TOWARDS A COLLABORATIVE LEARNING ENVIRONMENT FOR CHILDREN'S PAIN MANAGEMENT: LEVERAGING AN ONLINE DISCUSSION FORUM

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ABSTRACT

Effective management of pediatric pain requires pro-active and effective collaboration between health practitioners from a variety of health disciplines. This paper investigates the merits of a collaborative learning environment to address the knowledge gaps experienced by a community of pediatric pain practitioners. We present a knowledge management solution that leverages an online discussion forum as a collaborative learning environment rooted in team members sharing experiences, offering support to solve problems, guiding members to information/knowledge resources, informing peers about clinical practice guidelines and to simply seek advice on matters pertaining to pediatric pain management. Team interactions, via the discussion forum, will be captured and represented as a social network to provide useful insights into the dynamics of team collaboration and to identify the patterns of knowledge flow amongst the team members.

KEYWORDS

Paediatric Pain Management, Collaborative Learning, Online Discussion Forum, Social Networks, Community of Practice, Medical Training

1. INTRODUCTION

Effective management of pediatric pain requires pro-active and effective collaboration between health practitioners from a variety of health disciplines. Medical literature reports that current pain management in children is often inadequate and relatively ineffective due to perceived myths about children's pain and its management [1,]. A study on the assessment and management practices of community hospital nurses caring for children with pain highlighted a serious knowledge gap in children's pain management—only 21% of the nurses had taken a course on pediatric pain management [2]. These facts coupled with the finding that pain management in certain teams is of low priority [3] emphasize the importance of improving the knowledge and skill base of health practitioners involved with the care of children experiencing pain.

Notwithstanding the necessity and impact of formal health training regimes, we argue that in view of the current healthcare operational constraints there is an alternate, yet viable, learning/training opportunity in terms of a collaborative problem-solving and experience sharing environment.

From a health knowledge management perspective, a collaborative learning environment provides an apt setting for (a) domain experts to disseminate their wealth of knowledge and experience, and (b) novice/junior health practitioners to learn by either interacting with domain experts or by leveraging on their explicated knowledge. The value and

nature of interactions changes with time but usually results in the knowledge growth of all participants. Yet, it is noted that team dispersion and high acuity work environments create barriers for practitioners to participate in such collaborative learning experiences. This brings to relief a knowledge management strategy, and its technical implementation, to suggest interventions that would reduce the identified knowledge gaps of healthcare professionals' vis-à-vis an online collaborative learning environment that supports a community of pediatric pain practitioners to realize improved and effective knowledge sharing and problem-solving.

This paper investigates the merits of an online collaborative learning environment to address the knowledge gaps experienced by a community of pediatric practitioners. In this regard, we present an on-going health training project that promotes the use of an online discussion forum as a knowledge sharing medium. Interdisciplinary health professionals working with three teams in a pediatric tertiary care centre are provided the opportunity to participate in an asynchronous discussion forum that entails multiple professional discussions on issues related to the management of acute pain in children. It is anticipated that subsequent analysis of the various discussions held over a period of time may lead to the formation of a social network that can provide useful insights into the patterns of knowledge flow amongst the team members. The resultant social network, user-studies and surveys will provide an objective measure of the effectiveness of the said online discussion board as a knowledge sharing medium to support collaborative learning. Figure 1 gives an overview of the operational environment and functionality of the overall discussion forum project. The project is in progress and the discussion forum is deployed at the IWK Health Centre, Halifax, Canada.

