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## Clinical Computer Systems Survey (CLICS): Learning about Health Information Technology (HIT) in its Context of Use

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### Abstract

Successful health information technology (HIT) implementations need to be informed on the context of use and on users' attitudes. To this end, we developed the CLINICAL Computer Systems Survey (CLICS) instrument. CLICS reflects a socio-technical view of HIT adoption, and is designed to encompass all members of the clinical team. We used the survey in a large English hospital as part of its internal evaluation of the implementation of an electronic patient record system (EPR). The survey revealed extent and type of use of the EPR; how it related to and integrated with other existing systems; and people's views on its use, usability and emergent safety issues. Significantly, participants really appreciated 'being asked'. They also reminded us of the wider range of administrative roles engaged with EPR. This observation reveals pertinent questions as to our understanding of the boundaries between administrative tasks and clinical medicine – what we propose as the field of 'administrative medicine'.

### Keywords:

Health Information Technology, Survey, Hospitals, Evaluation Studies as Topic, Administrative Medicine.

### Introduction

Many health information systems have problematic and not unequivocally successful implementations. This may be explained in a number of ways: technology that is not fit for purpose or is difficult to use, inappropriate implementation, training and support, lack of user involvement or management commitment, or a poor fit regarding work practices. One way to achieve better outcomes is to gain a better understanding of the specific context within which the innovation is or will be deployed and the attitudes and opinions of the people who might come to use it. This is particularly the case when a system is organization-wide, will engage many people in many roles, and makes real demands on their time and attention.

A number of survey instruments attempt to gauge or evaluate health care institution's 'level of use' of HIT. But these generally are either seeking some aggregate measure by which to 'scale' the specific hospital/institution in terms of their intensity or level of HIT use [1-2], or are focused on specific issues of usability or benefit (e.g., attitudes towards ePrescribing [3], satisfaction with clinical pathways [4], or communication during handovers [5]). Others are task-oriented instruments that focus on technology in the context of specific clinical work [6]. Our research, studying the implementation of England's Care Records Service in a number of institutions in England [7] called for a different approach.

We started with the assumption that, at the multi-professional and cross-organisational level, we needed to know about overall usage of and utility found in HIT. We deliberately designed CLICS to evaluate a suite of different HIT applications rather than a specific application. CLICS reflects in particular the ambitions for HIT set out in the 2008 *Health Informatics Review Report* [10] expressed as the 'Clinical 5' - the core elements of strategic HIT in the clinical context: 1) A Patient Administration System (PAS) with integration with other systems and sophisticated reporting; 2) Order Communications and Diagnostics Reporting (including all pathology and radiology tests and tests ordered in primary care); 3) Letters with coding (discharge summaries, clinic and Accident and Emergency letters); 4) Scheduling (for beds, tests, theatres etc.); and 5) e-Prescribing including 'To Take Out' (discharge) medicines.

CLICS was designed to be answered by doctors, nurses, pharmacists, and other members of the clinical team including administrative staff who work with clinical staff. This inclusive approach reflects how multiple user communities use clinical systems [11]. Questions were carefully designed to capture personal HIT use as well as use of systems by the team or at ward or hospital level, and to show how keyboard tasks may be delegated to junior colleagues or other professional roles. CLICS may be used at various stages of implementation - prior to a major project or in developing strategy (baselines), during a period of change (for formative assessment), or as a new system achieves some stability (for summative evaluation).

The instrument is based on a socio-technical view of the adoption and use of clinical information systems [8-9]. It is constructed around four specific analytical dimensions: 'computerisation' (what work is computerised), 'usability and safety', 'clinical and organisational management' and 'patient journey' (Table 1). CLICS and a detail description of its constructs are available at <http://tinyurl.com/d2bq3ma>.

### Methods

Following a cycle of pilots and review by health care professionals, CLICS was used in an English hospital (the Hospital) as part of an internal review of their implementation of EPR software and systems for the NHS Care Record Service (CRS). It was offered to hospital staff as a way to provide feedback on 'CRS' – the local name for the substantial project underway at the time and 18 months into deployment.

In regards to the responses, it is important to consider the dual purpose of CLICS in the hospital setting: supporting evalua-

tion of CRS (the ‘new’ system), while also collecting data on attitudes to and use of all computer-based systems in use in the Hospital. The pro-forma CLICS allows a few targeted questions that reflect specific interests of the site using it. These site-specific questions may relate to the specific system (e.g., CRS) or to more general aspects of technology or data. In this case, the Hospital chose to use this space in the questionnaire with the open question ‘What would be your priorities for improvements in CRS?’ [Q5].

