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A Study of Clinicians' Information Systems Usage in Patient-Centered Situations – Preliminary Results

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Aims and motivation

- Aim of the study:
  - to identify and capture information and communication behaviour among healthcare workers in hospital wards
  - validation and further development of a previously iteratively developed framework for focused and structured observations of clinicians during patient-centred work

- Underlying motivation:
  - for the study and for the framework development has been to be able to elicit and produce comprehensive requirements for the user interface of mobile clinical information systems

Methods

- Non-participatory, structured observations of physicians' patient-centered work (e.g. pre-rounds, ward rounds, discharge etc.) in 2 different hospital wards
- Observer: Medical student (fifth year)
- Observation period: July – September 2005
- Field data recorded by means of a previously developed form based on pre-defined codes and free-text fields [1]
- Recorded data consist of sequences of information and communication acts of one main actor, and focus on *information sources* and *information categories* (e.g. diagnosis and procedure, medication, findings and examination results, biographical data, assessment etc.)
- Additional information include situation trigger, patient ID, start and end time, and various context information like location, co-actors and roles, and patient category

Ref: Sørby & Nytrø, 2007a

Information Sources

Patient-specific:

- Patient record (paper)
- Patient chart (paper)
- Patient list (paper)
- Personal notes (paper)
- EPR (electronic patient record)
- PAS (patient administrative system)
- X-rays/CT/MRI reports/pictures
- Patient
- Nurses
- Physicians

Other information sources:

- Physicians' Desk Reference (PDR); paper-based and electronic
- ICD-10 codes overview; paper-based, electronic and personal lists

Observation form and example data

Activity	Trigger	Location	Main actor	Role	Co-actors	Role(s)	Patient-ID	Reason for admission (RfA)	Time	Informaiton Source	I/O	Information	Purpose	Patient category
Pre-rounds	Continue after interruption	OFF4	Res9	PR	Nur9	GR	P57	Admitted due to unstable angina. Must be carefully watched when considering further treatment.	10:50	PATLIST	I	NAME	Name of the patient	New patient for the pysician. Under investigation
										NUR	I	NEW	Changes since admission	
										EPR	I	ALL	Overview of patient	
										NUR	O	FINDEX	Info. about examination	
										PC	I	MED	Review med.	
									11:05	PC	O	MED	Sign	
Examin.	The physician is under specialization and is obliged to perform a certain number of US examinations. Will receive a pager call if such an examin. is to be performed	OFF4	Res9	PR	CP13 on phone (Nur9GR)	Ex			11:10				The physician is paged from the ultrasound lab. Both the patient and the ultrasound machine are ready	
		LAB2	Res9	PR	CP13	Ex			11:45				Perform US examination	
Suppl. work	Quest. arose after pre-rounds. Asks before patient rounds in order to be able to give the answer to the patient during rounds	LAB3	Res9	PR	CP12	Ex	P55	As previously described	11:50				Discuss with colleague if the patient can delay aniography until tomorrow or if the pat. should start on K-vit. and wait for INR level to decrease until tomorrow.	New patient for the pysician. Particular examination
Rounds	After pre-rounds	PR10	Res9	PR	Nur9	GR	P41	Like Day 12	12:02	PATLIST	I	NAMEROOM	Overview of name of patient and where patient is placed	Under investigation
										PAT	O	MED	Inform about cease of med	
										PAT	O	FINDEX	Info about result of examination	
									12:08	PAT	I	NEW	Changes since yesterday	

Figure 1 – Excerpt from observational data (Dept. of Cardiology). The example shows data from one pre-rounds situation, one examination, one supplementary work situation, and one ward rounds situation. The main actor in all the situations is resident 'R9', and his role is 'patient responsible' (PR). The co-actors are one nurse ('Nur9'), who's role is the team leader ('GR'), and two different chief physicians ('CP12' and 'CP13'). Patients 'P41', 'P55', 'P57', and 'P67' are in focus and the locations vary from Office 4 via Lab2 and Lab3 to Patient room 10. The resident uses four different information sources/systems; the patient list (PATLIST) for retrieval of the name of the patient, the nurse (NUR) for retrieving changes since patient admission (information code 'NEW'), the electronic patient record (EPR) for getting an overview of the patient (information code 'ALL'), and the patient chart (PC) for information about the patient's medications. Information is given to the nurse (about examination), and the medication form in the patient chart is signed. During the ward round situation, the physician informs the patient (PAT) about ceasing a drug and the result of an examination, and the patient tells the physician about any changes since the previous day.