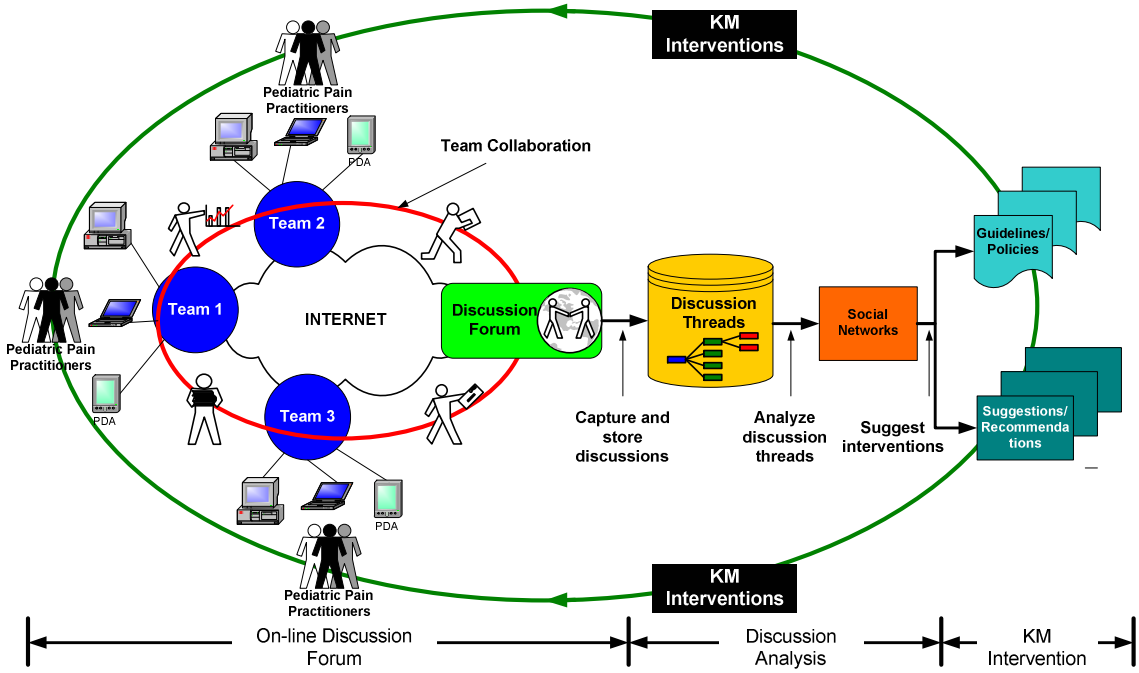

Figure 1: An overview of the entire discussion forum project, highlighting the players, processes, outcomes and actions.

2. KNOWLEDGE CONSTRUCTION VIA COLLABORATIVE LEARNING IN A MEDICAL SETTING

The problem solving and decision-making skills of a medical expert are characterized by reliance on intuition and instinct to guide thinking rather than procedural steps or guidelines [4]. This level of expertise is achieved through a large repertoire of clinical experiences and ongoing participation in various learning activities. Knowledge construction in this instance is a life long process as the practitioner evolves from novice to expert. The higher level cognitive processes associated with construction of scientific knowledge is consistent with a social constructivist paradigm [5]. Constructivist learning theory emphasizes interactivity in context rich environments as a means for constructing knowledge [6]—learning tasks initiating analytic and problem solving activities can be understood as knowledge construction enablers. In this milieu, knowledge construction is a dynamic process in which previous knowledge is deconstructed and new knowledge is reconstructed as individuals interact with new and relevant information. Such is the case as clinicians present their theories or hypothesis about care to other expert practitioners and reconstruct new knowledge based on expert feedback.

Collaboration is a key theoretical underpinning in a social constructivist learning environment [7]. The significance of collaboration in the learning process can also be found in other psychological perspectives on learning and cognition [8,9]. It has been observed that a collaborative environment, within or among groups, can provide experiences with and exposure to multiple perspectives pertaining to a domain. Collaboration, though at times informal and ad hoc, is a common activity in medical practice such that multiple healthcare experts from many roles converge to work collaboratively in order to suggest the best possible solutions for patients [10]. In a health care organization, a collaborative learning environment can be perceived as a group of practitioners who share occupational challenges and are working at similar problems, though maybe at different levels, and thus are involved in sharing experiences, providing recommendations, negotiating internal beliefs about pain management, explicating their tacit 'working' know-how, and getting themselves acquainted with practical knowledge about pain management in children.

3. THE PROBLEM DYNAMICS

Pain is a multidimensional subjective experience and as such is complex to understand, assess and manage. For health professionals charged with the duty to care for children this task increases in complexity as a child's understanding and ability to express their pain may be restricted by their level of cognitive development [11]. In addition, long-standing myths and beliefs held by health care professionals about pain management for children have been shown to negatively impact the pain management children receive [12]. The dispelling of these myths and biases are difficult for many reasons, one of which is that most health care professional education programs lack formal courses on pain management [13]. Considering that most children receiving care in a hospital setting will experience pain at some time from their injury, illness, procedures and/or treatments, inaccurate knowledge and negative attitudes held by health care professionals about pain management significantly impacts the care of many children.

