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# Why context counts when medicine meets computerised physician order entry systems

Medical errors have stepped into the spotlight, and now everyone is battling to keep them to a minimum. CPOE systems can help – but they also create a few extra hurdles of their own ...

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**Figure 1**  
PC table and paper patient records  
for both nurses and doctors

Medication errors are an increasing problem in healthcare. This may be because the problem has stepped into the spotlight. But it is also due to the higher availability of more potent drugs, increasing the likelihood for drug interactions. Time and route have become critical in administering the right drug to the right patient at the right dose. Many Western healthcare authorities have decided to implement computerised physician order entry (CPOE) systems to tackle medication errors. With CPOE, cumbersome handwritten orders on paper schemes – combined with a limited time span of use – can be replaced with electronic drug orders. Electronically submitted orders are easier to read and provide timely access to patient data across hospitals wards and different healthcare providers. They also open up “end-to-end” patient care. CPOE systems are therefore expected to improve safety, efficiency and effectiveness of patient care.<sup>1</sup>

Evaluation studies show, however, that CPOE systems foster new errors as well as reduce old ones.<sup>2,3</sup> This schism forms the central debate on the role of information technology in the development of healthcare.<sup>4-7</sup> The point seems to be that, despite disappointments in improving the quality of healthcare with IT, healthcare information technology (HIT) – including CPOE systems – is indispensable in modern healthcare.<sup>7</sup>

It also follows that the complexities of healthcare make it impossible to create a completely flawless system.<sup>5,7,8</sup> Instead, more iterative design processes that include the domain knowledge of the end-users are required.<sup>5,7,9,10</sup> Interdisciplinary research into human–computer interaction in a hospital can inform more clinically sensitive and iterative design processes.<sup>1,4,7,11,12</sup> Here, the quality of healthcare depends heavily on the inclu-

sion of the end-users’ domain knowledge in more iterative design processes.<sup>5,8,13</sup>

The argument goes that transformation of medication processes touches upon many people and techniques that all have responsible roles to play in the overall goal of medication – the right, and safe, treatment of individual patients. “Errors” are therefore not an impediment to HIT-mediated healthcare, but can be seen as something to learn from when new understandings and solutions are equally integrated into system design and work processes.

An ethnographic study of a CPOE system’s role in medical treatment within two medical wards at a middle-sized Danish hospital confirms the importance of context in preventing errors with a CPOE system.<sup>14</sup> The study points to transformations in clinical relations between patients, physicians and nurses that transcend the expected outcome and frame implementation problems differently. Developers and implementers have to focus on concrete physical settings and temporal aspects of medication work as CPOE systems mediate patient trajectories differently.

## CPOE and medical routine

CPOE systems are not unified products for medical work, but vary greatly in functionality. The CPOE referred to in this study was developed by a professional vendor (Systematic Software Inc, Aarhus, DK) in close cooperation with the responsible health management organisation (HMO, Aarhus County, DK), which supplied clinicians for the development project. The CPOE system at this stage of development only handles medication “bookkeeping”; it offers no decision support. At the time of the study, CPOE had been in use for eight months. Medication processes necessarily

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include the following actions:

- Treatment indication.
- Prescription – the choice of treatment and the patient's consent.
- Order – entry of clinical choice of treatment into the CPOE system.
- Dispensing – the drug is made ready for consumption.
- Administration – the patient is given the drug.
- Assessment of the drug's effect on the patient.
- Consideration of how to proceed – whether to continue with or to withdraw the drug.

These actions repeatedly unfold with ongoing adjustments, 24 hours a day, 365 days a year. The process of course includes, besides patients and drugs, a wide range of professionals, techniques and rituals, such as doctor's rounds, procedures and habits. Danish clinicians commonly understand the purpose of these actions as "the five rights": the right drug, to the right patient, at the right time, at the right dose, in the right way (eg, orally or intravenously). Any deviation from these goals is considered to be a medical error.

The CPOE system took part in the medication process of ordering, dispensing and deciding upon drug treatment. CPOE transformed medical routine. At doctors' rounds the relationship between doctors and patients transformed when prescribing and ordering drugs, when coordinating and adjusting orders and dosage for dispersion, and when readmitting patients. These transformations resulted from new temporo-spatial distances created by the CPOE that also required users to remember, reorganise and distribute tasks differently.

#### **Critical formations of e-patient, e-user and medication trajectories**

CPOE transforms the relationship between physician and individual patient to a "collective e-patient" relationship at doctors' rounds. The "collective e-patient" was created to prevent the physician from walking long distances between patient beds and the stationary dictaphone and CPOE table. Doctors would memorise three or four patients at a time, before recording prescriptions and entering drug orders in the CPOE system as a group.

This transformation to collective e-patients is, however, prone to new errors. More cognitive pressure is placed on doctors to remember and separate individual patient information. The doctor's memory bridges the distance between patients' beds and CPOE, creating a new source of error that is difficult to detect.

The network of log-ons and user rights

(developed with cooperation among vendor and clinical representatives) built into the system did not correspond with the actual process of dispersing orders and dosages among doctors and nurses. The clinicians configured a "collective e-user" in order to make up for time-consuming log-ins, too few and geographically separated PCs, an inflexible model of work division, and the actual rhythms and ongoing adjustments of orders and dosages. In order to restore the flexibility and speed needed for ongoing adjustments in orders and dosages, the doctor (given the most user-rights in the system) would log in and let the team perform under the same username.

Drug treatment considerations transformed because the paper medication scheme had put a material limit on how many drugs were used and for how many days consumption could continue. However, the virtuality of electronic documents does not put the same temporal and material limit on how long a drug order can stay active. Drug orders – not actively withdrawn in the system – stay active, in case a patient is discharged and readmitted. Medications not specifically terminated at previous discharge are therefore listed as active treatments on readmittance of the patient. This is an important issue, because it reveals previously hidden errors that occur when coordinating patient care paths and trajectories virtually with information technologies. Errors can live longer, reappear in different and future healthcare settings, and be more difficult to discover.

#### **Medicine transformation with CPOE**

The study confirms numerous usability problems that affect the overall quality of healthcare and relationships between professionals. One important issue concerns technical maturity in relation to stability and functionalities, and the CPOE system in this study is fairly unripe.

Another important issue is the rationality of the system. In this study, work division user-rights and individualised log-ons for clinical teams did not match the actual use of the system for medical work. This gap between a formal understanding of what nurses and doctors are trained and licensed to do, inscribed in the software, and how these roles are played out in a real clinical setting stays open and has not yet been bridged.

Among the Danish public, this issue is generally discussed either as a technical problem of making a faster and unbreakable log-in, a jurisdictional problem of healthcare authorities needing to secure and punish misuse of patient data more firmly, or as a problem of the hegemony

of clinical professions. The authority and right of the physician to delegate tasks and the duty of the nursing profession to protect care obligations from new tasks and workloads are diluted. These issues point to implementation problems that transcend the knowledge domain of the vendor and hospital owners, as they touch upon the power relations, core duties and responsibilities of healthcare professionals.

Tentatively, projects have demonstrated how the CPOE system effects medication goals.<sup>15</sup> Clinical rituals that focus on getting the right medication to the right individual patients are pushed towards establishing new habits and procedures that help the system perform well. Clinicians now concentrate on the CPOE system rather than the patient. But who can be held responsible for this transformation of relationships and routines? ■

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