Electronic Whiteboards and Intensive Care Unit follow up. Outreach – follow up within 24 h from the transfer to a general ward.

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Abstract. This paper is reviewing the existing literature on Intensive Care Unit (ICU) Outreach, in-hospital follow up 24 hours after the transition to a general ward from an ICU. It also touches upon the use of Electronic Whiteboards in a hospital setting and how the electronic whiteboards might support communication and collaboration between wards; in this setting between the ICU and general ward. The stakeholder is the health care staff focusing on the nurses in both ICU and general wards.

Research on ICU follow up outlines two fundamental issues in the transition between wards: 1) communication/collaboration and 2) information. However no literature has been found on how to maintain the communication and collaboration between wards when time of the respectively project has run out.

Research on electronic whiteboards in hospital settings find that supporting communication between e.g. wards and the transfer of information is optimized using an electronic whiteboard. Negative findings in the research on electronic whiteboards are present too e.g. it is crucial to have the same use language when sharing the same interface and reports on system in-flexibility; dash-board (standardized use of language) vs. open-ended dry-erase whiteboard (make-up-your-own-sentences).

In conclusion the primary feature in the two subjects is to optimize communication/collaboration and information between ICU and general wards in the transition. To make it a long term solution the content of such a support would need involvement of the end-users in the design process (Participatory Design). Hence these two findings, this review is setting the stage for further research on how electronic whiteboards can support the initial follow up when patients are transferred from an ICU to a general ward.

Keywords: Electronic whiteboards, Health IT, IT support in a clinical setting, Intensive Care Nursing, Intensive Care follow up (Outreach)

1 Introduction

This study is the offset to a Ph.D. project that aims to see how an electronic whiteboard can support the initial in-hospital follow up after the transfer from ICU to

a general ward. The follow up involves both a 24 h care giving plan (to-do-list/check-list) and a follow up visit. The researchers have been reflecting on the use of IT support in the actual care setting not only using the support as a tool for documentation or clinical overview. This review will try to set a current status for the research on ICU follow up and electronic whiteboards in a clinical setting and will be conducted to synthesize the understanding of ICU follow up and the clinical use of electronic whiteboards.

1.1 Aim

The aim of this paper is to review the present research on initial follow up on patients after transferring from an ICU to a general ward and how electronic whiteboards are supporting this transfer not only being used as a tool for clinical overview but also including the whiteboard in the care of and around the patients. This will give an overview of the current practices on ICU follow up and an overview of how the EWs contribute the Health Care in regards to support.

1.2 Clarifications

Outreach is an ICU follow up within 24 h from the transfer to a general ward. It is offered as an extra service to both nurses at the general ward as well as the former ICU patient and their relatives. Patients that have been mechanically ventilated either invasive or non-invasive and patients that have been admitted to ICU >72 h or unexpectedly are being transferred to a general ward in the evening/nighttime receive Outreach follow up. It includes an initial 24 h care giving plan (in extent to a long term care giving plan and summary), a follow up visit about 24 h after the transfer where an ICU nurse visits the patient responsible nurse at the general ward to evaluate the initial 24 h plan, to help clarify uncertainties, answer questions about the patient or plan etc. The ICU nurse also visits the patient to see how he/she has experienced the transfer.

The Electronic Whiteboard will be mentioned as EW further on. It is however important to understand that this particular electronic device is not a *whiteboard* which is open ended but rather a dashboard with standardized terms of language.

2 Method

The literature for this paper has been found at Medline, Embase, Cinahl and Cochrane Library using the matrix in table I and through snowballing. Literature has been selected through headlines and abstracts, including research on initial follow up (within 24 h of transfer from ICU to general ward), in-hospital, follow up teams, patients > 18 years, excluding Medical Emergency Team (MET), pediatric*, neonatal, patients that have not been transferred from ICU to a general ward within 24 h and patients transferred from ICU to a general ward for end-of-life-care. Table 1 is

showing the matrix for the search, first column and following columns combined with OR, leaving out results with NOT using *child** OR *neo** OR *pediatr**.

Table 1 the matrix for the search.