IWK is the premier centre providing quality care to children, youth, women and families in the three Maritime Provinces and beyond. The IWK is structured around a *Program-Based Care Model* that organizes interdisciplinary care teams around the needs of patients and families. Services provided by the Health Centre are delivered through three programs: Children's Health; Child and Adolescent Mental Health; and Women's and Newborn Health. The Pain team at the IWK Health Centre has a mandate to provide consultation services and teaching to all teams, children and families within the Children's Health Program. The team consists of one full time clinical nurse specialist, 0.5 full time equivalent (FTE) physician support, 0.2 FTE physiotherapist support and 0.2 FTE psychologist support.

The dynamics of the problem can be understood by the following operational elements:

- **Program Based Care:** The Children's Health Program is comprised of 40 teams throughout the health centre. Some teams are located in satellite settings offsite.
- **Interdisciplinary Teams:** Teams are composed of interdisciplinary health professionals. Formal professional knowledge will likely be grounded in their unique discipline. Team members vary in competency and accountability for Pain management. High patient acuity and limited resources pose barriers for attending formal learning sessions.
- **Pediatric Pain Management Team:** This is a small team with only one dedicated full time Clinical Nurse Specialist appointment. Other team members have extensive workload commitments elsewhere in the health centre.
- **Maritime Pediatric Pain Network:** This is a new initiative that will launch February 2004 linking health centers around the Maritimes. This community of practice is concerned with issues related to pediatric pain management and development of policy and standards.
- **Information Technology Infrastructure:** The Health Information System (HIS) is currently housed on an internal network that is not externally accessible to practitioners. Staff has Internet access in most clinical areas.

Given the above operational scenario, the Pain Management team at the IWK Health Centre has a mandate to improve the pain management of children throughout the Children's Health Program by direct clinical care, development of standards, and by supporting and creating informal and formal learning opportunities. Formal learning opportunities are currently provided through monthly pain rounds, invited presentations at in-house conferences and workshops and self-directed learning packages. Members of the pediatric pain team recognize the need and importance of proper training, but attendance at formal education sessions is often low due to high patient acuity in the clinical setting and competing professional and personal demands. On the contrary, members of the pediatric pain team identify informal individual learning opportunities, which arise during direct patient consultations, as a more effective method of sharing knowledge and influencing practice compared to formal teaching. Informal opportunities with fewer individuals provide a milieu conducive to discussions about individual attitudes and beliefs related to pain management. This observation is consistent with reports in the literature that recognize most human learning does not occur during formal

education [14] and that knowledge alone does not necessarily bring about practice change [15]

From a learning perspective, the pediatric pain team expressed a desire to engage more staff in the types of discussion and learning that takes place during these informal opportunities. We therefore proposed a knowledge management strategy that involves the development of collaborative networks within the Children's Health Program around the management of children's pain. In keeping with the operational constraints, yet the availability of a reliable communication infrastructure, a web-based discussion forum—specifically tailored towards the needs of the pediatric pain community—has been developed as an effective and flexible medium for knowledge sharing, informal learning and team communication.

4. A KNOWLEDGE MANAGEMENT SOLUTION FOR COLLABORATIVE LEARNING

Knowledge management can be described as an "institutional systemic effort to capitalize on the cumulative knowledge that an organization has" [16]. Knowledge management is generally concerned with activities pertaining to the acquisition, storage, and dissemination of knowledge. In healthcare, knowledge capital is present in both tacit and explicit formats. Explicit knowledge is codified knowledge represented by information in journals, protocol and procedures [17]. Tacit health care knowledge is the non-formalized knowledge that guides expert practice [18]. Organizations recognize that knowledge is a major asset and bringing information and knowledge to the *community of practice* contributes towards a learning environment [19].

Communities of practice are groups of knowledge workers informally bound together by a communication medium (such as an electronic discussion forum) to share experience, expertise and commitment to a common topic/area [20]. Granovetter [21] stressed that the strength of such weak and informal networking between like-minded practitioners entails a collaborative problem-solving environment in which domain-specific tacit experiential knowledge is challenged, explicated, created, and transferred from domain experts to less informed participants. Collaboration in a community of practice is not one-way traffic—i.e. knowledge flow from expert to novice. Rather, there are subtle gains for experts also in that by way of giving explanations they improve their own understanding: of the domain.

