

# Perception and Adoption of an Electronic Medication Record Three Years after Deployment

**Morten Hertzum**

Computer Science, Roskilde University  
Bldg 42.2, Universitetsvej 1, Roskilde, Denmark  
mhz@ruc.dk

**Maren Fich Granlien**

Computer Science, Roskilde University  
Bldg 42.2, Universitetsvej 1, Roskilde, Denmark  
maren@ruc.dk

## ABSTRACT

Region Zealand's electronic medication record is generally perceived by hospital staff as useful but not that easy to use. Neither perceived usefulness nor perceived ease of use is more than weakly correlated with actual adoption. The complex work domain with interdependent staff groups and many interrelated systems may be part of the explanation for the weak correlation.

## INTRODUCTION

As part of the extensive efforts to substitute electronic patient records for paper records at Danish hospitals, an electronic medication record (EMR) system has been deployed at the hospitals in Region Zealand (one of five healthcare regions in Denmark). The system has been in operation for two to four years at the region's hospitals, and work procedures involving the system have thus had time to stabilize.

According to technology-acceptance research [1, 3] people's adoption of a system depends to a considerable extent on their perception of its usefulness and ease of use, even when adoption is mandated. Several work procedures involving the EMR system are mandated in the region's standard operating procedures for medication. This study aims to investigate (a) how the EMR system is perceived by the hospital staff after they have gained considerable experience with it and (b) how aspects of perceived usefulness and perceived ease of use correlate with adoption in a complex work domain.

## THE ELECTRONIC MEDICATION RECORD

The EMR system is intended to help ensure that the right medication is given to the right patients at the right time. The system is used by both physicians and nurses for maintaining an overview of patients' medication and specifically by physicians for ordering medication and by nurses for dispensing and administering medication. Patients' diagnoses, lab tests, treatments, and other non-medication information are not documented in the EMR system but in other electronic and paper records.

## SURVEY METHODOLOGY

This study consists of an online survey. An email requesting participation was sent to all function managers, department managers, ward managers, and EMR coordinators at the hospitals in Region Zealand, a total of 430 people. Participation in the survey was anonymous and after issuing

two reminders we received 232 responses, for a response rate of 54%.

The survey contained questions about the extent to which different parts of the system were used and the extent to which different work procedures involving the system were followed. The response categories for these questions were *Always*, *Very often*, *Often*, *Rarely*, *Very Rarely*, *Never*, and *Don't know*. Participants were also asked to indicate their agreement to a number of statements about the usefulness and ease of use of the system. The response categories for these questions were *Agree completely*, *Agree somewhat*, *Either*, *Disagree somewhat*, and *Disagree completely*. Apart from these fixed-response questions participants were asked to describe barriers to using the system and following work procedures. In total the survey comprised 59 questions.

## RESULTS AND DISCUSSION

Regarding perceived usefulness Table 1 shows that 64-73% of respondents agree (completely or somewhat) that the EMR system provides a good overview of the different parts of the medication process. The three remaining items about perceived usefulness concern the quality of the medication process and yield slightly less positive results. The median response for the item concerning whether the right medication is ordered is neutral, that is neither agreement nor disagreement. Several respondents comment that the EMR system has not reduced the number of medication errors but merely changed the types of medication error.

Regarding perceived ease of use the results are more mixed. Medication ordering, which is the physicians' responsibility, is perceived as simple by only 37% of respondents and as too time consuming by 61% of respondents. Conversely, dispensing and administration of medication, which is the nurses' responsibility, is perceived as simple by 51% of respondents and as too time consuming by 39-40% of respondents. By comparing the ratings given by nurses ( $N = 129$ ) and physicians ( $N = 94$ ) we find that for two of the items about perceived usefulness and four of the items about perceived ease of use nurses and physicians assess the EMR system differently (Mann-Whitney tests, all  $ps < 0.05$ ).

