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# Knowledge Creation at Multidisciplinary Patient Care Meetings: Implications for the Use of Collaborative Information Technology

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## ABSTRACT

This paper describes a study of Bullet Rounds in General Internal Medicine at an urban teaching hospital in Toronto, Canada. Bullet Rounds are multidisciplinary meetings of healthcare professionals involved in patient care. The goal of the study was to examine the processes of the meetings to understand the level of collaboration and knowledge exchange that takes place, the issues faced by such groups, and the potential role of information technology in supporting them. The methodology included data collection through observation, and quantitative analysis of verbal exchanges in Bullet Rounds. Using the Knowledge Management framework, options for support using information technology are discussed. The author concludes that Knowledge portals that can be used for repositories, prompts and sharing may be helpful in the context of Bullet Rounds. The study extends previous work on analysis of verbal exchanges and contributes to knowledge of collaborative practices in multidisciplinary groups meetings of healthcare practitioners.

## Keywords

Interprofessional collaboration, Knowledge Management, information technology,

## BACKGROUND

There continues to be great emphasis placed on the enhancement of interprofessional education and collaboration in the healthcare field, because it is seen as a way to address the unacceptably high rate of errors in patient care (Corrigan, 2000).

Research in the area of collaborative practice is a key goal of funding agencies in Canada. In May 2005 the Canadian Health Services Research Foundation (CHSRF) commissioned a team of researchers to develop a synthesis report on the status of healthcare teamwork in Canada. (Ondasan, Lemieux-Charles et al, 2005) One of the conclusions was that future studies should “investigate the communication processes and information flow between providers “(pg 28). The understanding of these processes and flows is crucial to the effective implementation of information technology in healthcare settings. Information technology has been identified as a potential means to aid collaboration, but successful implementation of technology requires a proper assessment of user requirements and context (Haynes 1995, Reeder 1999).

Bullet Rounds are multi/interdisciplinary collaborative group meetings of health care personnel engaged in General Internal Medicine (GIM) at a major teaching hospital in Toronto, Canada. They take place four mornings a week and are attended by all or a subset of physicians (staff doctor, residents, and medical students), nurse managers (in charge of administration, ensuring staffing levels are appropriate, general management of wards), charge nurse(s), emergency nurse (occasional), Occupational Therapists, Physical Therapists, Dietician (occasional), Social Workers, Pharmacist, and Speech/Language Therapist (occasional).

The purpose of the meetings is to establish a treatment program and discharge plan for the patients in GIM, with a focus on quality of care and efficiency. This is achieved through a process of joint problem-solving and decision-making using the collaborative sharing of information, knowledge and experience within the group to identify the currently appropriate pathway.

Knowledge Management (KM) is the process through which organizations generate value from their intellectual and knowledge-based assets. KM distinguishes between information and knowledge: information is needed for building knowledge, but knowledge is associated with people (knower) while information is not (Brown, 2000). These processes may be assisted by new communication and information management technologies such as intranet resources, collaborative on-line technologies, and shared databases to support communities and project teams (Allee, 2000). Bullet Rounds are a good

example of the collaborative social interactions that lead to shared understandings: in Bullet Rounds group members exchange knowledge, and through socialisation of tacit knowledge the group as a whole increases its knowledge base.

Currently the Bullet Rounds process is paper-based, but explorations of the potential for electronic support of the Bullet Rounds process may be beneficial. This paper describes a study of Bullet Rounds which is a first step towards establishing a framework for the potential application of information technology to support Bullet Rounds.

## LITERATURE REVIEW

The synthesis report commissioned by the CHRFS (Ondasan, Lemieux-Charles et al, 2005) noted that in all jurisdictions reviewed (Canada, USA, Australia, UK and New Zealand), a team approach to the delivery of healthcare is promoted, although it is practised to varying degrees. In such teams or groups, positive collaborative practice allows shared communication and decision making to positively influence patient care.

Knowledge Management (KM) distinguishes between tacit knowledge, needed for knowledge creation, explicit knowledge that can be shared, and cultural knowledge, which determines its use. Creation of knowledge in organisations is important for their success: it is difficult to quantify, but one of the ways to promote knowledge creation is to enable the exchange of tacit knowledge through groups that practise collaboration towards a common goal (Carvalho, 2001). These groups are referred to as "Communities of Practice" in KM literature. Communities have a sense of mission—there is something people want to accomplish or do together that arises from their shared understanding (Allee, 2000). Bullet Rounds participants are one such Community of Practice, because their common goal is to maximise the safety and efficiency of patient care.

