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Title

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Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 19(0)

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Publication Date

1997

Peer reviewed

Communication in a Collaborative Health Care Team: Coordinating Tasks and Attaining Goals.

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Abstract

Decisions are being made by groups with increasing frequency, requiring that individuals collaborate within teams. In order to do so, the team must create a shared mental model of its goals and processes. Communication has been shown to play a fundamental role in the development and evolution of this model as well as in the achievement of team goals. Previous research has established that roles within teams are well-defined and that each team member is familiar with them, that communication is most frequent among those whose tasks are most interdependent and interrelated, and that communication centers around attaining team goals. This study addresses the structure of team collaboration and the role of communication in maintaining the structure of an out-patient primary care unit at Beth Israel Deaconess Medical Center in Boston, Massachusetts. A work and activity analysis showed that individual roles are clear and distinct and part of the shared mental model of the team, reducing redundancy and omission of goal-directed tasks. Communication was found to be more frequent among team members with related tasks and with more similar models of practice. Communication topics were found to be related to team goals. The importance of the shared mental model and of communication in the collaborative process is emphasized. Different domain experts working together in a collaborative way complement each other through this shared understanding, maximizing the efficiency and the effectiveness of the process and outcome.

Introduction

Over the past decades, knowledge and technological abilities have expanded beyond the mastery of any one individual. In order to achieve common goals in an increasingly complex environment, individuals with expertise in specific domains have found it expedient to combine their skills, knowledge, expertise, and resources. Through collaborative processes, mechanisms are then developed by the participants so that common goals are achieved with a minimum of overlap and redundancy.

Theoretical Framework

Reasoning processes within the individual have been extensively studied. It has become increasingly clear that, while the contribution by the individual is critical (Salomon, 1993), there is more involved in the process than that which occurs within the cognitive capabilities of the individual. Cognitive processes are supported through identification of patterns in the environment or situation, manipulating these patterns when possible to provide scaffolding for the thought processes of the individual (Perkins, 1993). This has been extensively described in cockpit crews carrying out a memory task necessary to land an airliner (Hutchins, 1995), where it was found that the cognitive processes of the individual were inadequate to explain the overall process. Examination of the representations that are external to the pilots found that flight crews use gauges, instruments, a booklet, and verbal exchanges to provide situational scaffolds, recruiting other individuals and groups as well as objects. These external representations support the internal representations and processes of the individual pilots.

The grouping of individuals to accomplish complex cognitive tasks has become the focus of study, and characterizations of such groups have been developed. Orasanu & Salas (1993) differentiate between groups of people, tending to consist of homogeneous and interchangeable members, versus teams, generally made up of highly differentiated and interdependent members. The goal of a team is to accomplish a task or set of tasks of which decision making is a component. Team members have developed the knowledge and skill bases required to accomplish the tasks or a parts of the tasks. They describe the development of shared mental models in the formation of the team, defined as models of shared understanding of the issues determining team functioning, of goals, of information cues, of strategies, and of member roles. Development of this structure involves consolidation of information, assessment of the structure for inconsistencies between information parcels, and rectification of these inconsistencies. Through this process,

common understanding develops among the members of the group, resulting in a whole that is greater than the sum of the parts (Grosz, 1996). This results in the evolution of the group of individuals into a team, characterized by common goals, defined roles and responsibilities, coordination and interdependence among members, task relevant knowledge, and management of resources (Orasanu & Salas, 1993). These are characteristics of individuals who collaborate effectively to form teams.

Collaboration involves the commitment of individuals to the joint activities needed to achieve the goals, assuring that each member will support goal-directed action. They must agree on goals, develop a plan as to how they are to be achieved, identify component activities, and determine who will be responsible for them (Grosz, 1996).

The fundamental pathway through which this shared understanding is formulated is that of communication between collaborating team members (Grosz, 1996; Orasanu & Salas, 1993). Individual representations are revealed and assessed, with adjustments made as needed to reduce redundancy as well as to resolve inconsistencies and conflict. The communication of cockpit crews in computer simulations of emergency situations revealed different patterns of communication in high-performing crews compared with low-performing crews. Expert crews gathered more information related to the situation, discussed a greater number of solution options, made more plans, and elaborated with more explanations (Orasanu, 1990). A similar pattern was observed in the health care setting of operating room teams, in which expert anesthetists were found to be more assertive in communicating their concerns to the team leader, the surgeon, compared with less experienced practitioners (Gaba, 1992).