Six of the 12 items in Table 1 correlate significantly with the extent to which system facilities are used and five items correlate significantly with the extent to which work procedures are followed. The correlations are however weak, suggesting either that adoption of the system does not yield sufficient benefit to produce consistently positive

Item	Positive	Neutral	Negative	Correlation with system use	Correlation with work procedures
Perceived usefulness					
Good overview of medication orders	73%	19%	8%	0.16 * <sup>a</sup>	0.11 <sup>d</sup>
Good overview of dispensed medicine	64%	26%	9%	0.35 *** <sup>b</sup>	0.31 *** <sup>e</sup>
Good overview of administered medicine	69%	26%	6%	0.30 *** <sup>c</sup>	0.25 *** <sup>f</sup>
The right medication is ordered	47%	35%	18%	0.13 <sup>a</sup>	0.14 * <sup>d</sup>
The ordered medication is administered	69%	22%	9%	0.11 <sup>b</sup>	0.13 <sup>e</sup>
Medication is administered at the right time	56%	30%	14%	0.08 <sup>c</sup>	0.12 <sup>f</sup>
Perceived ease of use					
Ordering medication is simple	37%	34%	29%	0.06 <sup>a</sup>	0.12 <sup>d</sup>
Dispensing medication is simple	51%	35%	14%	0.40 *** <sup>b</sup>	0.36 *** <sup>e</sup>
Administering medication is simple	51%	33%	16%	0.39 *** <sup>c</sup>	0.37 *** <sup>f</sup>
Ordering medication is too time consuming	61%	29%	9%	0.21 ** <sup>a</sup>	0.10 <sup>d</sup>
Dispensing medication is too time consuming	39%	39%	22%	-0.05 <sup>b</sup>	0.01 <sup>e</sup>
Administering medication is too time consuming	40%	39%	21%	0.00 <sup>c</sup>	-0.01 <sup>f</sup>

**Table 1. Perception of the EMR system and the work processes in which it is used, N = 232.**

Notes: ‘Positive’ gives the sum of responses in the categories *Agree completely* and *Agree somewhat*. ‘Neutral’ gives the responses in the category *Either*. ‘Negative’ gives the sum of responses in the categories *Disagree completely* and *Disagree somewhat*. ‘Correlation with system use’ gives Spearman correlations with: <sup>a</sup> Question: extent to which the tab sheet *Medication orders* is used. <sup>b</sup> Question: extent to which the tab sheet *Dispensing/administration* is used when medication is dispensed. <sup>c</sup> Question: extent to which the tab sheet *Dispensing/administration* is used when medication is administered. ‘Correlation with work procedures’ gives Spearman correlations with: <sup>d</sup> Question: extent to which standard medication orders are used. <sup>e</sup> Question: extent to which the dispensing of each medication is signed for separately. <sup>f</sup> Question: extent to which the medication is signed for when it is administered to the patient. \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

assessments or that assessments are not sufficiently positive to foster consistent adoption. The weak correlations are somewhat contrary to the technology-acceptance model [1, 3], specifically for perceived usefulness. One explanation for the weak correlations might be that the EMR system has multiple groups of user, such as physicians and nurses. While the groups are highly interdependent in their actual use of the EMR system, they may tend to perceive its usefulness and ease of use mainly from a within-group perspective. Another explanation might be that the EMR system is only one of several interrelated records. For years hospitals have been and will continue to be in a transitional state where some records have become electronic and others have not. The consequence of this transitional state is a disintegration of information, as stated by one respondent:

*Nothing has been achieved, except that data are now recorded in [the EMR system]. Medication is no longer in the patient record; that is the unified overview of medication and symptoms is lost, which is a clinical disaster.*

This quote captures an adoption barrier that is easily dismissed as merely transitional, but such transitional states

have become an almost permanent characteristic of work in many complex domains. As a consequence, not only the usefulness but also the alignment and organizational implementation of systems are key concerns in achieving acceptance and consistent adoption of systems [2].

#### ACKNOWLEDGEMENTS

We thank Jette Gudmundsen and Mikkel Lundstrøm, who were instrumental in the design and administration of the survey. Special thanks are due to the survey respondents.

#### REFERENCES

1. Davis, F.D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* 13, 3 (1989), 319-340.
2. Markus, M.L. Technochange management: Using IT to drive organizational change. *Journal of Information Technology* 19, 1 (2004), 4-20.
3. Venkatesh, V., Morris, M.G., Davis, G.B., and Davis, F.D. User acceptance of information technology: Toward a unified view. *MIS Quarterly* 27, 3 (2003), 425-478.