs) are saved automatically, limiting the risk of human error in handwritten flow sheets. At least once an hour the nurses validate the data coming from monitor and ventilator in the ICIS. Several other parameters as fluid output (urinary, blood loss, digestive, etc.) are entered manually by nurses every hour. In addition on a daily basis, at seven o'clock in the morning, several automated scripts are performed. For example, one query compares the amount of fluid intake and fluid output with the results of the algorithm calculation per day per patient.

Our ICIS system includes prescription assistance. Indeed, all orders are prescribed though a similar interface and all orders are pre-entered in the system. For every drug, we have pre-registered parameters such as dose, route of administration, frequency and time to be given in the system. All documentation and protocol updates are completed using the ICIS (by nurses and/or intensivists).

To maintain, apply and develop the system, a team of specialized nurses and ICU doctors has been created.

2.3. *Program*

Our ICIS is an adjustable system that can be completely reformatted or adapted for specific needs. After defining clinical, biological and radiological parameters to diagnose and follow-up several organ dysfunctions or failures, several monitor screens have been created. Secondly, the study investigators developed a program that can identify and retrieve major procedures from the database and then used a specific screen to aggregate them (Fig. 1). This specific program was developed with the aim of improving billing efficiency, reducing the administrative workload of physicians and increasing the accuracy (reducing errors) usually encountered with a non-computerized (manual) system.

In practice, when a procedure is performed, it is recorded by a nurse (drug administration, blood product or fluid transfusion, etc.) or transmitted directly by a machine (ventilator, hemodialysis, etc.) to the ICIS. A program is included in the system which enables the selection of the corresponding code for the procedure in the specific "coding" screen. For example, when the prescription of norepinephrine is validated by the nurse, the corresponding code (EQLF003) is automatically selected in the specific "coding" screen. Thus, at the patient's discharge, the major procedures screen is ready to be transmitted, as a table, to the Department of Medical Information (DIM), with all the procedures carried out during the ICU stay.