From a knowledge management perspective, online discussion forums provide a virtual meeting space for a vibrant community of practice to engage in activities that lead to the explication and sharing of domain-specific knowledge that can impact both training and collaborative problem-solving[22]. The entire workflow of an online discussion forum characterizes collaborative learning and problem-solving in action: (1) a practitioner seeks a solution/advice to a problem by presenting it to the discussion forum; (2) members of the community with interest and expertise related to the problem react and self-organize to discuss the problem; (3) a debate ensues between experts during which they share experiences, relate theory to practice and collaboratively conclude a solution; (4) the entire solution information—*i.e.* the knowledge created in the process—is disseminated via the discussion forum and most attractively is available to not just the initial solution seeker but to the entire community. In essence, from a learning perspective as the discussion unfolds the learner learns by observing the expert in

discussion. The learner can benefit in two ways: (a) capture the tacit knowledge (know-that) of the expert; and (b) but also to reflect on the expert's experiential knowledge (know how).

More so, we believe that the various discussion threads (the temporal progression of the discussion in terms of periodic exchange of messages) emanating at the discussion forum hold highly specialized knowledge, or "wisdom" that can be captured, organized and operationalized in a meaningful manner for a variety of downstream applications.

We contend that the issue of improving and supporting collaborative learning in relation to pediatric pain management can be aptly addressed via an online discussion forum that is ubiquitously accessible and easily usable to the team members. Experiential and tacit knowledge has been identified in terms of specialists and senior nurses. Hence, what is required is an environment that facilitates the explication and flow of this experiential knowledge from experts to novice practitioners. It is anticipated that this focus will provide a viable solution for supporting collaborative problem-solving and in turn present various training opportunities. More so, the technical investment can lead to future solutions related to tacit knowledge acquisition and sharing.

5. AN ONLINE DISCUSSION FORUM FOR PEDIATRIC PAIN MANAGEMENT

In this section we present the working details of our online discussion forum for the interdisciplinary members of the pain team in the Emergency Department and the Pediatric Intensive Care Unit.

In principle, the discussion forum offers a collaborative learning environment rooted in the team members sharing experiences, offering support to solve problems, guiding members to information/knowledge resources, inform about clinical practice guidelines and to simply seek advice on matters pertaining to pediatric pain management.

In practice, the text message based communication paradigm offered by the discussion forum ensures that an individual is not necessarily overheard—when an individual posts a statement it is viewed, responded, challenged and corrected by the entire community. Implications of ideas or practices can be unfolded, critiqued and contextualized with respect to existing knowledge. These learning activities can be characterized as being productive in an instructional sense. Procedurally, the team members are required to register with the discussion forum (see figure 2). The registration procedure captures information in relation to the users email address, professional affiliation, and purpose for joining the Pain Management Discussion Board. This information is useful in understanding the knowledge flow patterns and to evaluate the user satisfaction at a later point in time. Each member is assigned a unique user ID and password and all postings on the discussion board will be tagged with the users name and date of posting.