A review of healthcare research shows that the use of information technology is regarded as useful, and necessary for information exchange between healthcare professionals (Weiner 2005, Reeder 1999) especially as healthcare professionals are increasingly called upon to work in interprofessional teams (Miller 1998). Information Technology spending in the healthcare field in general is predicted to increase in both the US (Butler 2005) and Canada (Sharp, 2005) although precisely which approach should be used is not clear, and further research is needed in this area (Currell 2005, Johnson 2000, Wiecha 2004).

Electronic medical records (EMRs) have been shown to improve communication among medical staff, although they do not yet adequately support the collaboration and information exchange processes that persist in hospital environments. The use of electronic spaces that function as meeting rooms facilitate asynchronous exchange and serve as a repository of historical records, and extension of electronic medical records to include some function of information repositories may have a positive effect on communication among in-hospital staff (Jovicic, 2005). The Electronic Health Record (EHR) has been suggested as a means for making healthcare more efficient and reducing costs, although the results from studies undertaken regarding the efficacy of the EHR have been inconclusive (Neergaard, 2005).

Although technology is not the main component of KM, it is seen by some researchers as having a supporting role (Carvalho, 2001). Others suggest that for leveraging knowledge community building is more important than information technology. Although information technology is seen as having inspired the vision of knowledge management, it cannot by itself bring it into being (McDermott, 1999). Some companies have invested millions of dollars in technologies only to find that people do not use them (Allee, 2000).

There are a number of softwares that can be used to support KM: they include Webtanks (Gill 2002), Intranet-based systems, Electronic document management, Groupware, Workflow, Artificial intelligence-based systems, Business intelligence, Knowledge map systems, Innovation support tools, Competitive intelligence tools and Knowledge portals. (Carvalho, 2001). However, the implementation of KM software is complex process. It needs to be integrated into the existing information technology infrastructure and to the organizational culture, procedures and Human Resources policy as well. Recommendations include the need to ensure that everyone benefits from it, the need to understand the current work practice and the involvement of users in design. (Brown 2000)

One way to understand communities of practice such as Bullet Rounds is to examine the interactions between team members using team interaction classification systems that exist to analyse team verbal exchanges. They include Interaction Process Analysis (IPA), A System for the Multiple Level Observation of Groups (SYMLOG) (Marks (2001)), and The Team Observation Protocol (TOP). TOP has been used to analyse conversations that take place in multidisciplinary team meetings in the Health Care Field. These conversations were the evidence used to examine the team processes occurring in a team conference in a stroke unit (Gibbon 1999).

Both prior and subsequent to this study, there are few empirical studies exploring the processes that take place in multidisciplinary patient care meetings or documenting instances of collaboration and teamwork (Gibbon, 1999, Ondasan et al, 2005).

## OBJECTIVE

The objective of the Bullet Rounds study was to capture qualitative data through observations at Bullet Rounds, and extend previous work done on the study of verbal exchanges in interdisciplinary team meetings using the TOP. The purpose was to understand the means by which knowledge is shared in Bullet Rounds, the knowledge management needs of such a group, and the potential role of information technology.

## USE OF TOP

The categories used in TOP analyses are shown in column 1 of Table 1 below. Column 2 provides the description of each category. Column 3 indicates categories that were adapted by the author to provide more detail. For example, we were interested in looking at team dynamics at Bullet Rounds, and noted that many apparent questions were in fact requests for action or instructions phrased as questions and we wanted to examine that more closely.