A customised online version of CLICS was created for distribution. In order to capture both the widest possible audience and also team work dimensions at a ward and clinic level, the questionnaire was distributed through three channels: online, with the URL link sent via email to general distribution list (ca. 4,000 recipients); on paper, distributed by researchers outside of the hospital canteen over 2 days (in December 2010); on paper, distributed to 2 wards (one medical, one surgical), anonymised as B and A Ward. The Hospital provided a list of staff names working in the two wards, and copies of the questionnaire were distributed in named envelopes, each with an envelope inside for returning anonymously to a box at the nursing station or via internal mail. Some respondents reported problems in accessing the online version via the URL in the email, and a second email had to be circulated. This initial problem may have had an impact on the final response rate. Paper questionnaires and envelopes were colour coded to inform response rates for each of the distribution methods. There was no identification or tracking of respondents to avoid duplicate responses online or on paper.

The survey period was originally established to span two weeks. However answers on paper were accepted over a longer period. Quantitative data were imported into SPSS and an Excel spreadsheet. Given the small sample, only a descriptive analysis of aggregate data was carried out, and no formal statistical analysis was conducted. Answers to the open questions (free text fields) were imported into Excel, treated as qualitative data and subject to thematic analysis. Themes were drawn from the data in a bottom-up inductive approach informed but not constrained by CLICS framework of 4 primary themes (as in Table 1). Additional themes, emerging during the analysis beyond the 4 constructs, were noted (among them, the theme of ‘administrative medicine’ discussed in this paper). The qualitative data also helped our understanding of the quantitative data. Both quantitative and qualitative data were then related to CLICS framework of primary themes.

## Results

A total of 130 questionnaires were returned (76 online + 54 paper). Response rates were calculated for each of the different distribution methods (Table 2). 29 Doctors, 23 nurses and 3 pharmacists counted for 22%, 18% and 2% of respondents respectively; the majority of respondents (49%) were among ‘Other’ professionals; no midwives answered the survey, although one clerk in midwifery and one nursery nurse were counted among the ‘Other’ professions answering the survey. Not all respondents revealed their professional background and one explicitly refused because of concerns regarding the anonymity of answers provided (“*This will tell you who I am so refuse to answer*”).

The sample of respondents, although limited, covered a variety of clinical and administrative areas in the hospital. Among the clinical areas represented were Accident and Emergency (A&E), Cardiology, Community Outpatient, Maternity, Gy-

naecology, Dermatology, Geriatrics, Haematology, Orthopaedics, Radiology, and Urology. Administrative areas represented included Clinical Coding, Formal Complaints, and roles such as outpatient booking clerks, ward and theatre receptions, and other ‘administration’ roles. The self-selected sample of 130 respondents was relatively senior, including 15 consultants and 30 Band7-8 people among the nursing and pharmacy professions. The majority of respondents (57%) had worked for the Hospital for more than 5 years and of those with a clinical background, the majority had more than 10 years of clinical practice (48%). The sample had relatively high IT skills (36% claimed ‘high’ computer skills). In terms of age and gender, the majority of respondents were over 35 years of age (26% in 36-45 range plus 38% over 45) and female (72%).

We present below some results of the survey. Given limited available space, we restrict results reported here to the first two CLICS constructs (Computerisation and Usability/Safety), and focus on answers that expressed the use of HIT beyond narrow clinical roles and tasks, and the use of administrative functionalities not only by administrative staff but also nurses and doctors.

Table 1 - Analytical dimensions of CLICS

Construct	Description
Computerisation	The availability (or absence) of specific functionalities and the computerisation of otherwise manual or paper-based tasks and processes
Usability and safety	How safe, usable, efficient and effective systems are perceived to be
Clinical and Organisational Management	The use made of information and IT for clinical and organisational reasons, the quality of care, the adherence to standards.
Patient Journey	Information flows between settings and the consequences of using IT along the entire patient case.

