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Review

Organizational issues in the implementation and adoption of health information technology innovations: An interpretative review

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ABSTRACT

Purpose: Implementations of health information technologies are notoriously difficult, which is due to a range of inter-related technical, social and organizational factors that need to be considered. In the light of an apparent lack of empirically based integrated accounts surrounding these issues, this interpretative review aims to provide an overview and extract potentially generalizable findings across settings.

Methods: We conducted a systematic search and critique of the empirical literature published between 1997 and 2010. In doing so, we searched a range of medical databases to identify review papers that related to the implementation and adoption of eHealth applications in organizational settings. We qualitatively synthesized this literature extracting data relating to technologies, contexts, stakeholders, and their inter-relationships.

Results: From a total body of 121 systematic reviews, we identified 13 systematic reviews encompassing organizational issues surrounding health information technology implementations. By and large, the evidence indicates that there are a range of technical, social and organizational considerations that need to be deliberated when attempting to ensure that technological innovations are useful for both individuals and organizational processes. However, these dimensions are inter-related, requiring a careful balancing act of strategic implementation decisions in order to ensure that unintended consequences resulting from technology introduction do not pose a threat to patients.

Conclusions: Organizational issues surrounding technology implementations in healthcare settings are crucially important, but have as yet not received adequate research attention. This may in part be due to the subjective nature of factors, but also due to a lack of coordinated efforts toward more theoretically-informed work. Our findings may be used as the basis for the development of best practice guidelines in this area.

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Contents

1. Introduction

Drawing on health information technology (HIT) innovations to improve the quality and safety of care is now firmly established as a priority area throughout much of the economically-developed world [1–3]. However, healthcare is, when compared to other industries, slow to adopt technology [4–7]. Underlying this is a complex web of inter-related social and technical issues situated within a wider organizational environment [8–13]. There is increasing appreciation that introducing technology within complex organizational systems such as healthcare is not a straightforward linear process. Rather, it is dynamic in nature involving often various cycles of iteration as technological, social and organizational dimensions gradually align (or not) over time [14,15].

Organizational dimensions surrounding HIT introduction have been the subject of much empirical activity, but progress is hampered by the use of inter-related terms that are often used synonymously. Consequently, navigating and interpreting the surrounding body of evidence is somewhat difficult, resulting in a lack of integrated accounts of the most important factors associated with implementation. Existing concepts include adoption, deployment, diffusion, implementation, infusion, integration, normalization and routinization (Box 1). In essence, these all relate to the processes by which innovations are introduced and then incorporated (or not) into routine care by professionals and/or patients within organizational settings.

Keeping in mind that technological innovation in healthcare also requires expertise in technical considerations and clinical practice, the study of organizational dimensions in relation to HIT innovations is not a clearly defined area of interest. Rather it is a problem-based approach centering on the interaction between organizations or, more accurately, the people working within these organizations and with technology. The field may therefore encompass human factors considerations, but can also include issues that go beyond the direct human–computer interface (such as strategies employed to introduce systems and the way these are adopted by various stakeholders within organizational settings). Similarly, social aspects such as individual attitudes and behaviors of groups are integral to organizational issues. We summarize the existing bodies of knowledge that may be potentially useful in contributing to the understanding of organizational issues in the context of HIT implementation and usage in Box 2 .

Perhaps as a result of these different bodies of knowledge, there are also a range of theoretical approaches that can help to conceptualize the interaction between technology, humans and the organizations in which they function. Some of these are outlined in Box 3 .

Our list in Box 3 is by no means exhaustive, but our intention is to illustrate the range of different existing theoretical lenses surrounding the introduction of HIT. Overall, there is no overarching conceptual framework in relation to the implementation and adoption of HIT innovations. The main tensions of various theoretical considerations seem to be: (1) a

Box 1: Examples of concepts surrounding organizational considerations in HIT innovations.

Adoption [16]: Construed as the acceptance and incorporation of HIT applications into everyday practice.

Deployment [17]: The process of putting technology into use in the organization.

Diffusion [16]: The study of how, why, and at what rate new ideas and technology spread through organizations.

Implementation [16]: The consideration and the introduction of HIT applications. Procurement decisions and development pathways can in some cases impact on implementation considerations [18].

Infusion [19]: The degree of comprehensiveness or sophistication of use of an innovation and the degree to which it is embedded within an organization.

Integration [20]: The process by which technology becomes incorporated within organizational practices.

Normalization [21]: The process by which an innovation becomes routine.

Routinization [21]: The process by which using an innovation becomes part of regular organizational practice.

Box 2: Examples of bodies of knowledge surrounding organizational issues in HIT innovation.