		Outreach (145 hits)	Follow up (8 774)	Post-ICU plan (4)	Nursing plan (361)	
"Intensive Care Unit" OR **ICU (127 296 hits)**	AND	Outreach Team (65)	Critical Care Team NOT Medical Emergency Team (MET) (1850)	Critical Care Outreach Team (47)	Rapid Response Team (231)	ICU nurse liaison (59)
		Intensive Care Aftercare (166)	Post-ICU (245)	Handover (76)		
		Physical effects (12)	Long term	Short term		
		Psychological effects (36)	Long term	Short term		
		Transfer of patients (2)	Transfer of knowledge (104)	Patients´ perspective (518)	Nurses´ perspective (387)	
		Communication (3529)				
		Mortality after ICU (13)				
		Morbidity after ICU (4395)	Co-morbidity (335)	At time of hospitalization (262)	At discharge (282)	
		General Length of Stay (LOS) (1962)				
		Re-admission to the ICU (449)	48h outcome (dead or alive) (943)	Outcome after one month (669)	Long term outcome (2414)	

Searching for literature on EW the databases Medline, ACM Digital Library and Computer and Information Systems Abstracts where used. Table 2 is showing the matrix on this search. Columns are combined with OR downwards, rows are combined with the indicated AND/OR. Literature has been selected through headlines and abstracts, including research on communication between wards, collaboration between wards and handover.

Table 2. showing the matrix on this search.

Electronic Whiteboard*		Transfer of knowledge between wards/units	AND	Safety
Electronic Dashboard*		Implement*	OR	Evaluat*

		Computerized whiteboard*		Status board*
				Tracking board*
		Health care informatic*		Medical informatic*
		Overview		

Effort has been made to combine the two matrix´ with no results in none of the used databases. Few papers have been found researching on using electronic discharge letters in general focusing on the collaboration/handover between hospitals and general practitioner (GP) or primary health care.

3 Results
3.1 ICU follow up

Follow up after Intensive Care Unit (ICU) is being described back in the early 90´ies [1],[2]. Former ICU patients´ experiences are being described and horrible stories are being told. – Stories about hallucinations, Post-Traumatic Stress Disorder (PTSD), anxiety, depression, all sorts of physical and psychological dysfunctions and nowhere to go to [2],[3],[4],[5],[6], and [7]. Throughout the 90´ies the follow up is getting more structured as we learned more and more about the former ICU patients´ experiences both physically and psychologically, how they are related to their treatment at the ICU [1],[2].

Some of the pioneers in describing ICU follow up in a structured and scientific way are Griffiths and Jones [2]. Internationally the authors of *Intensive Care Aftercare* have set their footprint when ICU aftercare and follow up are discussed and they keep on contributing to the development of Critical and Intensive Care [2].

Intensive Care Aftercare 2002 describes the many facets' of being a patient at the ICU and being transferred to a general ward afterwards. There are a lot of physical challenges to deal with both at the general ward and when being discharged and going home. These challenges mean a lot to both patient and their relatives in means of *"now I´m going home – I´m supposed to be better but still have a number of physical challenges"*, *"will I ever get better"*, *"Am I getting sick again when my physics are not getting better"* and so on.

Because the physical recovery is quite specific for the former ICU-patient a lot of "non-ICU" staff is not familiar with the symptoms although being in health care therefor demanding an ICU-professional. The psychological challenges are being described as well but this particular area is being investigated ongoing. Several researchers describe patients´ experiences. During their stay at the ICU it is well known that there is a risk of ICU delirium. Patients describe more or less horrible scenarios during their ICU stay some can be linked to a specific caregiving task and some cannot.

Griffiths & Jones 2002 are not only setting the scene for how to manage the patients in an out-patient setting, giving the health care professionals examples of the former ICU-patient´s physical and psychological state, they also state that the follow

up should start from the moment that the patient is planned to leave the ICU. However the focus on ICU follow up has been on diaries and ICU clinics.

Later in the late 90´ies and through the 00´ies there has been an increased interest in the Outreach Team/Liaison Nurse Team. This concept is embracing the statement of early follow up giving by Griffiths & Jones in the 90´ies.

