Chapter 23
Modeling a Chilean Hospital Using Specification and Description Language

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ABSTRACT

In this chapter, the authors present a formal model of the Anesthesia Unit and Surgical Wards (UAPQ) of a Chilean hospital. The objective was to document and to understand its operation, to assist hospital management and to facilitate its simulation. The model was built with Specification and Description Language (SDL). This methodology was used because it allows the design of a model that represents the system in a graphical, modular, and standard way. Our design contains the following agents: the system, 11 blocks, and 52 processes. The blocks and the processes describe the clinical and administrative activities. The environment of the UAPQ model contains 3 components: clinical services, emergency units, and support units.

INTRODUCTION

The anesthesia unit and surgical wards (UAPQ, in Spanish, "Unidad de Anestesia y Pabellones Quirúrgicos") play a strategic role in the quality of patient care and in the health objectives in a hospital. Their complexity and high cost of operation, combined with scarce resources and high demand, pose a constant optimization challenge. This optimization challenge requires the specification and documentation of all processes involved.

Documentation of the processes is difficult for many reasons. Often, there is no procedures manual, or the existing manual cannot be updated with the required frequency. Functions and tasks do not always follow protocols and are transmitted by informal channels instead. Clinical and administrative processes are not all measured or

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quantified; there are limited available resources (economic, human, material and time) to perform such tasks (often prioritizing short-term needs and urgent health activities). In addition, the lack of knowledge of new tools for institutional administrative management and logistics presents difficulties when specifying processes of this complexity in a hospital.

Models are increasingly used to solve real life problems and to assist in decision-making. They can describe processes, facilitating understanding of the system. A simplified version of the model development process is presented in Figure 1. The problem is the system (actual or proposed), the conceptual model is the logical-mathematical representation of the system and the computerized model is the conceptual model implemented using a computer application (Sargent, 2007).

The conceptual model is developed through different phases of analysis and modeling involving the behavior, structure, and data available in the system. The computerized model is developed by means of a programming or software application, using the conceptual model as the specification. At the conclusion of the modeling phase, the model is used for experiments (simulations), to perform model operational validation and implementation verification (Sargent, 2007).

Validation of the conceptual model is defined as the determination that the theories and the assumptions that support the conceptual model are correct and the representation of the problem is reasonable for its intended purpose. Verification of the computerized model is defined as ensuring that the programming or computer application that represents the conceptual model is correct. Operational validation is defined as the determination that the computational model outputs are sufficiently accurate for the purpose envisaged and in the domain of applicability of the model.

Figure 1. Simplified version of the modeling process (Sargent, 2007)