| Category          | Description  | Assumptions  |
|-------------------|--|--|
| 1. Client         | All affective statements regarding the client: i.e. joking/hostile references indicating emotional reaction                        | Applied as per the TOP definition  |
| 2. Team           | All affective statements about the team or team member. Includes joking, laughing or hostile remarks                               | <b>Included in this category were statements providing background, commenting on the physical environment, anything personal about team members, and team dynamics</b> |
| 3. Questions      | All statements asking for information, suggestions, or opinions or requesting reports  | Applied as per the TOP definition  |
| 4. Information    | All statements giving factual information, dealing only what is observed without interpretation                                    | <b>Included in this category were requests or instructions, and comments</b>   |
| 5. Interpretation | All statements that give an opinion or interpretation, going beyond empirical data to make inferences about what has been observed | Applied as per the TOP definition  |
| 6. Alternatives   | All statements that suggest alternatives, explore or compare possible courses of action  | Applied as per the TOP definition  |
| 7. Decisions      | All statements which deal directly with the final decision – expressing, clarifying, or elaborating the decision reached.          | Applied as per the TOP definition  |

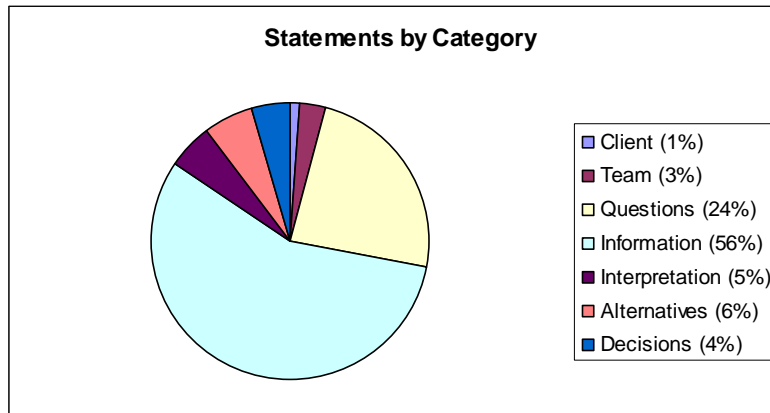
**Table 1: TOP Categories**

## METHODOLOGY

### Qualitative Data Capture

The goal of the initial phase of the Study was the documentation of qualitative data. The methodology adopted was an ethnographic study, and consisted of unobtrusive unstructured non-participant observation of Bullet Rounds, which were not taped. We attended a total of 20 meetings over the course of 3 months in 2005. The wards and patients in question were in GIM, and over 400 patient discussions were documented. We attended the full meetings which generally took between 1 and 1.5 hours in the morning, for an approximate total of between 25 and 30 hours. During that time extensive notes were taken by hand by the observer who did not participate in any way in Bullet Rounds; these notes transcribed the conversations that took place at Bullet Rounds and identified the role of the speaker (doctor, nurse etc). This body of data has been transcribed into Field Notes, and is referred to as the Baseline Data.

### Quantitative Data Coding : Using the TOP Coding Scheme



**Figure 1: % of Statements in each TOP Category**

The Field Notes were organized into discrete pieces of verbal exchange to enable coding. There are 7 categories of statement in TOP, and interactions at Bullet Rounds were coded into one of them. Figure one above shows the results of the TOP coding exercise. Information is the largest category (56 %) of verbal exchange, seconded by Questions (24%) which relate to information in that they are generally requests for more information or clarification

Examples from each category are as follows:

**Category 1: Client (1%):** There is only occasional discussion of social situation or personality as it relates to issues that may affect ongoing treatment.

- Doctor notes that the patient's social situation is complicated and that he is not aware of it

**Category 2: Team (3%):** There are some comments on team functioning and processes, including other teams, but very few overt comments about individuals..

- Comment that there is a lack of coordination between what the team wants to happen and what is actually happening, and the need to delegate tasks

**Category 3: Questions (24%):** Questioners are mainly doctors asking nurses, and nurses asking doctors.

- How do we know if something is booked?/Do we enter that in system?
- So I have to document that?/Did someone print off the names?/Can we speed the process?

**Category 4: Information (56%):** This is the largest category of verbal exchanges, and involves all team members.

- Patient was taken to radiation but left there, nurse not sure if received radiation ordered
- I 'm not sure, I'll check into it/It's not the in notes
- I hadn't realised that was still happening
- Doctor describes their planned treatment program and approach

**Category 5: Interpretation (5%):** This category represents a small proportion of the total verbal communication, includes expressions of opinion or uncertainty on the part of team members, and can relate to process or clinical issues

- She doesn't need an MRI – clinically doesn't make sense. We'll talk to pharmacy about meds

**Category 6: Alternatives (6%):** The teams discuss possible alternatives in cases where the required information is available, but the percentage of verbal communication in this category is low because to do so the team generally requires outside information that is unavailable.

