Extending the understanding of computerized physician order entry: Implications for professional collaboration, workflow and quality of care

Jos Aarts[a,*], *Joan Ash*[b], *Marc Berg*[a]

[a] *Institute of Health Policy and Management, Erasmus University Medical Center, P.O. Box 1738, 3000 DR Rotterdam, The Netherlands*
[b] *Department of Medical Informatics and Clinical Epidemiology, Oregon Health & Science University, 3181 SW Sam Jackson Park Road, Portland, OR 97239-3098, USA*

ARTICLE INFO

ABSTRACT

Objective: To describe the perceived effect of computerized physician order entry (CPOE) on professional collaboration, workflow and quality of care. *Design*: Semi-structured interviews with experts involved in the design, implementation and evaluation of computerized physician order systems in the United States. *Measurements*: The interview transcripts were analyzed using six key concepts that identify context, professional collaboration, workflow and quality of care. *Results*: The interviews reveal the complexity of CPOE. Although providers enter the orders, others collaborate in the decision-making process. There is a profound impact on workflow beyond that of the provider. While quality of care is the main impetus for implementation, it remains terribly difficult to measure the impact on quality. *Conclusions*: A proper understanding of CPOE as a collaborative effort and the transformation of the health care activities into integrated care programs requires an understanding of how orders are created and processed, how CPOE as part of an integrated system can support the workflow, and how risks affecting patient care can be identified and reduced, especially during hand-offs in the workflow.

1. Introduction

Computerized physician order entry (CPOE) is defined as a process that allows a physician to enter medical orders directly and to manage the results of these orders. The concept is receiving an increasing level of attention because the Institute of Medicine notes that CPOE holds potential for decreasing the number of medical errors in health care organizations and recommends full-fledged implementation [1]. The Leapfrog Group – a coalition of over 150 public and private organizations providing health care benefits – has echoed this plea by recommending that hospitals introduce computer systems to computerize drug prescribing and that they be rewarded for it [2]. The California State Health and Safety Code, Section 1339.63, requires the introduction of technology, such as CPOE, that has been shown effective in eliminating or substantially reducing medication-related errors, in all California hospitals by 1 January 2005.

In reality, the implementation of CPOE has been problematic. In a recent survey, Ash et al. found that less than 10% of the US hospitals have implemented CPOE, a figure even lower than the results of an earlier survey by the same authors [3,4]. Several case studies describe how physicians have opposed CPOE for different reasons, such as the amount of time spent at the computer and concerns about clerical work that fall outside of their professional practice [5–8].

* *Corresponding author*. Tel.: +31 10 4088534; fax: +31 10 4089094.
E-mail address: j.aarts@erasmusmc.nl (J. Aarts).

Order communication is a highly collaborative process. A case study by Goorman and Berg suggests that the notion of interdependence in work is a key feature in creating medical orders and that nurses play an active role in entering medical orders in computerized systems [9]. Gorman et al. contend that the model of health care delivery underpinning CPOE is too naïve and suggest a model of distributed cognition among professionals to understand the creation of medical orders in a collaborative environment [10]. In a study about communication among health care providers in the ICU Pronovost et al. found how a daily goals form – developed to improve a common understanding of the daily goals of therapy – was associated with improved patient outcomes [11].

High-level CPOE experts recognize the difficulties with getting CPOE systems to work in everyday health care settings. This paper reports results of interviews with these experts to combine their rich experience and insights with theoretical insights from medical sociology and the field of computer supported cooperative work (CSCW). The goal is to enhance the general understanding of CPOE implementation and use. More specifically, the notions of professional collaboration and workflow are core themes in this understanding. A proper understanding of these themes is a *sine qua non* to reap the full benefits of CPOE technology in health care work.

The experts have been selected from among attendees of a consensus panel meeting to identify principles for the successful implementation of CPOE; the first and second authors took part in this meeting [12].

