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The use of model constructs to design collaborative health information technologies: A case study to support child development

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ABSTRACT

Objective: Health information technology could provide valuable support for inter-professional collaboration to address complex health issues, but current HIT systems do not adequately support such collaboration. Existing theoretical research on supporting collaborative work can help inform the design of collaborative HIT systems. Using the example of supporting collaboration between child development service providers, we describe a deductive approach that leverages concepts from the literature and analyzes qualitative user-needs data to aid in collaborative system design.

Materials and Methods: We use the Collaboration Space Model to guide the deductive qualitative analysis of interviews focused on the use of information technology to support child development. We deductively analyzed 44 interviews from two separate research initiatives and included data from a wide range of stakeholder groups including parents and various service providers. We summarized the deductively coded interview excerpts using quantitative and qualitative methods.

Results: The deductive analysis method provided a rich set of design data, highlighting heterogeneity in work processes, barriers to adequate communication, and gaps in stakeholder knowledge in supporting child development work.

Discussion: Deductive qualitative analysis considering constructs from a literature-based model provided useful, actionable data to aid in design. Design implications underscore functions needed to adequately share data across many stakeholders. More work is needed to validate our design implications and to better understand the situations where specific system features would be most useful.

Conclusions: Deductive analysis considering model constructs provides a useful approach to designing collaborative HIT systems, allowing designers to consider both empirical user data and existing knowledge from the literature. This method has the potential to improve designs for collaborative HIT systems.

1. Introduction

Collaboration among healthcare teams is universally recognized as beneficial. Policymakers worldwide suggest that collaboration is necessary to provide quality patient care [1–3]. Collaboration is often interdisciplinary [4–6]. Care for chronic conditions in particular requires collaboration between multiple sectors in the community including public health, health care, community organizations, and businesses [7]. Definitions of collaboration include “planned or spontaneous engagements between individuals or teams” where information is exchanged [4], or an ongoing partnership with “shared objectives, decision-making, responsibility, and power” that works together to solve problems and provide services [5,6].

Collaborative practice between different professions allows service providers to collectively leverage their strengths to address complex health issues, which in turn can optimize health services and improve outcomes [8]. Research indicates that collaborative practice can improve access to health services, reduce redundant medical testing, and improve patient safety [8]. Alternately, a lack of collaboration can cause medical errors due to inadequately reported information or information misinterpretation [9]. Diverse health professionals, who could potentially collaborate to address complex health issues, have traditionally not worked together due to factors such as time and resource restraints or differing approaches to work, leading to the inefficient use of resources and a diminished impact on health outcomes [7].

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The domain of child development support work is an area with a clear need for improved collaboration. Child development refers to the process by which children gain the skills that they need to succeed in life, including skills in a number of interrelated domains such as motor, language, social and emotional, and general cognition [10]. Persistent delays that inhibit daily life activities are considered to be *developmental disabilities* [11]. An estimated 5.75% of children in the United States have some form of developmental disability [12], and children with unaddressed delays and disabilities face many negative long-term effects such as increased medical expenditures [13] and lower educational attainment [14,15].

While pediatricians play an important role in identifying potential developmental disabilities and managing a child's care, pediatricians also regularly refer families to a wider range of stakeholders to provide developmental evaluations, therapeutic services, and care coordination [11,16]. Effective care management requires pediatricians to partner with and incorporate information from many systems of care such as public health, education, and social services in order to determine developmental status, develop a plan of care, make appropriate referrals, and manage care over time [11,16].

Unfortunately, the fragmented nature of child development services imposes many barriers to the receipt of these necessary services: referrals can be missed due to poor communication or missing paperwork [18,20]; service providers often lack information about children's conditions [17]; and providers report mistrust in information provided by other professionals [19]. Both parents and providers report that interprofessional care coordination requires significant time and effort [17,19]. The role of facilitating communication between different professionals often falls on parents [17–19], who may lack the health literacy or knowledge to adequately communicate information between care settings [17–19]. Families that face economic or language barriers in particular may require extra assistance with care coordination activities [19].

Researchers and policy experts have called for a new infrastructure to help coordinate child development services [10,21,22]. Health information technology (HIT) has the potential to improve the effectiveness and efficiency of collaborative work throughout the community. By providing a common platform for efficiently sharing information, HIT could facilitate collaboration between child development stakeholders [23–27], and has the potential to bridge professional gaps in the care of chronic diseases [4,7,28,29].