An expert health care team of an Intensive Care Unit was examined, analyzing the roles of the team of professionals involved and their communication (Patel, Kaufman, & Magder, 1996). Well-defined and differentiated responsibilities and tasks for each role were discovered, as well as formalized methods for the distribution of relevant information. Mechanisms were also in place to support team problem solving which centered on the senior staff physician. The ability to communicate and collaborate with other members of the team is a characteristic of the expert, thereby maximizing the utility of the varying skills and capabilities of other team members. This reflects collaborative processes, illustrating that expertise in the work area includes expert skills in collaboration. Expert teams are distinguishable from less expert teams by evidence of the development of complex shared mental models.

In a different approach, the processes of collaboration by five institutions working in the area of the development and dissemination of medical informatics was explored (Patel, Kaufman, Poole, & Shortliffe, 1996). It was discovered that participation during discussions of particular issues was modified based on the strengths of the different member institutions and the goals and requirements of the interactions at that time. This highlights the efficiency of the processes developed, with involvement of individual member institutions being determined based on the relevance of their expertise to the goals and issues of the particular communication episode.

Processes and mechanisms through which individuals of these varying domains could collaborate evolved to maximize the effectiveness of the problem solving skills of the team.

There are several common threads to be drawn from these characterizations of teams and collaboration. Teams are based on groups of individuals with well-defined areas of expertise, knowledge, and skills, all of which come together to achieve a common goal through completion of interrelated tasks. A shared mental model must be refined and maintained so that team members have a clear understanding of each role within the team and the goals to be accomplished. Communication is fundamental to the development and maintenance of the shared mental models necessary for team evolution and functioning. It is also fundamental to the execution of team responsibilities and goals. Communication itself is a collaborative skill, at which expert collaborators excel.

This suggests certain characteristics of expert teams. Firstly, roles within teams are well-defined so that each team member is aware of the knowledge, skills, and responsibilities of the others, facilitating collaboration and avoiding redundancy and duplication. Secondly, communication is most frequent among those whose tasks are most interdependent. Thirdly, communication centers around attaining the team goals.

In this study, these hypotheses were explored through an examination of individual roles as the framework on which group processes are developed (Patel, Kaufman, & Magder, 1996; Patel, Kaufman, Poole, & Shortliffe, 1996). This was followed by an analysis of group communication processes to determine expert individual functioning as it is supported by maintenance of co-ordination, avoidance of redundancy of effort, and achievement of common goals. The setting was an expert health care team of an out-patient primary care unit of Beth Israel Deaconess Medical Center in Boston, Massachusetts.

Method

The focus of this analysis is the work activity of the health care teams of the HealthCare Associates (HCA) of the Division of General Medicine and Primary Care at the Beth Israel Deaconess Medical Center in Boston, Massachusetts, a Harvard Medical School teaching hospital. Team members include Primary Care (Faculty) Physicians, Psychiatrists, Medical Residents, Nurse Practitioners, Clinical Nurses (triage for all patients concerns and issues, usually by telephone call), Psychiatric Social Workers, HIV Case Managers (initiates and coordinates community and hospital resources for patients who are HIV positive), Community Resource Specialists (organizes resources for other patients), and administrators. Key practitioners were followed as they went about their daily activities, generating a picture of a typical day in the lives of individuals in the unit. Data collection involved field notes and audio taping of patient appointments with providers. Interactions through voice mail and email were analyzed in a similar manner. Audio tapes were transcribed verbatim. These observations were supplemented with semi-structured interviews. Probes in the semi-structured interviews centred on evaluating who the team member would consult when requiring assistance, reported lines of accountability, and conflict resolution.

Table 1: Content Categories of Health Care Provider Interactions.

Category	Description
Patient Data	Information describing the patient's condition: patients' reports, observations, tests.
Assessment	Identification of problem or issue. Eg: medical diagnosis.
Plan	Treatment plan for identified issue, what is to be done.
Intervention	Actions taken with respect to identified issue, determined by the plan.
Evaluation	Determination of outcome of plan and intervention. Was desired outcome attained?
Assistance with Procedure	One staff member assisting another with a procedure.
Patient Flow	Issues related to the movement of patients through the unit and the hospital.
Administration	Issues related to the functioning of the unit.
Monitoring Team Activity	Determining observations, assessments, plans, and interventions of other providers.

Work and Activity Analysis A work domain analysis was carried out, identifying objectives, functions, and within the unit (Rasmussen, 1993; Rasmussen, Pejtersen, & Goodstein, 1994). An activity analysis was then carried out in which individual roles were identified, specifying goals, tasks, and responsibilities accomplished within the roles.