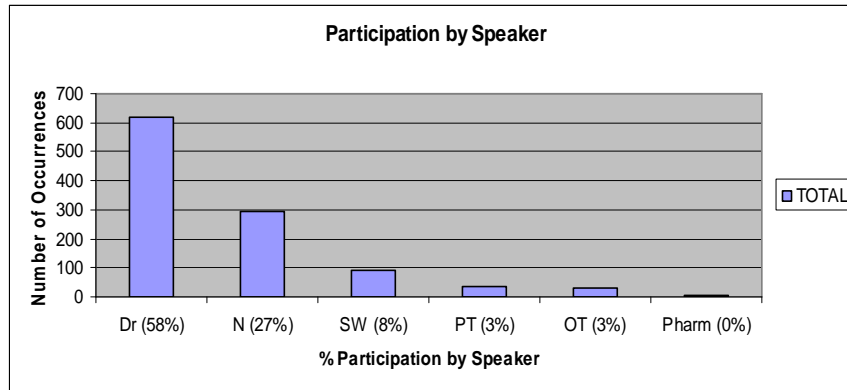
- Patient is HIV positive, with diarrhea and abdominal pain. Doctor indicates that if he can manage a lactose free diet he can discharge

- Who’s doing plastic surgery? They’ll have to find her a bed after head surgery. Is this the thought? That this should fix things with the falls?

**Category 7: Decisions (4%):** The decision-making component of the meetings is very small and represents only 4% of verbal exchanges. On any given day there are few discharges, and where a discharge is to take place, discussions around it are generally very brief. The group quickly move on to another patient unless the discharge is conditional upon further action being taken, because at patient discharge they have reached their collective goal, and need to move on to the “active” or “unsolved” cases.

- Ok she can go back to the Nursing Home/waiting for two things – then discharge/ Homecare – being discharged.

**Quantitative Data Coding: Participation by Speaker**



**Figure 2: Participation by Speaker**

By tagging each piece of verbal exchange to a speaker, participation by speaker could be identified. Doctors and nurses have the largest amount of verbal participation at Bullet Rounds with 58% and 27% respectively, followed by social workers at 8%.

**FINDINGS**

**Knowledge Exchange**

The results of the coding exercise show that the dominant form of communication in Bullet Rounds is the sharing of information, and that doctors and nurses are the participants who speak the most. The questioning component is linked to this insofar as it seeks further information that has not been made available or is unknown. The information provided by doctors is: diagnosis, background, and treatment plan/status, including general statements about what needs to be done. The doctors also use the meetings for discussions amongst themselves. Although physicians are responsible for the clinical diagnoses and the treatment protocol, other participants may get involved, or attempt to get involved, in clinical matters, especially the nurses. This is seen in the form of “leading” questions or outright questioning of diagnoses, information or instructions given.

**What Kind of Information is Shared at Bullet Rounds?**

Further breaking down the information exchange at Bullet Rounds, as per Table 2, shows that doctors at Bullet Rounds talk a great deal about sources outside the meetings (such as specialist reports, test results etc) to provide additional information required by the team, as do Pharmacists. Nurses and Occupational Therapists talk mainly about patient status, while Social Workers and Physical Therapists talk mostly about process because their roles and responsibilities are unfamiliar to other team members, such as new or training doctors.

| Information Category | Participant |      |      |      |      |       |
|----------------------|-------------|------|------|------|------|-------|
|                      | Dr          | N    | SW   | PT   | OT   | Pharm |
| Instructions         | 19%         | 5%   | 3%   | 5%   | 0%   | 20%   |
| Process              | 16%         | 18%  | 50%  | 36%  | 0%   | 0%    |
| Patient Status       | 27%         | 50%  | 12%  | 32%  | 67%  | 40%   |
| Outside BR's         | 38%         | 27%  | 34%  | 27%  | 33%  | 40%   |
| Total                | 100%        | 100% | 100% | 100% | 100% | 100%  |

**Table 2: What types of Information do Participants Talk About at Bullet Rounds?**

## DISCUSSION

Bullet Rounds meetings are a Community of Practice with the common goal of maximising the quality and efficiency of patient care. A great deal of time is spent on information exchange, which through the process of socialisation is transformed into knowledge (Brown 2000). Since the management and sharing of this knowledge is crucial to patient outcomes there may be potential benefit to supporting this process. The findings show that doctors and nurses are the prime communicators in Bullet Rounds, which must be taken into account as background in the design of any supporting information technology.

