



## Review

# The organizational and clinical impact of integrating bedside equipment to an information system: A systematic literature review of patient data management systems (PDMS)



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### ABSTRACT

**Objective:** The introduction of an information system integrated to bedside equipment requires significant financial and resource investment; therefore understanding the potential impact is beneficial for decision-makers. However, no systematic literature reviews (SLRs) focus on this topic. This SLR aims to gather evidence on the impact of the aforementioned system, also known as a patient data management system (PDMS) on both organizational and clinical outcomes.

**Materials and Methods:** A literature search was performed using the databases Medline/PubMed and CINHALL for English articles published between January 2000 and December 2012. A quality assessment was performed on articles deemed relevant for the SLR.

**Results:** Eighteen articles were included in the SLR. Sixteen articles investigated the impact of a PDMS on the organizational outcomes, comprising descriptive, quantitative and qualitative studies. A PDMS was found to reduce the charting time, increase the time spent on direct patient care and reduce the occurrence of errors. Only two articles investigated the clinical impact of a PDMS. Both reported an improvement in clinical outcomes when a PDMS was integrated with a clinical decision support system (CDSS).

**Conclusions:** A PDMS has shown to offer many advantages in both the efficiency and the quality of care delivered to the patient. In addition, a PDMS integrated to a CDSS may improve clinical outcomes, although further studies are required for validation.

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## 1. Introduction

The proliferation of medical information in hospitals has resulted in a growing demand for information technology (IT) to effectively support the management of data. While IT has the potential to transform the delivery of healthcare, the introduction of such a system is a challenging task that has profound implications on the organization. A Clinical Information System (CIS) is an IT system that has been established in many hospitals today. It is a broad term used to describe a computer-based system capable of collecting, storing and/or manipulating clinical information important to the healthcare delivery process. Examples of currently available CIS's include the Electronic Health Record (EHR), Hospital Information System (HIS), Computer Physician Order Entry (CPOE) and Patient Data Management System (PDMS). The impact of an EHR [1–3] and CPOE [4–8] has been widely investigated in literature; however, PDMS's have received considerably less attention. Given that the purchase of a PDMS requires significant investment, not only financially but also from a resource perspective, an overview of the potential impact of introducing a PDMS can be beneficial for decision-makers.

Our definition of a PDMS is an information system that automatically retrieves data from bedside equipment (e.g. a patient monitor, ventilator, intravenous pump, etc.). The data are subsequently presented in a structured format that enables improved interpretation and manipulation of the data [9,10]. There has been tremendous development in the PDMS since it was first introduced in the late 1980's. The first generation PDMS was a standalone system that only provided automatic data collection and integration from limited bedside equipment. Over the years, the PDMS has grown in sophistication and expanded its functionality to beyond what it was originally conceived to offer and can now support not only automatic data collection and integration of various bedside equipment, but also data manipulation, statistical analysis and clinical decision support.

There have been previous systematic literature reviews investigating a CIS [11–13], in which the CIS is an information system that includes one or more of the aforementioned subgroups described; however, no systematic literature review has focused solely on the impact of a PDMS. Furthermore, the systematic literature reviews on a CIS concentrate primarily on the organizational impact (e.g. charting, documenting, patient care, etc.) and not on the clinical outcomes. The purpose of this systematic literature review is to gather evidence on the impact of integrating bedside equipment to an information system on both the organizational and clinical outcomes.

## 2. Methods

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) [14] was followed for this review.

### 2.1. Search strategy

A literature search was performed using the online databases Medline/PubMed and Cumulative Index to Nursing and Allied Health Literature (CINHAL) for peer-reviewed articles in the English language published between January 2000 and December 2012. The following search term was used to capture all the applicable departments in the hospital: (*patient data management system\* OR clinical information system\* OR ICU information system\* OR computerized clinical documentation system\* OR critical care information system\* OR intensive care information system\* OR anaesthesia information management system\**) AND (*implement\* OR experience OR introduc\* OR install\**). Articles were included in the review if they satisfied the following criteria:

1. Description of a PDMS based on our definition
2. Evaluation of at least one of the following:
  - a. Implementation experience
  - b. Impact on workflow
  - c. Attitudes towards a PDMS
  - d. Clinical outcomes

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