Content of Interactions Interactions were identified between providers or between providers, support staff, and patients from the time of initiation of the contact to its conclusion. Individual episodes of communication were identified in field notes and audio tape transcripts. Content categories for this analysis were developed based on deep conceptual structure of the statements made rather than their literal surface structure (Patel, Evans, & Kaufman, 1989). These categories are described in Table 1. Statements made during the interactions were evaluated for references to the content categories and tabulated.

Data were collected at the Beth Israel Deaconess Medical Center in Boston, Massachusetts by the first author and analyzed at Cognitive Studies in Medicine, McGill University.

Results

Work and Activity Analysis The observations of the unit and of the results of the semi-structured interviews were subjected to a work and activity analysis. The roles of health care providers within the out-patient unit are described in Table 2. Each role focuses on a specific aspect of health care delivery, with a minimum of overlap of functions. Both doctors and nurses collected data from patients regarding their level of health or illness. However physicians were more concerned with diagnosis of illness and developing treatment plans while nurses focused more on monitoring patients' status and detection of changes, with a more health related orientation. The roles of team members were differentiated on three dimensions: 1) domain knowledge, expertise, and responsibilities, 2) availability on the unit, and 3) the area of focus (individual versus group, health versus illness). Within each profession there were further subdivisions based on education, training, and experience. For example, physicians included Medical Students, Interns, Residents, and Faculty Physicians. Nursing roles included both Nurse Practitioners and Clinical Nurses.

Further analysis of observations and interviews shows that each individual was aware of the responsibilities of each team member, including their own, based on their shared knowledge of the tasks and responsibilities. With this shared knowledge, they were less likely to cross over into the areas of expertise of other team members. In this way, overlap of responsibility was reduced and redundancy of effort avoided, increasing the probability that team members would accomplish their own responsibilities. Further, it facilitated the collaborative effort in that each team member was aware of where the constituent types of expertise lay and thereby knew who could best meet the goals of the team, i.e. the needs of the patient.

The presence of the preceptor role illustrates the importance of accessibility to the expertise of the physician, who was available only intermittently in the clinic setting. It also illustrates a weakness in the structure of this team, however, in that this role required duplication in order to provide the preceptor with patient data, information of which the primary care physician was already aware or would need to be made aware of. When a preceptor was consulted, he first had to be made aware of the relevant information, a summary of the patient and the relevant problems. Other team members, such as nurses, were observed to seek out the Primary Care Physician rather than create the redundancy of communication with the preceptor.

The preceptor role also illustrates the importance of the shared mental model. Other team members were observed to seek out the physician with whom they usually worked and with whom they shared a common mental model of care rather than approaching a preceptor who might have the necessary knowledge and expertise but not the same view of patient care.

It is not sufficient, to simply have the knowledge. This knowledge has to be communicated in an effective way for redundancy to be avoided and efficiency maintained. Communication too is necessary but not sufficient for successful team functioning.

Communication Patterns and the Nature of Interaction

The frequency of health care providers' interactions is shown in a map in Figure 1. There was a tendency for nurses and doctors to interact with each other, with the heaviest concentration of interaction, as shown by the thickness of the lines, seen between the Faculty Physicians, Residents, Nurse Practitioners, and Clinical Nurses. Expert Primary Care

Table 2: The Roles of Personnel of HealthCare Associates.

<u>Participants</u>	<u>Responsibilities</u>	<u>Presence</u>	<u>Unit of Focus</u>
<u>Medical Care:</u> Faculty Physician, Fellow Resident, Intern	Collect patient data, formulate diagnoses, and plan interventions.	Intermittent	Patient Disease
<u>Nursing Care:</u> Nurse Practitioner Clinical Nurse	Collect patient data, formulate diagnoses and develop treatment plans in conjunction with the physician. Monitor patient status and provide continuity of care.	Continuous	Patient Health
<u>Mental Health Care:</u> Psychiatrist Psychiatric Resident	Collect patient data related to mental health, diagnosis, plan and implementation of interventions, including psychopharmacological care.	Intermittent	Patient Disorder
Psychiatric Social Worker	Collect patient data, identify level of functioning related to psychosocial issues, develop and implement plan.	Continuous	Patient/Family Health
HIV Case Manager, Community Resource Specialist	Initiate and co-ordinate hospital and community resources.	Continuous	Community
<u>Support Staff:</u> Practice Assistant, Secretary	Assist provider with patient flow, procedures.	Continuous	HCA Unit
<u>Administrative, Teaching Roles</u>	Assure the provision of a high quality of care in their areas through supervision and teaching.	Intermittent	HCA Unit

Physicians were seen to communicate more than the Residents, who communicated more than the Interns. The Nurse Practitioners similarly were more involved in communication than the Clinical Nurses. This was partly due to the awareness of the Physicians and Nurse Practitioners of the expertise and resources available in the team and their greater skills at communicating within the team, as discussed earlier. It was also the result of the expert physician being a team leader and therefore a center hub of communication and interaction, as was seen in the examination of the Intensive Care Unit discussed earlier (Patel, Kaufman, & Magder, 1996).