Results (Dept. of Cardiology)

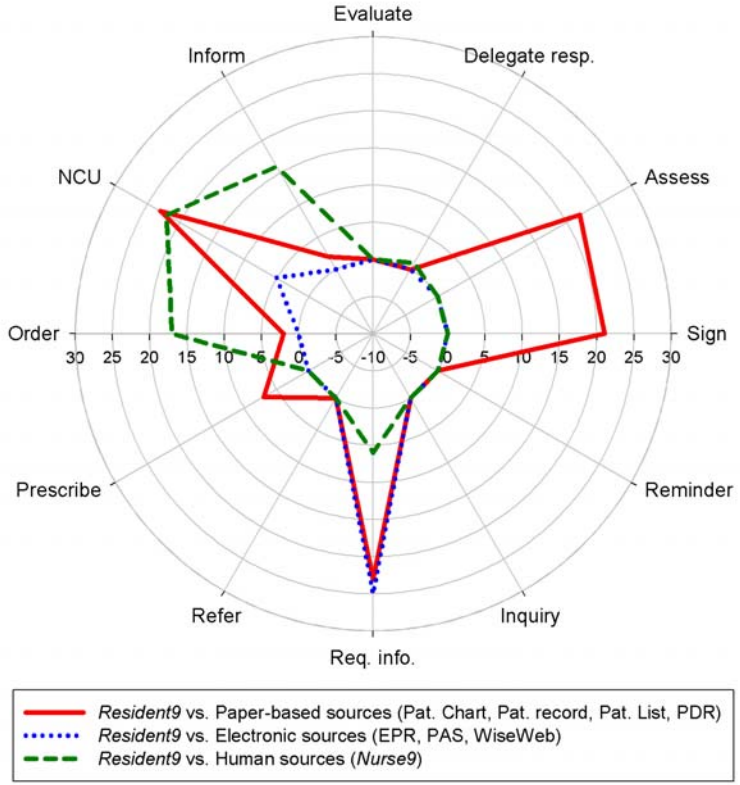
Situation type	*Main actor*				**Sum**	*# drug rel. situations*	*Sources for drug information*	#events per situation	
	R7	*R9*	*R14*	*CP9*				*Min.*	*Max.*
Pre-pre-ward-rounds	5	-	-	-	5	1	COL, NOTE	2	2
Pre-ward-rounds	7	22	11	24	64	62	PC, NUR, PDR, EPR	1	16
Ward-rounds	7	21	11	24	63	23	PAT, PC, NUR	2	11
Examinations	-	8	2	6	16	-	-	-	-
Office work	-	8	9	13	30	4	PC, NUR, PDR	1	9
Discharge prep.	-	-	2	4	6	6	PC, PATINFO	8	15
Discharge meeting	-	-	-	4	4	3	PATINFO, RES, PAT	2	10
Heart meeting	-	1	-	1	2	-	-	-	-
Total	19	60	35	76	190	99	-	-	-

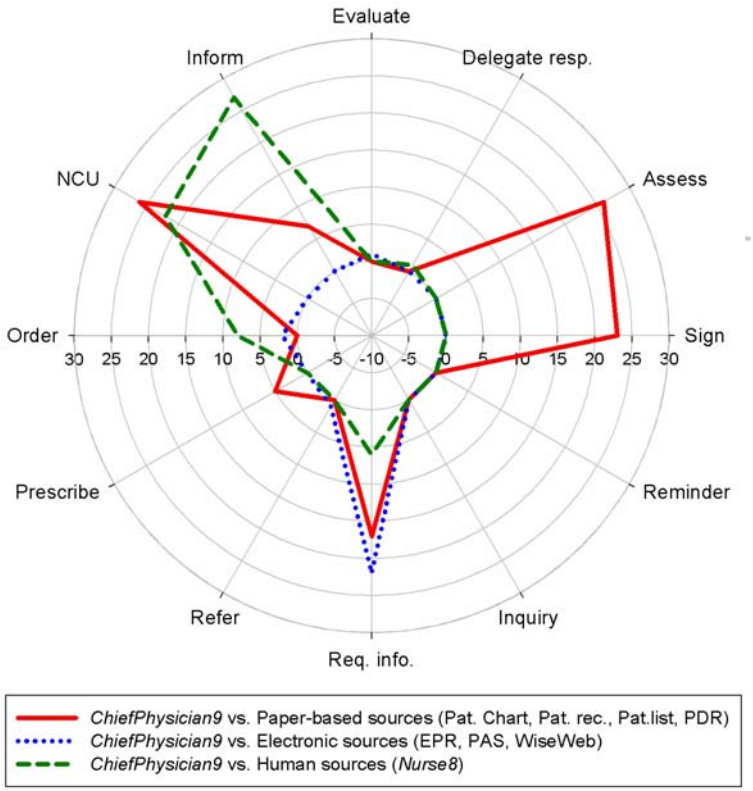
Table 1 – Summary of observations from Dept. of Cardiology. The first part summarizes the number of different observed situation types per main actor (residents"R7", "R9", and "R14", and chief physician "CP9"). The next column shows the number of situations related to drugs (prescription, administering or assessment) and the associated information sources used for gathering or recording drug information. The two last columns denote minimum and maximum number of events or communicative acts in the various situation types.

Analysis of communicative behaviour: Profiling roles and activities

- The observed events have been categorized into 12 different predefined communicative acts (i.e. navigate into common understanding, assess, answer inquiry, inform, evaluate, request information, prescribe, order, refer, delegate responsibility, remind, sign) [2]
- Resulting profiles are plotted as radar graphs that show distribution of communicative acts for several actors during various situations.
- The angular axes of the plots show the 12 communicative acts that have been identified in the observational data
- Radial axes indicate the number of each act found in the various selected observational data sets.