In a systematic review [8] prior research on ICU follow up have been accessed to evaluate the effectiveness of interventions in order to improve the safety and efficiency of patient handover between ICU and general wards [8]. Only 11 out of 6591 citations were included and only six (55 %) of these reported statistically significant effects. No significance in the reduction of mortality was found. However there were found significant effects on use of care and continuity and preventable adverse effects. Furthermore results on improvement of communication and coordination of care between ICU and ward healthcare professionals, complete and accurate clinical information from ICU to ward were found statistically significant [8].

[8] elaborate on additional findings as liaison nurses as a useful tool for bridging coordination gaps, communication, the effectiveness of standardizing tools, improving information transfer and quality of care. They comment on how published studies up till now focus on these themes even though the important factors for inadequate patient handover have been identified as culture, team climate and verbal communication.

They [8] highlights the absence of evidence on how to improve patient handovers between the ICU and general ward and search for e.g. a shared electronic information exchange system to improve handover situations.

Researchers have found that ICU Outreach has a positive effect on patients´ survival, morbidity and Length of Stay (LOS); relatives find it less stressful when their loved one is transferred from the ICU to the general ward and never the less health care staff finds it helpful to have resources available when needed.

Transferring patients to different wards is described as one of the most dangerous initiatives in the hospital. In her Ph.D. thesis, [9] found that the main factors influencing the transfer of patients are: communication, information, organization, infrastructure, professionalism, responsibility, attention to themes and culture. These factors are well correlated to the main concerns in this project. [9] is pointing out the lack of structure in the transferring situation in regards to both oral and written communication, skills and taking responsibility which will enhance the collaboration between staff and wards.

[9] is suggesting a structured framework for the transition, a setting of expectations towards each other (that being both wards and colleagues). Furthermore she recommends hospitals to have a "concept of safe patient transitions" based on the action research method. She suggests that making a template for transitions cannot stand alone if you want clinical results but has to be supplemented with education, implementation, follow up and evaluation which are equally important to a template for safe transitions.

Others have been working on identifying the structures of a framework in transition (e.g. transferring patients between ward, in-patients, and discharge situation). The case study [10] finds positive effects when using a manual whiteboard to support the transition, to support the collaboration, and give a clinical overview to

the health care staff (both doctors and nurses). However the premise for a success is a well-planned implementation, introduction, and engagement for participation of staff as well as "a powerful, guiding coalition…best achieved with joint, multidisciplinary, systematic planning on the basis of shared goals and a shared vision" [11].

To sum up the existing research in ICU Outreach, it is suggested that there should be more focus on these themes when transferring a patient:

- Communication
- Information
- Organization
- Education/Professionalism
- Cultures
- Responsibility
- A shared electronic information exchange system

3.2 Electronic Whiteboards

To summarize the current research on the implementation and effects of electronic whiteboards in clinical settings, two systematic reviews are worth noticing. [12] is focusing on the effects that arises from the implementation and identifies a number of mediating factors that have an impact on these effects. [13] is a later review that tries to identify a number of factors that influences the process of electronic whiteboard implementation itself.

Common to the reviews are the identification of a number of positive and negative effects from the implementation of electronic whiteboards. The difference relates to the scope of the hospital setting. [12] is focused on emergency departments (ED) whereas [13] includes any hospital department. Since a lot of the research found on the implementation of electronic whiteboards and the effects thereof are concerned with the work*flow* we are in this review interested in the scope of research that deals with hospital departments that have a high degree of patient flow i.e. emergency departments, surgical departments, x-ray departments and of course intensive care units.

Our effort to compare the two reviews has resulted in a table that extends the list of consequences found in [12] based on the additional findings in [13] See Table 3.

We depart from the categories identified in [12], and try to fit the positive and negative effects found in [13] into these categories. The [12] review deals with 21 references and the [13] review with 27. Across the two reviews 14 references are in common. In the following we go through the categories and explain how the two reviews overlap and where they stand out. The categories are 'changes to work practice', 'effects on coordination and communication', 'changes to whiteboard information content', 'language and accuracy', 'changes to whiteboard role and usage', 'clinicians' perceptions attitudes and satisfaction', 'effects on patient care', and 'effects on financial and administrative aspects'.

Both reviews refer to cases of successful implementations of electronic whiteboards [14][15][16][17]. The cases has resulted in *improved and simplified workflow*, the *rate of interruptions* has decreased in some cases improving the quality of care [12]. [13] does not directly refer to changed work practices but rather the immediate effects such as *"…better overview of the hospital('s) actual status…"*.