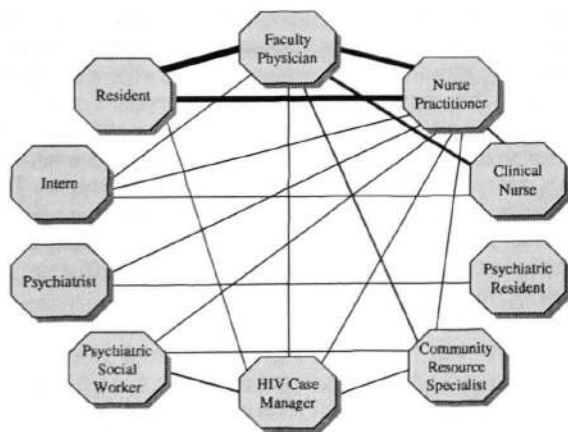


Figure 1: Pattern of Interactions of Health Care Providers. The thickness of the lines shows frequency of interactions.

Communication is heaviest among individuals who share the greatest overlap of accountability in the area related to patient care, i.e. doctors and nurses. The responsibilities of these two groups are similarly more intimately intertwined and complementary, with the tasks of each requiring the assistance of the other. Participants providing mental health care interacted with the team, however their responsibilities were more disparate and independent of medicine and nursing (Table 2). The Community Resource Specialists communicated with the Physicians and Nurse Practitioners because of the interdependency of their tasks. The doctors and nurses identified patient needs that were best met by the community resources, requiring the expertise of the Community Resource Specialists. This suggests that the degree of interdependence of tasks is a major factor in determining the degree of communication.

There was an egalitarian character to the interaction pattern between the providers of the HealthCare Associates. Communication centered on the goals of the interactions. The players, content, and direction were determined by the nature of the expertise required and the care giver who possessed it, be that Community Resource Specialist or Faculty Physician. Interactions among health care providers were based on individual levels and domains of expertise rather than on hierarchical positions, creating this egalitarian pattern.

The analysis of the nature of the patient problems that were seen in the health care unit shows that the composition of the team changed as a function of the patient problem. Table 3 illustrates the consultants involved with patients with the most common problems in the sample. Every patient required coordination of care as provided by Faculty Physicians. One third of these patients required the Nurse Practitioners. As the

Table 3: Frequency of Recruitment of Expert Team Members Related to Patient Diagnosis.

Provider	Diagnosis					
	Heart or Circulatory Problem	Gynecologic Problem	Stomach or Intestinal Problem	Urinary Tract Problem	Weight	Auto Immune Deficiency Syndrome
Number of Patients	7	5	4	4	4	3
Physician	7	5	4	4	4	3
Nurse Practitioner	6	1	0	1	0	2
Cardiologist	2					
Gynecologist		4				
Gastro-Enterologist			2			
Urologist				3		
Nutritionist					1	
Infectious Diseases						1

patient problem evolved, experts were consulted. These consultants were specialists in their area and were called in as the needs of the patients changed. Team members were included related to those specific, individual needs. The frequency of consultation requested from expert team members was a function of the patient problem. The consultants provided feedback to the team member who requested their counsel through several methods, including face-to-face contact, telephone, email, voice mail, the on-line medical record, and the paper record (which was not usually seen by the Primary Care Physician unless specifically requested). This ad hoc method was usually effective, but was far from infallible.

Content of Provider Communication The result of the analysis of communication episodes is shown in Figure 2. The plans for the patients' care was the topic most frequently discussed (29%) among providers. Symptoms, or data leading to the plan, were the next most frequently discussed (21%). This suggests that the focus was on the information available and on the most appropriate action to take. Discussion of

interventions was also seen (16%), but consisted largely of nurses asking physicians to sign prescriptions. Diagnosis (11%) was seen as well, though it was usually implicit, based on shared knowledge, and therefore stated less frequently. The issues of patient flow (8%) and administration (9%) were also discussed by providers. Questions about actions of other providers, monitoring activity of other team members (5%) arose as well. Evaluation of the effectiveness of earlier plans was part of the ongoing cycle of assessment, monitoring, and treatment, however it was rarely explicitly addressed (0.6%).