To an outsider the Bullet Rounds meetings appear chaotic and unstructured. Communication is hampered by noise, illegible writing and language issues. Currently there are paper based records that are used as the basis for discussion: nurses bring shift notes whose purpose is to provide patient updates from the night before; doctors have their personal notes and other groups have patient lists, on which they write their own notes. There is a computer system into which doctors enter orders outside of Bullet Rounds, which links into the pharmacy system. There is therefore potential for decision support in the form of electronic records for sharing updated information, to replace the paper records.

One of the recurring themes in information technology implementation to support KM is the importance of focusing on the actual problems and issues faced by the people involved (Penuel, 1999). In Bullet Rounds the knowledge exchange is often tacit to tacit: in such cases Knowledge maps and Portals are the most appropriate (Carvalho, 2001). Knowledge maps work like yellow-pages that contain a "who knows what" list, and do not store knowledge. However, Bullet Rounds themselves to a large extent replace this function. Portals can be utilized not only as a publishing medium for explicit knowledge but can support organizational communication and collaboration as well, facilitating information access and retrieval, the negotiation of collective interpretations, the development of shared meanings and the accomplishment of cooperative work (Carvalho, 2001).

A Bullet Rounds portal may offer potential for support of the meetings by incorporating both repository, prompting and sharing functions. For example, many team members in Bullet Rounds are not aware of the respective roles and responsibilities of other team members, especially because team members change often. Descriptions of processes may be helpful for reference. In addition, a dynamic body of knowledge or Best Practices that grew over time could reduce repetition and churn: a FAQ and Lessons Learned section could contribute to this. The paper based Shift Notes that provide the bases of much discussion are often illegible and incomplete. An on-line approach allowing simultaneous group review might be helpful to promote and target discussion. Nursing staff could input their notes into this tool for review the next day. This tool could also provide an opportunity during the meeting for the group as a whole to identify information required for the next day. The ability to anticipate required information would be a valuable tool in reducing the necessity for follow up outside of the Bullet Rounds meetings. Similarly, if all team members knew the patient diagnosis ahead of time they could use this tool to comment on that or add to the knowledge base outside of Bullet Rounds. Instead of being destroyed each day the collective notes could be stored and form a history, a source of backup documentation or training, as well as reference. A reminder system could be used such that follow up with groups outside of Bullet Rounds is documented and recorded to potentially reduce missed handoffs. The portal might provide a good resource for physicians unable to attend the meeting. Doctors often engage in side discussions at Bullet Rounds: they could benefit from portal functionality that enabled them to interact synchronously or through discussion or chat technologies.

### Issues to Consider

- Currency of material: most technologies work best when users have time to assimilate information, which is not the case in Bullet Rounds where knowledge is constantly changing. This presents a challenge for both documenting and keeping records timely.
- Maintenance: a Bullet Rounds portal would require constant updating
- Central role played by nursing: this must be taken into account in the development of collaborative technology
- Turnover and collaborative practice of participants at Bullet Rounds: the success or failure of information technology would depend on adoption. There is a wide and constantly changing array of healthcare professionals involved in Bullet Rounds and accommodation of user requirements may be complex.

### CONCLUSION AND FUTURE WORK

The results of the analysis of the Bullet Rounds observations point to different levels of awareness of the evolving treatment program and discharge plan amongst group members. Given their synchronous and asynchronous communications capacity and information-gathering and sharing capacity portals are a logical platform to investigate for supporting interdisciplinary clinical teamwork. Further study of Bullet Rounds is needed to better understand how multidisciplinary group members can work together in everyday practice to guide the development of effective and efficient software applications to support greater collaboration. Future work will focus on establishing measures that can be used to evaluate interventions in Bullet Rounds meetings designed to improve the creation and exchange of knowledge, in order to create a model to improve decision-making and ultimately patient care through the use of information technology

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