Example profiles, pre-rounds situations



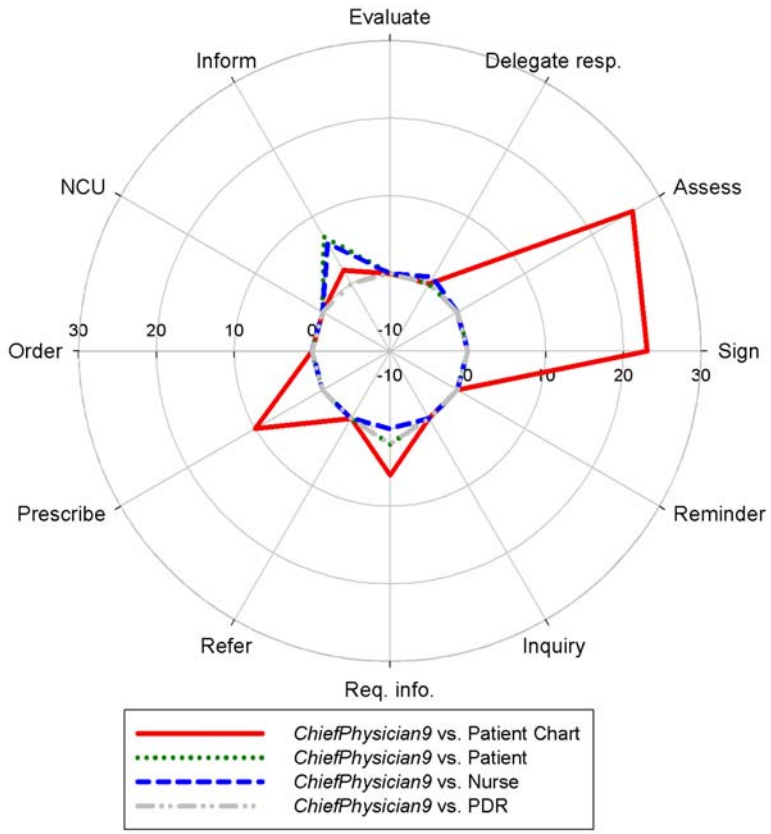


Communicative acts profile, *Resident9 (Dept. of Cardiology). 22 pre-rounds situations, #comm. acts: 214*

Communicative acts profile, *ChiefPhysician9 (Dept. of Cardiology). 24 pre-rounds situations, #comm. acts: 220*

Ref: Sørby & Nytrø, 2007b

Example profile, drug related events



Communicative acts profile, *ChiefPhysician9 (Dept. of Cardiology). Pre-rounds and ward rounds situations, drug-related events. #comm. acts: 108*

Communicative acts profiles

- give a good visual presentation of the information and communication behaviour of individual clinicians, roles, or larger groups of healthcare workers during various clinical activities
- can serve as a basis for generating use cases and scenarios
- can serve as input for systems requirements specifications (e.g. regarding medication activities)

- So far: Merely counting number of different communicative acts
- Next step: Statistical analysis and profiling of other roles and actors (e.g. nurses)

Ref: Sørby & Nytrø, 2007b

Conclusions

The results of this study confirm our previous findings:

- Structured observation by means of pre-defined forms enables efficient recording of field data during observation of clinicians' information and communication practice

- Apprentices (medical students) as observers is beneficial due to their domain knowledge and natural, non-intrusive presence in the hospital wards

- The data recorded via observational studies differs from e.g. survey data, and the combination of coded values and detailed context information of the various situations is valuable when eliciting and specifying requirements for new clinical information systems

Further Work

- Method Validation and Triangulation:
  - To improve the validation of the method, future observational studies will include an initial phase where field data recorded by two or more concurrent observers will be compared and analyzed in order to ensure consistency.
  - Data/results from an observational study carried out during summer 2007 will be compared to survey data and data from laboratory experiments

- Focus on Actors and Patient Trajectories
  - Future studies will focus on following *actors* with different roles (chief physicians, residents, interns, nurses etc.)
  - We also plan to follow *patients* from admission to discharge to enable analysis of patient trajectories.

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References*:

[1] Sørby ID, Nytrø Ø. Towards a Tomographic Framework for Structured Observation of Communicative Behaviour in Hospital Wards. In: Sawyer P, Paech B, Heymans P, editors. Proceedings of REFSQ 2007 (LNCS 4542). Berlin: Springer-Verlag; 2007. p. 262-276.

[2] Sørby ID, Nytrø Ø. Analysis of Communicative Behaviour: Profiling Roles and Activities. In: Third International Conference on Information Technology in Health Care (ITHC2007): Socio-technical approaches; 2007; Sydney, Australia; 2007.

*These publications contain more detailed presentations of our research, and include references on related work by Coiera et al., Schoop, Searle, Winograd & Flores, Dietz, and others

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