To summarize, providers discussed how the patients were doing and what should be done for them. The content of communication between team members was directed toward the resolution of the patient problem, centering on evaluation of patient data and specific actions to be taken based on the data.

Discussion

Communication has been identified as a critical factor in the development and functioning of a collaborating team (Patel, Kaufman, & Magder, 1996; Orasanu & Salas, 1993; Grosz, 1996). Previous research on team structure and processes has identified three features: (1) clear roles and responsibilities which are understood by all team members, (2) frequent communication among team members whose responsibilities and tasks are interrelated, and (3) communication which centers around team goals. In this study, the collaborative nature of an expert health care team was examined, identifying patterns of work activity and communication in the delivery of health care.

The work and activity analysis revealed that roles were well defined, with specific tasks and responsibilities matching specific skills of the team members. Most foreseeable tasks and responsibilities were distributed over the team members so that duplication of effort was avoided. Each team member was aware of each other team member's areas of expertise, having developed a shared mental model of the functioning of the team, and called upon the individual who could provide the expertise required based on the specific goals of the situation.

Communication focused on achieving the goals of the team. Half of the interactions between team members were related

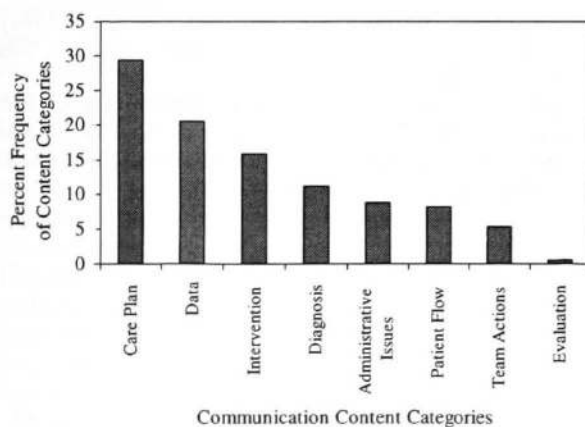


Figure 2: Percent Frequency of Categories Used During Communication by Providers.

to gathering data about the patient problem and planning for its resolution. Expert team members functioned independently, bringing other team members and consultants in to the decision making process when additional expertise, knowledge, or skills were required in order to achieve the goal of attending to the patient problem.

Collaboration of independent yet interdependent experts in this manner requires communication in order to co-ordinate the activities necessary to achieve the goal of the team. It is therefore not surprising that the communication necessary to maintain this shared representation of the team and to accomplish the goals of the team was found to be most frequent among team members whose tasks were most similar or most interrelated, requiring ongoing co-ordination and feedback. In this way, it was assured that the plan of action developed by the team was indeed carried out without any tasks being overlooked. At the same time, communication between team members assured that redundancy and duplication of effort were avoided.

Historically, models of task attainment have emphasized the skills of the individual. Individual domain expertise remains critical in the team situation as well, since each role is incorporated within the team based on the ability of individuals with the required expertise to fill the role, contributing to goal attainment. Experts must also develop expertise in working within a collaborative, developing communication skills at a level that might not have been required of an individual functioning independently. For example, expert reasoning does not always involve evaluation of all available alternatives in search of the best possibility (Simon, 1989), often relying on pattern recognition (Klein, 1993). Yet, in the process of collaborative negotiation, it might be necessary to supply an explanation to other team members involving issues that the expert had not overtly considered in the decision making process.

With the support of team members with a spectrum of spheres of expertise, it can also be argued that it is no longer necessary for experts in one area to maintain expertise in others. An example might be a physician who, up until now, was required to be an expert physician as well as an expert communicator. Working as part of a team, a physician could be free to focus on medical expertise while other team members, better skilled in communication techniques, might focus on interacting with patients. This is not to suggest that physicians need not communicate with their patients. A sensitivity to the needs of others and to communication with them remains fundamental. However, tasks such as teaching and explaining concepts or techniques to patients might be better left to others who have received more training in these areas. Through adjustments such as these, teams can combine the expertise of team members in a complementary fashion, maximizing their abilities, knowledge, and skills.

Acknowledgements

Support for this study was provided in part by the Social Sciences and Humanities Research Council of Canada (Grant No. 410-95-1206) Dr. Vimla L. Patel and by the and in part by AHCPR (No. U01HS08749) to Dr. Charles Safran.

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