- **Human factors/systems ergonomics**: All-embracing terms that cover: the science of understanding the properties of human capability, the application of this understanding to the design and development of innovations, and the art of ensuring successful application of human factors engineering to information technology [22,23].
- **Organizational/occupational/social psychology**: A subset of psychology that is concerned with the application of psychological theories, research methods, and intervention strategies to workplace issues. Relevant topics include: personnel psychology (e.g. behavior and attitudes, changes in what jobs entail, working patterns and effects on the individual); motivation and leadership; employee selection; training and development; organizational development and guided change; organizational behavior; and work and family issues [24–26].
- **Management and, in particular, organizational change management**: A structured approach to change in individuals, teams, organizations and societies that enables the transition from a current state to a desired future state. It often focuses on increasing organizational effectiveness and on identifying barriers and facilitators to reaching a desired future state [27].
- **Information systems**: An academic discipline that is concerned with the uses of information and information technology in organizations and, more generally, society. This area emerged from Systems Theory, which assumes that the world consists of complex systems, which are inter-related with each other and the world at large. The defining feature here is that a system is viewed as being more than the sum of its parts [28–32].

Box 3: Examples of theoretical approaches conceptualizing the interaction between technology, humans and organizations.

- **Diffusion of innovations** [16]: These are approaches that focus on how innovations spread in and across organizations over time.
- **Normalization process theory** [33]: This describes how complex interventions in healthcare are routinely incorporated into the day-to-day work of healthcare staff (or "normalized"). The model highlights the importance of social processes, and the organizational context in shaping outcomes.
- **Sensemaking** [34]: This approach assumes that individuals in organizations discover meanings of the status quo (frequently as a result of some kind of change), often by transforming situations into words (expressed in language or texts) and then displaying a resulting action as a consequence of their interpretations. The underlying assumption is that organizations are not existing entities as such, but are "talked into action" or produced by sensemaking activities (and also the other way around). The very way in which they are talked about defines their existence.
- **Social shaping of technology** [35]: This approach highlights the importance of wider macro-environmental factors in influencing technology and its implementation into organizations. It emerged as a response to studies focusing on the social consequences of technology implementation, and in doing so increasingly shifts the focus to viewing technology itself as being shaped by social processes.
- **Sociotechnical changing** [8,36–38]: These approaches conceptualize change as a non-linear, unpredictable and context dependent process. They assume that both social and technical dimensions shape each other over time in a complex and itself evolving environment.
- **Technology acceptance model** [39,40]: This assumes that individual adoption/usage of a system is determined by the attitude toward use, perceived usefulness, and perceived ease of use of the application.
- **The notion of "fit"** [38,41–43]: These models emphasize that one not only needs to consider social, technological and work process factors in isolation, but also the extent to which these align with each other. The better the fit, the more likely the implementation is assumed to be "successful" and the higher levels of adoption amongst users are likely to be.

focus on relatively linear stages and integration of technology over time, with some models focusing on exploring one particular aspect of the lifecycle in detail; (2) a focus on individual adopters in isolation; (3) a focus on complexity and unpredictability characterizing the change process; and (4) a mixture of the above with models trying to be as inclusive as possible (which in turn makes them less specific).

With the importance of the wider organizational considerations associated with HIT deployment in mind, we conducted a secondary review of data obtained during related work [4]. The rationale for focusing on this particular topic of interest is an apparent lack of integrated accounts surrounding the issue, as outlined above. This may be due to social and organizational issues being experienced subjectively and in different ways by different actors, but hampers obtaining insights into potentially generalizable findings across settings.

2. Methods

This work is a subset analysis of a recently completed systematic review of the literature examining the effectiveness of eHealth applications to improve the quality and safety of healthcare [4]. As part of this work, and in addition to investigating clinical outcomes, we examined evidence relating to

ways of promoting the effective development, deployment and routine use of eHealth applications in healthcare settings. In doing so, we searched for systematic reviews relating to organizational issues in HIT innovations published between 1997 and 2010 [4].

We developed a comprehensive search strategy and an associated list of search terms drawing on Medical Subject Headings (MeSH) and free text searches [44]. This involved combining terms relating to eHealth applications implemented in organizational settings (such as computerized decision support, electronic prescribing, electronic health records) with organizational- and implementation-related terms (such as those outlined in Box 1).

We examined papers published in MEDLINE, EMBASE, The Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, The Cochrane Central Register of Controlled Trials, The Cochrane Methodology Register, The Health Technology Assessment Database, Google, LILACS, IndMed, PakMediNet, The National Research Register, ClinicalTrials.gov, Current Controlled Trials, and the National Health Service (NHS) Economic Evaluation Database.

Papers were scored by two independent reviewers, applying relevant methodological filters to identify systematic reviews [45]. This involved initially screening abstracts and subsequently potentially relevant full text papers for empirical work associated with eHealth applications and organizational implementation and adoption processes.

Quality assessments of included studies were conducted by two independent reviewers drawing on relevant instruments, which we adapted for eHealth systematic reviews [44]. As the overall body of literature identified was too diverse to make any quantitative synthesis of the literature meaningful, we chose to qualitatively synthesize retrieved studies drawing on relevant conceptual work to guide this narrative synthesis [44]. In doing so, we extracted data relating to: (1) specific care settings and contexts; (2) skills, knowledge, experience, attitudes and values of individuals (clinicians, healthcare managers, and patients); (3) the characteristics of tools (such as adaptiveness); and (4) environmental factors, tasks, goals and their inter-relationships [46,47].