Regarding 'effects on communication and coordination' [13] point to *improvement in communication between staff, quicker way to access information, data updated real time and traceable* and that the whiteboard *provides a better overview* from the same references as [12], [14],[15], and [17].

When it comes to negative effects of changes to work practice as well as communication and coordination, [12] and [13] turn to the same references [18], [19], and [20] both emphasizing that the collaborative nature of working with a traditional whiteboard turned out to an individual work practice.

When it comes to the "changes to whiteboards information content, language and accuracy" both reviews turn to the exact same references, [18], [21],[22], and [20]. The studies respectively indicate that the electronic whiteboards are "less effective for providing information related to the coordination of patient care" [18],[21],[22], and [20] the information is less accurate and contains more types of errors than a manual whiteboard [21] and that the language is less flexible. Further even though the systems contain the same core information, the manual whiteboards contain more information [18] and [22], are more effective for relaying extra information [21] and [20].

Regarding 'changes to whiteboard role and usage' only [12] comments on the usage of a whiteboards. The cases are diverse – almost contradicting. In some cases the electronic whiteboards are being used for administrative purposes [21] and [18]. Opposite [23] finds that the electronic whiteboard is used in the same manner as the manual whiteboard - as a tool for coordination and communication.

Another important factor concerning the implementation of electronic whiteboards is 'Clinicians' perceptions, attitudes and satisfaction towards them. To our surprise only positive attitudes towards EW's are found. [17] finds an overall satisfaction. [16] finds that EW's decrease the mental workload and can improve on the distribution of workload between physicians. [24] show that clinicians have positive expectations towards the introduction of EW and expect they can be beneficial. [13] adds one account of greater acceptance of EW's in a case where an electronic whiteboard system where used as a preventive checklist for operations [25].

Both reviews refer to the same reports on improved 'effects on patient care' [26] and [27]. This refers to reduced length of stay, reduce number of patients not "being seen" and increased patient satisfaction. [13] refer to these improvements under one as "better control of the patient flow". On the negative side of effects on patient care [12] has a single reference [28] that emphasizes the potential link between usability flaws and patient safety. [13] refer two different sources [14] and [17] which discuss the issue of exposing confidential information, which can also be considered a part of patient safety.

Finally [15] and [27] finds that the electronic whiteboards have a positive influence on the administrative and financial aspects of the operation of an ED as they can

provide i.e. reporting, educational feedback and impact assessment. Also improvement in the discharge process has led to financial improvements

In addition to [12], [13] report from a single case where Electronic Whiteboards allowed the participants to share information in a more adaptive manner than a group using manual whiteboards [29].

What we can gather from a view on these categories is the well-established notion that electronic whiteboard *do* affect work practice. However there are accords on both the positive and negative side.

Table 3. Summarized table of identified positive and negative effects.

Positive effects	Negative effects
Improved and simplified workflow	The collaborative nature of working with a traditional whiteboard turned out to an individual work practice
The rate of interruptions has decreased	
Better overview of the hospital('s) actual status	
Improvement in communication between staff	Less effective for providing information related to the coordination of patient care
Quicker way to access information	EW's are less accurate and contains more types of errors
Data updated real time and traceable	The language is less flexible
Positive attitudes from physicians	Electronic whiteboards contain less information
Decrease the mental workload	
Can improve on the distribution of workload between physicians	Less effective for relaying extra information
Greater acceptance when used as a preventive checklist for operations (lop 18)	Potential link between usability flaws and patient safety
	Issue of exposing confidential information
Reduced length of stay	
Reduce number of patients not "being seen"	
Increased patient satisfaction	
Positive influence on the administrative and financial aspects	
Allowed the participant to share information in a more adaptive manner	

What we find that both reviews miss out on is a more thorough discussion on the issue of 'flexibility'. Both reviews mention the aspects of flexibility constraints in the transition from analog/manual dry-erase whiteboards to digital electronic whiteboards, but they avoid any deeper elaboration on the matter.