Table 2 - Distribution methods and response rates

Distribution mode	Sample	Responses	Response rate
Web survey online distributed via email	4000 email addresses on distribution list	76	1.9%
A Ward (paper)	68 named envelopes	4	5.9%
B Ward (paper)	37 named envelopes	13	35.1%
Canteen – Day 1	148 distributed	31	20.9%
Canteen – Day 2	39 distributed	6	15.4%

## Computerisation

### Information recording and retrieval, clinical ordering

This theme reflects the use of computers to record or retrieve patient information over a range of patient care activities and using a range of system types: from the basic demographic information repositories (e.g., a simple PAS), to more ad-

vanced OrderComm or ePrescribing systems. Depending on the functionalities available, these systems are expected to bring a range of benefits in terms of, for instance, efficiency and patient safety (e.g., [12]). Patient information is often recorded in different discrete systems and its integration is expected to facilitate task-oriented access appropriate to clinical need. Questions associated with this theme ask for straightforward yes/no answers to gather data on available systems and their use, without commenting on consequences. A few respondents however wanted to support the idea of using computers and indicate their principle ideas of benefits:

*A good computer system definitely makes things much easier. [Q6.id6]*

*...Real time is good [Q6.id1]*

*IF crs worked properly, it would be very very helpful and avoid delays and reduce paperwork and time [Q6.id14]*

CLICS asks participants for their perception of degrees of system integration. More than half of respondents considered some integration to be available, although answers were not unanimous. It is possible that at times integration is potentially available but users are unaware of this with wasted data entry efforts as a consequence:

*[...] most staff have only knowledge of parts of the system they use regularly and do not see the whole - so do not know about what integrates to what or see the benefits that we hope some departments gain from the huge time input of front line clinicians in feeding information into the system in the first place. [Q8.id7]*

One participant pointed out that systems integration might not be bi-directional: *"Partially integrated to CRS but not always fully bi-directional (no Rad appts go to CRS)" [Q8.id2].*

The instrument indicates if available computer systems are actually used and by what professional role. It is clear from the answers that CRS was used by a variety of professionals. Figure 1 shows an overview of use of available functionalities by doctors and nurses. Apart from ePrescribing functionalities, nurses use to various degrees all functionalities also used by doctors and vice-versa, from ordering tests to scheduling systems. A senior nurse for instance explained her clinical and administrative use of this range of systems:

*Within my role I retrieve results and reports for doctors, order radiographs and blood tests/swab tests (with verbal or written permission/instruction). I look up outpatient [appointments], book patients in and out of clinics. I use scheduling/appointment book (see what clinics are on) to complete the nursing staff rota for my dept. [Q11.id16]*

Respondents were asked for their use of computer systems in terms of purpose – e.g., recording or sharing information. About 38% of participants answered that they use computer systems to record (e.g. input) patient care information, and only about 5% do this when with the patient or at bedside (among them were 1 doctor and 2 nurses). It seems that in this setting in the words of one participant: *"Not enough use of CRS is made - for the storage of clinical data"* [Q8.id23]. However, it also appeared that about 5% of respondents (mostly among the 'Other professions') were able to use computer systems to access patient records held by other institutions.

### Clinical decision support

One of the principle benefits expected from computerisation of the patient record is the possibility to use patient information for computerised decision support (e.g., [13]). CLICS thus asks whether the clinical computer systems available in the hospital offer an appropriate level of alerts, suggestions, and/or guidance during the process of care. We found general expressions of agreement with, and support for, the vision of computerised decision support, though it appears to be a vision not well met by the system(s) in use. It also emerged that patient information and alerts are seen as useful not only for clinical tasks but also for other patient-centred care related arrangements such as for transport or arrangements for interpreters [Q4.id27]:

*The clinical systems are usually helpful, even if all the data is not always accurate [...]. I have already suggested that more alerts should be included – e.g., transport, interpreter or any other special arrangements. It would be great if admin/clerical staff could insert these as well [Q4.id27]*

Respondents also reminded us that computerised decision support is depended on users' data entry work (e.g., keeping data up-to-date along the process of patient care and across systems).