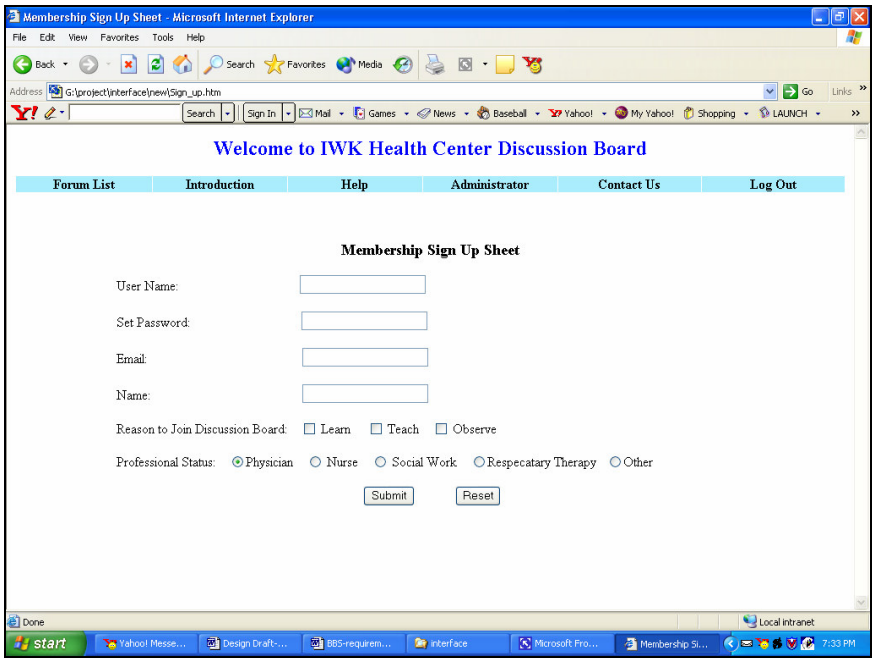

Figure 2: Screen shot of member registration

Discussions are organized at two levels: (1) **Forums** correspond to the highest level of structure and represent the broad category of the issue (shown in figure 3); and (2) **Topics** within forums (figure 4) address smaller, yet more focused, discussions related to the parent forum issue. Forums are initiated by the discussion board administrator at the request of a team member, but only after its relevance are evaluated and approved. A topic can be initiated by a team member; the team member who initiates a topic of discussion is both the owner and moderator of the topic. We believe that this two-level classification of a discussion allows a more manageable discussion environment in which participants are able to relate better with a focused discussion. Furthermore, we are able to distinctly characterize the larger problem of pediatric pain management at varying degrees of specificity. Depending on interest and need, the user may choose to either follow the entire discussion within a forum or refer to only a specific topic within the larger theme of the discussion.

To provide a measure of user activity and forum importance, statistics such as the number of message posts, the time of the last message post, the number of message posts since a certain time, the originator of the forum/topic, the number of related topics, the number of participants and so on are instantly made available to users (shown in figure 2).

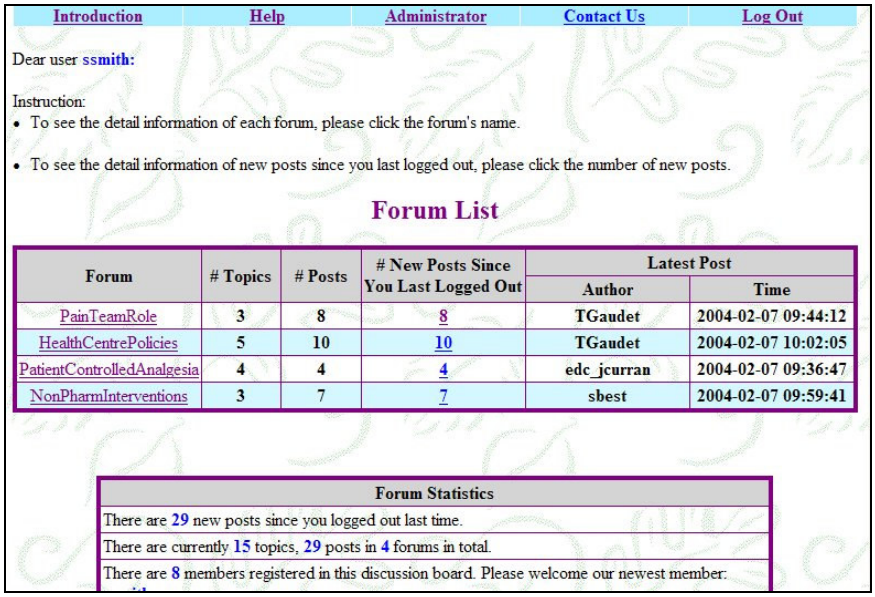

Figure 3: Screen shot of the forum interface. Showing multiple discussion forums and some helpful statistics about the discussion board.