Researchers have noted that collaboration is a complex and nuanced phenomenon [4], however, and work is needed to understand how collaboration is expressed in different care contexts to inform the design of collaborative systems. This paper will outline a rationale for leveraging constructs from existing collaboration research to guide the design of collaborative HIT systems, and demonstrate the use of this method in the field of child development.

1.1. Interprofessional collaboration and health information technology

The use of HIT such as electronic health records (EHRs), personal health records (PHRs), and telemedicine systems are suggested as a means to connect various service providers in the care of chronic health issues [4,7,28,30]. There is a growing body of work investigating the use of HIT tools to support collaboration in both primary care [31–33] and hospital settings [34–39]. A review by Eikey, Reddy, and Kuziemsky [4] identified HIT features that could support collaboration, such as allowing communications between distant collaborators, alerting multiple caregivers when emergencies arise, or removing organizational barriers to communication. Alternately, their review uncovered that HIT systems can inhibit collaboration when separate documentation tools are not integrated, documentation practices disrupt work processes, exchanged information is de-contextualized, or when the use of HIT negatively impacts interpersonal relationships [4].

While many data standards exist to define EHR functionality, existing standards do not consider the unique needs of team-based care [31]. Many EHRs are not configured to adequately interface to other systems [40], and EHRs also may not accurately store information important to collaboration, such as the composition of the patient's care team [41] or referrals and consultation reports [40]. The use of HIT can also negatively impact social dynamics between collaborators in unexpected ways. For example, a study of the use of EHRs to support collaborative practice by Chase et al. [42] found that clinicians may not trust information from other providers if their notes were hard to find in the EHR system.

While HIT has received increased attention in collaborative care situations, HIT has received much less attention as a means of supporting collaboration between clinicians and other healthcare professionals in non-acute settings [4], or as a means to bridge gaps between the healthcare field and other sectors such as education or social work. This poses a significant challenge to HIT system designers who are interested in addressing health domains such as child development that are supported by complex networks of caregivers across many organizations.

1.2. Constructs affecting collaborative work and their use in design

Researchers have called for further work exploring the creation or implementation of collaborative systems [43–45]. In order to adequately support interprofessional collaboration, HIT system designers need to consider a wide range of technical and social factors. The extensive corpus of literature on collaboration could provide useful guidance for designing and evaluating HIT to support collaborative work [29]. Collaboration has been studied in a wide range of fields such as healthcare, social work, engineering, and administration, and the literature contains an expansive collection of constructs, defined as mechanisms postulated to influence behavior within a theory [46], that could provide the basis for design work.

A review of the literature yields a number constructs hypothesized to affect the effectiveness of collaborative practice. While there is significant heterogeneity between models of collaboration, there is also significant overlap [47], indicating that existing research has discovered consistent themes across different fields of practice. For example, much work notes the importance of understanding work processes across collaborators [2,4–6,42,47–58], roles and role expectations [1,5,48,53,54,57,59–66], power differentials [47,51,62,66–69], and the importance of trust [42,47,48,51,52,57,61,67,70–76]. Appendix A contains a listing of 47 empirical and review articles in the literature [1,2,4–6,27,31,42,47–85] concerned with collaboration, and a brief synopsis of the constructs they theorize to be relevant to collaboration. These articles take different approaches to examining aspects of collaboration, and include: typologies, components, antecedents, barriers and facilitators, and considerations for HIT.

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Despite this extensive literature on collaboration, many interventions designed to support interprofessional collaboration are atheoretical [86,87]. This indicates that, during the design process, there is a missed opportunity to apply existing constructs for understanding the complex needs of a collaborative space. The Collaboration Space Model (CSM), defined by a review of the biomedical informatics literature [4], provides a potentially useful model for guiding the design of collaborative HIT. The CSM contains technically-focused constructs relevant to collaboration in healthcare while also moving beyond work that solely considers issues of data and process interoperability [31,55] to consider the social aspects of collaboration as well.

The CSM contains four main concepts: processes, context, technology, and outcomes. The construct of 'processes' refers to the workflows and communication that support collaborative work [4]. 'Context' refers to the user roles, the work setting, and whether communication in this space is synchronous, asynchronous, or mixed [4]. 'Technology'