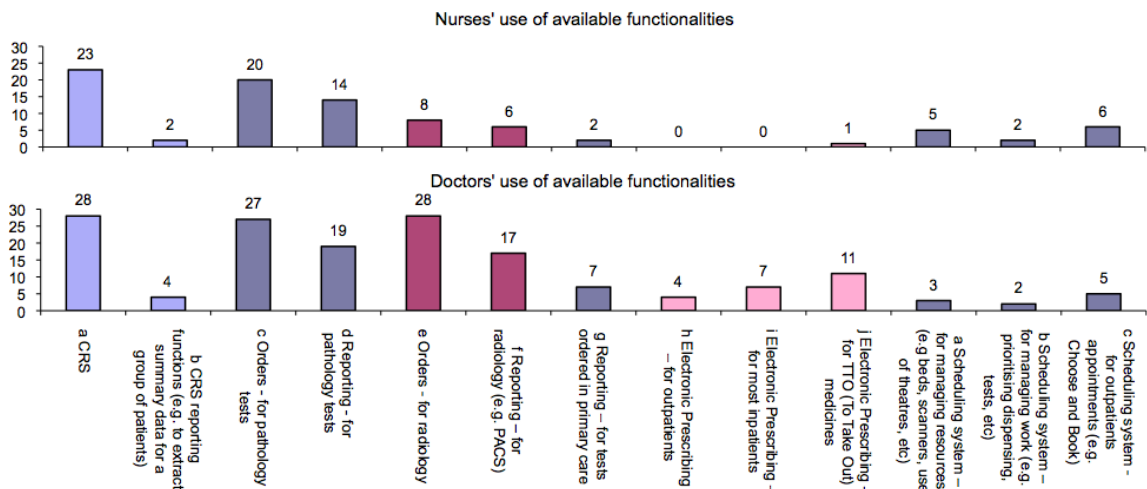


Figure 1 - Nurses' (top) and Doctors' (bottom) use of available functionalities (number of responses - 'Available, I use it' – for Q9a-Q9j and Q10a-Q10c)

tems) and that ‘intangible’ computerised alerts are only visible if and when the system is accessed.

*(It) only works if the correct alert is put on at the right time, i.e., a mum to be has an alert, baby is born, alert must be changed to the babies record, but this is never done.. What if baby turns up at A&E post discharge, how will the Drs know that baby has an alert? They won't!! [...] [Q4.id11]*

*If the patient has an alert, such as MRSA, this doesn't bleep until after you have seen the patient. [...] [Q4.id18]*

CLICS also asked if “computer systems support adherence to Hospital protocols”. While 37% remained undecided, 38% agreed that this is true. A large part of these belonged to ‘Other professions’ (11 doctors (38%), 10 nurses (43%) and 25 other (39%)).

### Usability and Safety

Usability problems permeated respondents’ comments. For instance a consultant annotated on paper in relation to the use of ePrescribing systems for TTO that he/she would “get the junior to do it as so difficult to use!” [Q11.id19]. A nurse lamented that she “also had to take over a lot of the admin work previously done by clerical staff, such as booking beds for daycase patients, because they find it too difficult, or [they] order incorrectly despite training being given” [Q23.id4]. The system was found to be complex, not flexible – or as one respondent wrote, “unforgiving” [Q23.id1] – not intuitive and requiring “too many steps” [Q2.id5] or “too many pages to go through to find something simple” [Q2.id6].

More than 50% of participants did not perceive that their feedback and ideas on “how to improve the computer systems were sought and welcomed” (about 31% disagreed and 25% strongly disagreed). One participant recounted a meeting held when CRS was rolled out, problems were discussed but they have not yet “been resolved to my way of thinking”:

*My only problems are with the CRS system which has many many problems associated with it. A meeting was held reasonably soon after we had all started working with CRS on a daily basis and none of the problems raised [...] have been resolved to my way of thinking. [Q2.id2]*

A comment from a booking clerk/receptionist illustrates the kind of everyday issues that, if responded to, could make users feel that their needs are met, and that system’s perceived shortcomings are going to be addressed:

*...I do not feel that the comments from the frontline staff are appreciated by the IT staff - one example for all - we have asked many, many times for the wording of the appointment letters (automatically generated) to be changed and nothing happened in a year. The wrong wording in some letters causes great difficulties to some patients, as they are instructed by the letter TO REPORT TO [xxx wrong place in the hospital yyy] [Q2.id39]*

The emotional dimension of the user experience with the hospital computer systems is revealed in adjectives such as ‘hindrance’ [e.g. Q2.id16], ‘irritating’ [Q2.id12] or ‘frustrating’ [e.g. Q2.id36], and from users’ cries for help, such as “Please Please Please get rid of CRS...” [Q23.id33] or the one expression of strong support “I LOVE CRS, i think it's great...” [Q23.id8].