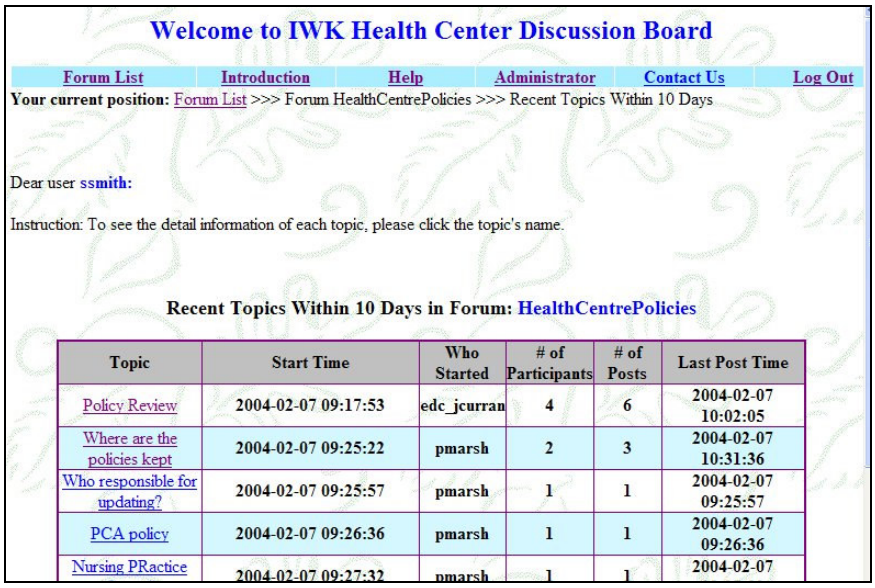

Figure 4: Screen shot of the topic interface. Showing multiple discussion topics related to a forum and some helpful statistics about each topic.

Team members engage in a discussion by exchanging message in response to previously posted messages. When responding to a message, users are provided with the option to respond in private to another user through an email or place their contribution on the public discussion board (see figure 5). Additional information is captured with each posting regarding purpose or intention of the posting.

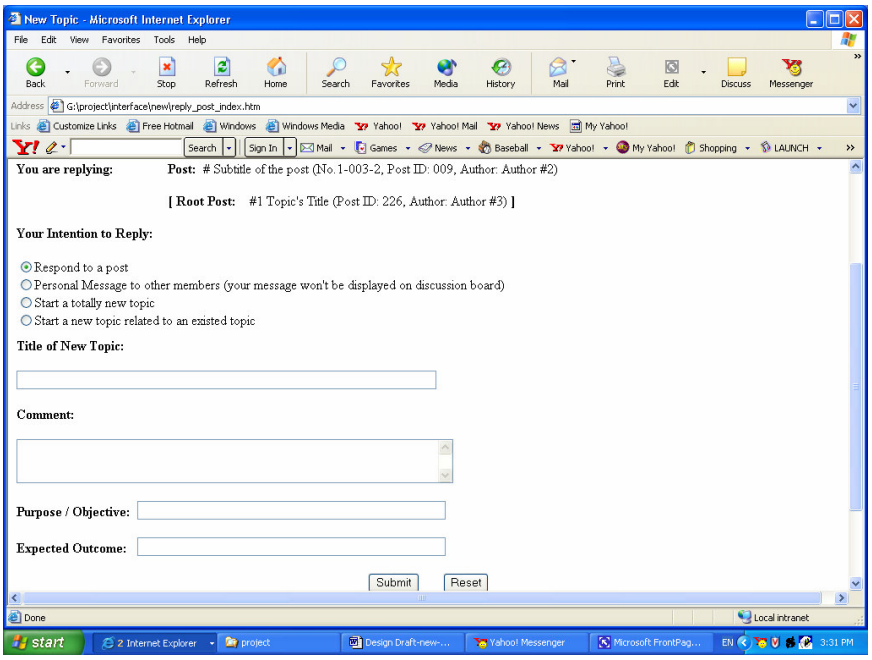

Figure 5: Screen shot of the message reply interface.

The discussion is displayed and captured in the temporal order in which it proceeds—i.e. the entire *discussion thread* is captured. At the top of the discussion is the message, by the discussion initiator, specifying the pediatric pain issue. Other team members respond to the original message or to the responses by other team members. Each response is indented under its parent message. This allows a graphic illustration of how the discussion proceeded and who responded to whom. Each message is displayed with the identity of the author and the time of its posting. Figure 6 illustrates the progression of a real-life discussion in which multiple team members are responding, at different levels of the discussion thread, to messages posted by their colleagues.

Figure 6: Screen shot of a discussion thread, highlight a live discussion in progress.

A number of policies have been stipulated to administer the discussion forum, for instance (i) when and how to culminate a discussion; (ii) when and how to determine that the discussion topic has either merged with another topic or implicitly led to the new topic—i.e. topic drift; (iii) what are the exclusion criteria to regulate discussions that tend to become commercially oriented and seem like product endorsement; (iv) how long to display a particular forum/topic at the discussion forum after it has been declared closed; and (v) what conditions warrant the re-opening of an a priori discussed and closed topic, and if so whether to start fresh or continue from the previous discussions.