2. Extending the understanding of CPOE

CPOE systems have primarily been designed with the tasks and responsibilities of individual physicians in mind and implementation efforts have been primarily targeted at them. Goorman and Berg, however, argue that the model underpinning CPOE contains a projection of medical activities that does not match the activities of physicians as they actually take place on a ward [9]. In their study of order creation, Gorman et al. also suggest that the implicit model underlying CPOE does not take account of its collaborative nature [10]. In these models, orders originate with a physician, who enters them into a system. Then the orders are transcribed and distributed to various departments, and are translated into executable functions such as lab tests, medications, treatments or other procedures. Health personnel then carry out these procedures that together comprise the patient care that is provided (see Fig. 1). Such views often simplistically present medical work as a fixed sequence of steps based on the rationality of the scientific method.

Many scholars have explored the collaborative nature of medical work. In a classic study Strauss et al. describe how the delivery of patient care can be characterized as managing a patient illness trajectory that includes the total organization of work done of over that course [13]. The authors contend that decisions about patient care are not made by a single individual but are the result of "negotiations" of health professionals, sometimes even including the patient and his/her family. They argue that this concept is necessary for a sociological understanding of illness management preventing the researchers
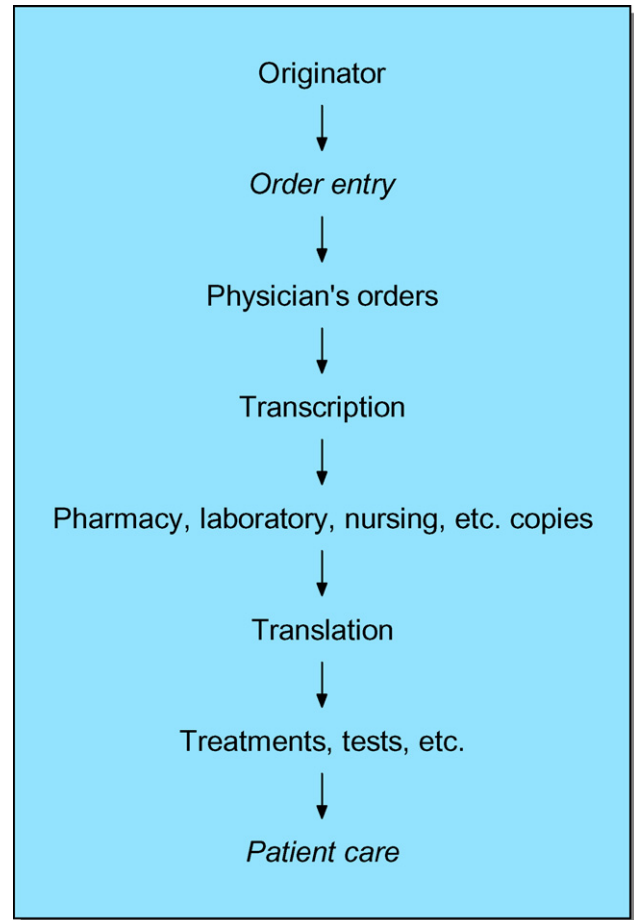
Fig. 1 – Processing of physician orders after Gorman. This is a very simplified, linear model that does not take account of complexity of the CPOE workflow. Much of the understanding of CPOE is directed on the order entry part. Each of the subsequent steps is less understood. Each of the hand-offs in the workflow is a potential source of errors.

from being confined by simplified models of medical work and workflow found in most medical textbooks. The authors base their concept on close observation of health care professionals through seeing, hearing, and interviewing. Berg builds on this understanding by arguing that systems design and implementation should take into account the fluidity of the process and the content of medical work [14]. He also argues that in practice, boundaries between tasks and roles of health professionals are not so tightly drawn.

Pratt et al. argue that medical work, because of its inherent collaborative nature, can benefit from design and implementation methodologies from the field of computer-supported cooperative work (CSCW) [15]. In the 1980s, CSCW emerged as an interdisciplinary field that examines how computer systems can be instrumental in reducing the complexity of coordinating cooperative activities, individually conducted and yet interdependent [16]. Østerlund found that seemingly inefficient practices of duplicating or reduplicating patient data in different documents (whether on paper or in the form of information systems) in a patient trajectory are in fact instru-