On the negative side, [13] emphasizes the aspect of inflexibility, saying that "(Electronic Whiteboards) didn't offer the same level of customization as the dry-erase whiteboard…". This is somewhat related to what [12] refers to as "differences in language".

> *"…each ED in their study has developed an agreed upon language for displaying information. However, they also find that when this language is codified in the electronic system it becomes static and inflexible". p.487*

[20]

The quote is central to the discussion of the electronic whiteboard as a general tool for sharing and maintaining a clinical overview to coordinate and communicate patient care. The transition from manual whiteboard to electronic whiteboard is indirectly becoming more than just exchanging the hardware from a dry-erase whiteboard and board marker to a touch sensitive screen. The electronic whiteboard is in many cases intrinsically a distributed system that pushes a collaborative intradepartmental agenda, that doesn't exist with the manual dry-erase whiteboards.

Further we pick up a tendency to think that the visual part of the user interface of electronic whiteboards generally are being designed to resemble the tabular format of the manual whiteboards found in the studies [14],[15],[30],[18],[28],[21],[19],[22],[31],[23],[20],[17], and [32]. Even though the tabular layout resembles the traditional manual whiteboard layout and as such makes very good sense to do so, we argue that the major difference and a primary source of negative effects regarding effects on communication and coordination is due to the sacrifice of flexibility and adaptation towards the local departmental language.

In a sense we can see a transition from the open-ended manual whiteboard to an electronic whiteboard that in some cases would be better characterized as an electronic *dash*board. When the collaborative nature of work transforms to an individual work practice, the dashboard might serve as a tool for gaining overview for the individual, but not as a coordination and communication tool as the manual dry-erase whiteboard – essentially degrading the work practice.

Nonetheless EW's have been found useful in a health care setting not only in a treatment situation or logistically but they seem to play a vital role in facilitating communication between ED staff and coordinating care for the ED patient. The EWs have been found to have impact on the organization and the work practice but it is less conclusive whether it is in a good or bad way.

Some research found the EWs less effective for providing information to the coordination of patient care.

This upcoming project will embrace the findings and recommendation from [9], van [8] and others and try to overcome the obstacles in the transferring situation, enhancing the communication, information, organization, professionalism,

responsibility, attention to the relevant themes and barriers in different ward cultures by using the EWs through participatory design.

4 Discussion

It would seem obvious that handing over a caregiving plan in paper in this world of "no-papers" is doomed. However when the different wards in a hospital does not have the same it-systems that can´t interact it is a challenge to face what to do. Does the transferring ward need to do double documentation and risk mistakes or loss of information or do they handover the data in paper? Given the EW in every ward in the hospital it is straight forward that we need to involve this technology even more – not only to get an overview of the patients and the clinical exams waiting to be done but also involve the EW´s in the caregiving situation.

Ever since the concept of Outreach was enrolled at the hospital (2008) and since the EW was hung up all over the hospital (2012) we have seen that the basic health care staff haven´t embraced the two. The word between the basic health care staff is among other things that there has been a lack of information, it´s been a top-down decision and no resources have been granted.

That´s why this upcoming project is designed to re-implement Outreach by the means of the EW through Participatory design. – Making it the end-users that define the content of the caregiving plan in a certain framework. Not only will this give the end-users a feeling of ownership and hopefully increase the fulfillment of Outreach caregiving plans and visits but it might even show in the former ICU-patients mortality, morbidity and LOS making the hospital a safer place even though you get transferred between wards.

The upcoming project is contributing to three areas: 1) Intensive Care Nursing – embracing technology that isn´t bedside and extending the ICU-service to outside the ICU, 2) Health Care Informatics – using it systems in a caregiving context and 3) Outlining another way of implementing new things in a so far rigid health care system where "*we have a certain way of doing things...*" (Top-down).

5 Conclusion

Recommendations in the transfer situation of a patient require structure, communication, information, organization and education between the transferring ward and the receiving ward. Complementing this sensitive context one should consider the different work practices between wards and take responsibility of the patient.

Combing the transfer of patients, follow up after ICU with the EW, it should be possible for the EW to embrace these recommendations and optimize the structure and the communication through information and change the organization in regards to the transfer of patients from ward to ward and in the ICU follow up. However the implementation of the EW´s is crucial for the staff to embrace them.

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