Understanding barriers and facilitators to the use of Clinical Information Systems for intensive care units and Anesthesia Record Keeping: A rapid ethnography

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ABSTRACT

Objective: This study evaluated the current use of commercial-off-the-shelf Clinical Information Systems (CIS) for intensive care units (ICUs) and Anesthesia Record Keeping (ARK) for operating rooms and post-anesthesia care recovery settings at three Veterans Affairs Medical Centers (VAMCs). Clinicians and administrative staff use these applications at bedside workstations, in operating rooms, at nursing stations, in physician's rooms, and in other various settings. The intention of a CIS or an ARK system is to facilitate creation of electronic records of data, assessments, and procedures from multiple medical devices. The US Department of Veterans Affairs (VA) Office of the Chief of Nursing Informatics sought to understand usage barriers and facilitators to optimize these systems in the future. Therefore, a human factors study was carried out to observe the CIS and ARK systems in use at three VAMCs in order to identify best practices and suggested improvements to currently implemented CIS and ARK systems.
Methods: We conducted a rapid ethnographic study of clinical end-users interacting with the CIS and ARK systems in the critical care and anesthesia care areas in each of three geographically distributed VAMCs. Two observers recorded interactions and/or interview responses from 88 CIS and ARK end-users. We coded and sorted into logical categories field notes from 69 shadowed participants. The team transcribed and combined data from key informant interviews with 19 additional participants with the observation data. We then

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integrated findings across observations into meaningful patterns and abstracted the data into themes, which translated directly to barriers to effective adoption and optimization of the CIS and ARK systems.

Results: Effective optimization of the CIS and ARK systems was impeded by: (1) integration issues with other software systems; (2) poor usability; (3) software challenges; (4) hardware challenges; (5) training concerns; (6) unclear roles and lack of coordination among stakeholders; and (7) insufficient technical support. Many of these barriers are multi-faceted and have associated sub-barriers, which are described in detail along with relevant quotes from participants. In addition, regionalized purchases of different CIS and ARK systems, as opposed to enterprise level purchases, contributed to some of the identified barriers. Facilitators to system use included (1) automation and (2) a dedicated facility-level CIS-ARK Coordinator.

Conclusions: We identified barriers that explain some of the challenges with the optimization of the CIS and ARK commercial systems across the Veterans Health Administration (VHA). To help address these barriers, and evolve them into facilitators, we categorized report findings as (1) interface and system-level changes that vendors or VA healthcare systems can implement; (2) implementation factors under VA control and not under VA control; and (3) factors that may be used to inform future application purchases. We outline several recommendations for improved adoption of CIS and ARK systems and further recommend that human factors engineering and usability requirements become an integral part of VA health information technology (HIT) application procurement, customization, and implementation in order to help eliminate or mitigate some of the barriers of use identified in this study. Human factors engineering methods can be utilized to apply a user-centered approach to application requirements specification, application evaluation, system integration, and application implementation.

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1.   Introduction

Successful implementation and adoption of health information technology (HIT) in healthcare environments is an ongoing challenge. For intensive care units (ICUs) and other acute care environments, acceptance of HIT can be especially difficult to achieve [1], where the complexity of care and presence of critically ill patients often demand rapid decisions and actions [2]. For a healthcare system like the Veterans Health Administration (VHA), use of a commercial-off-the-shelf (COTS) application can add an additional layer of complexity because it must be integrated with the VA's existing, internally developed HIT systems. The VHA uses an electronic health record (EHR) known as the Computerized Patient Record System (CPRS). CPRS, through a graphical user interface, integrates multiple Veterans Health Information Systems and Technology Architecture (VistA) software applications designed to allow clinicians to order medications, laboratory tests, consultations, and document actions [3]. Clinicians use Clinical Information Systems (CIS) and Anesthesia Record Keeping (ARK) at bedside workstations, in operating rooms, at nursing stations, in physician's rooms, and in other various settings. CIS and ARK systems are COTS HIT applications and intended for use in coordination with an EHR, such as CPRS/VistA. A CIS or an ARK system is designed to facilitate creation of electronic records of data, assessments, and procedures from multiple medical devices, thereby eliminating manual entry or use of traditional critical care and anesthesia paper documentation. CIS and ARK systems can provide information to also produce analytics for reports and analysis to potentially improve patient care.

For a facility with as-is CPRS/VistA and paper flowsheets, the CIS and ARK systems are meant to enable the following after implementation: clinical documentation in one electronic application, rather than on a paper chart or in CPRS templates; chart data transferred from CIS to CPRS/VistA, making it available for all clinical, administrative, and/or business staff external to the critical care unit; data from monitors and medical devices recorded automatically by the application, rather than transcribed by nurses onto paper charts; single sign-on to CIS/ARK and CPRS/VistA; and lab results, medication orders, and other care data from CPRS/VistA viewable in CIS or ARK. Each of the 23 regional Veterans Integrated Service Networks (VISNs) purchased separate CIS and ARK systems from a selection of vendors. At the time of this study, 90% of the VISNs had purchased and/or deployed a CIS system and 74% had purchased and/or deployed an ARK system. However, inconsistent adoption of these systems across the VHA suggested the presence of barriers to their effective use. Therefore, we designed a study to identify barriers, facilitators, and suggested improvements to currently implemented CIS and ARK systems at a sample of VA Medical Centers (VAMCs).

We framed our study with sociotechnical systems theory, which has been used and discussed prominently in the medical informatics literature [4–14]. Although there is no one "sociotechnical approach" [4], studies that rely on a sociotechnical perspective all have a high-level recognition that organizational and health systems at large have a substantial influence in shaping HIT and that the technology and context are intertwined [5]. For example, two studies examined the interrelation of the organizational environment and technical subsystems for the implementation of computerized provider order entry (CPOE) systems [6,13], resulting in