CLICS asked whether available computer systems provide users with the required patient information when and where needed. About 30% of respondents agreed, but about 70% of

doctors (20 out of 29) disagreed or strongly disagreed. From comments added, it is apparent that the systems have more an administrative than a narrow clinical role, and more administrative than clinical data. To be useful, information needs to be accurate and relevant (data quality). More than one respondent pointed out the relationship between data entry and data extraction – two tasks not necessarily accomplished by the same people. A senior nurse commented on this in these terms:

*poor training of junior medical staff, leads to clerical staff having incorrect information on the system. This complicates patient care and causes delay to treatment. ... [Q2.id26]*

### Discussion

The findings can be grouped under two main categories: relating to the technology (e.g., software design, usability) and the social dimension (e.g., team work and professional roles). From a socio-technical perspective the two cannot, and should not, be assessed in isolation one from the other. In this setting, CLICS reveals clearly room and need for improvement of the technology, and processes of change centred on the users, their needs, strengths and weaknesses. Human (individual) and organisational factors emerged from participants’ comments as creating both challenges and opportunities. Primary among the latter is a widely shared vision (in abstract) for an IT-supported care delivery. This vision can be nurtured and turned into a foundation for improvement, one that does recognise the administrative dimensions of patient care intertwined with clinical tasks. The HIT in this setting (the CRS and other systems) are not only clinical systems, but also and as much administrative systems – reflected explicitly for example in the concept of ‘scheduling’ as one of the ‘clinical 5’ [10]. The responses remind us of the wider range of administrative tasks, and the multiple staff roles who make use of these systems. Critically, and often overlooked, is that administrative staff might often be the primary user at the keyboard level, and the successful adoption of HIT is dependent as much on the ward clerk as on the senior consultant. For just this reason, CLICS was designed as a survey that could be answered by a variety of members of the clinical team and their administrative co-workers. Still, a large number of respondents with administrative roles found some questions not applicable to them and did not feel well represented:

*It is very clinical based, yet all admin staff have regular dealings with CRS [Q23.id11]*

*Survey should be available for all levels of staff who use CRS [Q23.id19]*

This finding opens interesting questions as to the boundaries between administrative tasks and medicine, the field we might call ‘administrative medicine’.

One overarching finding emerging from these answers is that participants really appreciated ‘being asked’. The questionnaire did not explicitly ask for comments on the initiative of distributing a survey to seek feedback on HIT and CRS. However, more than one respondent expressed gratitude for this effort, though there was concern that the results would then not be taken into account as the CRS implementation proceeded. One participant expressed the regret that such a survey, ‘consulting the users’, had not been done earlier, to inform the decision whether to implement CRS [Q23.id32]. This is a reminder to those who manage implementation of systems not to limit engagement initiatives to representatives of a narrow set of clinical roles at set points of time, but to find multiple and

on going ways to engage everyone, and to be inclusive of other (arguably) purely administrative roles. The limited response rate we achieved is a clear limitation of this survey. The low rate certainly has an impact on the generalizability of the findings and their interpretations. The sample of respondents may not be representative of the population (all hospital staff) and there is a risk of multiple responses from single participants. Concern over a possible low response rate was reflected in the choice of a 'multi-channel' distribution strategy. We understand, informally, that the low response rate both at hospital level and ward level may be a symptom of 'audit fatigue' reported across the NHS, and may also reflect a level of 'disengagement' towards this implementation of CRS. Respondents' type and level of 'engagement' relationship with CRS can also be expected to have contributed to a biased sample: it is reasonable to expect that those strongly in favour of CRS and those strongly against it would be most interested in providing feedback, while for those less 'engaged' answering the survey could have been a lower priority. For some a survey may be an opportunity to express frustrations with the technology, for others a chance of reporting problems they wished to be fixed.

## Conclusion

We designed CLICS as a tool to capture socio-technical dimensions of use (or non-use) of hospital-wide information systems across a range of staff roles. CLICS provides a means of evaluating IT specific and general attitudes and uses in a healthcare setting. This research tool might serve multiple purposes such as benchmarking before new implementation, or formative assessment of current/recent implementations. Since this paper was written, CLICS has been adapted for use in another London hospital to evaluate the implementation of ePrescribing within a critical care EPR system, with distribution in four units before and after implementation. We used CLICS as part of an internal evaluation of a hospital wide EPR system implementation 18 months in. The design of the questions, leaving ample opportunity for free-text answers, allowed some respondents to transform the survey into an opportunity to communicate with the 'implementers' and express their most current and pressing concerns. In this way the survey revealed the porous and flexible boundaries between individual and team use, as we expected, and between clinical and administrative work as reflected in system usage. This second aspect was not expected but we feel has important implications for HIT and our approaches to its design, implementation, use and evaluation.

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