6. UNDERSTANDING COLLABORATION IN A DISCUSSION FORUM: SOCIAL NETWORKS

Collaborative environments, such as online discussion forums, emulate the physical, temporal and functional settings in which practitioners operate. Experiences with both asynchronous and synchronous discussion forums can be found in the health care literature supporting academic activities, patient education and to a lesser degree for health professionals to share experiential knowledge in clinical practice [23]. Yet, these distributed technologies provide opportunities to advance collaborative work and knowledge sharing, particularly for dispersed teams. To date, evaluation of the utility of electronic discussion tools has focused primarily on replacement of conventional communication systems [24]. However, there is a need to examine the impact on social processes such as collaborative knowledge sharing. Given the discussion threads recorded via the discussion forum, we plan to generate social networks of pediatric pain team members based on their mutual interactions during a discussion—the act of replying to a message is viewed as an embodiment of social interactions [25]. Our intention is to use the graphical illustrations of communication patterns depicted by a variety of social networks—each social network will be developed based on a specific research question and will provide focused insights into a particular issue—to evaluate the efficacy of the discussion medium and to determine the patterns of knowledge flow amongst team members over a period of time.

Social network analysis [26,27], a knowledge management diagnostic tool, will provide useful insights into patterns of relationships among people and teams, and can reveal (a) who is collaborating with whom? (b) sub-groups or clusters of individuals with similar interests [28]; (c) What are the size and make up of specific collaborative subgroups? (d) How does information flow among group members? (e) Is there evidence of content expertise? (f) if so, who is the content expert for a given topic; (g) who is the knowledge donor and who is the knowledge seeker? (h) is the content expert contributing and is accessible? (i) who is serving as an information broker—i.e. an interface between multi-disciplinary teams; and other questions that may provide an idea of the flow and consumption patterns of knowledge within the pediatric pain team.

Information about social networks can be gathered using a variety of data collection methods [29]. For the purposes of this project the entire discussion threads for each topic, containing the identities of the sender and the target, will be collected. Our approach is to employ simple graph algorithms to create a dynamically evolving social network and probabilistic methods to extract sub-groups that exhibit higher levels of collaboration. We plan to use Graphviz toolkit from AT&T for automatic layout and visualization of the social networks, such that clicking on an edge (representing interaction between two team

members) will retrieve the discussion thread and clicking on a node (representing a team member) will list all messages posted by a particular team member.

In conclusion, social network analysis will be used as an objective measure to establish the effectiveness and sustainability of an online discussion forum—where the discussions may span over a period, topics and across multiple institutions—for an online pediatric pain community in relation to pediatric pain management.

7. CONCLUDING REMARKS—THE WAY AHEAD!

Discussion forums bring about the meeting of minds—this informal, yet inspirational, meeting of minds can be channeled to foster a collaborative learning environment. Vis-à-vis learning, the skills, experience and knowledge required to solve problems can be gained via this meeting of professional minds. Medical training, in particular pediatric pain management training, can significantly benefit from the sharing of occupational experiences between multi-disciplinary health practitioners working at different levels of expertise and responsibility. The inherent advantages of collaborative learning settings are manifold: high immersion of the collaborating team members; an informal yet practice-oriented design for learning; exposure to diverging opinions; exchange of explanations and the opportunity to progressively integrate new knowledge with existing knowledge/beliefs. In this context, we believe that the learning points that one can look forward to as a result of the establishment and operationalization of an on-line discussion forum can be characterized as follows: (a) networking with peers in a trusted environment that is meant for mutual support and advice; (b) learning about the safe, unsafe, good and not so good practices based on peer experiences; (c) sharing and reflecting on clinical practice guidelines; (d) exploration of methods for managing atypical clinical cases through the discussion of cases and clinical scenarios; (e) identification of the subject specialists and means to access them; and (f) undertaking focused group research.

The project is in progress in that the discussion forum has been established and discussions are taking place. The suggested evaluations are expected to take place as soon as a reasonable body of data—i.e. discussion threads—have been accumulated. Nevertheless, based on user feedback and discussion traffic we believe that the project will make a significant impact in narrowing the knowledge gap currently experienced by the pediatric pain team.

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