3. Results

Overall, our initial searches generated 121 systematic reviews investigating eHealth applications. Applying our inclusion criteria, we found 11 systematic reviews focusing on organizational issues surrounding the implementation and adoption of HIT [48–58], and two systematic reviews, which focused more generally on related questions of innovation in healthcare settings [59,60]. Fig. 1 depicts a flow diagram of the screening and selection process and Table 1 summarizes the main findings of individual reviews.

Overall, the evidence from systematic reviews draws attention to the importance of a number of inter-related technical, social and organizational factors that can help describe and explain potential underlying causes for "success" and "failure" (or the perceptions of these) [48,56,58,60]. Acknowledging that these factors are inter-related, we have organized our results along these dimensions to illustrate the particularities of each, before moving toward examining inter-relationships between them.

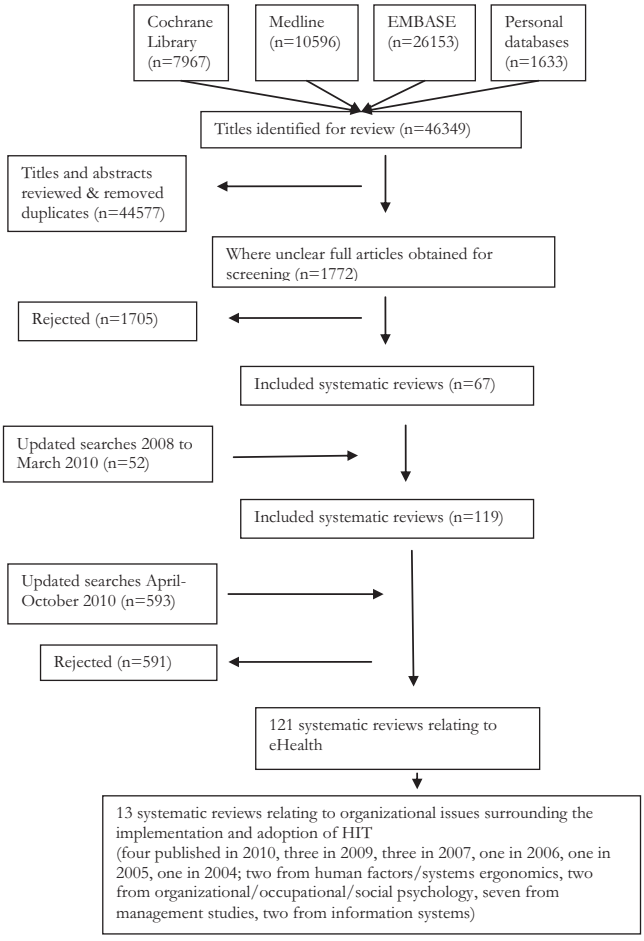

Fig. 1 – Flow diagram of the screening and selection process.
Adapted from: Cresswell K, Majeed A, Bates DW, Sheikh A. Computerized decision support systems for healthcare professionals: an interpretative review (in press). Informatics in Primary Care.

3.1. *Technical characteristics*

The literature consistently indicates that the majority of end-users are not averse to technology per se. However, they are likely to resist use of systems that are viewed as inadequate or, worse still, as interfering with their values, aspirations and roles [48,52,53,55,57,58].

A key feature of technology should therefore be, as demonstrated by a review of 101 studies of adoption by Gagnon et al. [58] that it is useful and offers relative advantages over existing practices. This is most commonly conceptualized in relation to speed: a new system needs to be at least as quick as the system that was previously operational (i.e. not significantly slow down users in their everyday work) [48,55].

Other features of technology that are repeatedly found to facilitate adoption include early demonstrable benefits, perceived ease of use, costs, the extent to which a system is

Table 1 – Summary of main findings from included studies.

Author and year	Key findings
Alexander and Staggers 2009	Reviewed the literature for human factors-related research in nursing Found the following to be important: effectiveness of user interfaces (e.g. simple, easy to navigate, reducing cognitive loads, graphical, heuristic compliance, information density, information presented in line with importance), including users in development and design, effective integration with existing work practices, impact of system on user workload, customizability of systems in line with user needs, flexibility of systems, ease of learning how to use a system
Boonstra and Broekhuis 2010	Systematic literature review to identify barriers to electronic medical record (EMR) adoption amongst primary care physicians Identified the following categories: 1. Financial – this includes high perceived start-up costs, high on-going costs, uncertainty surrounding return of investment, lack of financial resources 2. Technical – includes a lack of computer skills amongst users, lack of training and support, complexity of the system resulting in issues with usability, perceived limitations of the system (e.g. it may not address all needs or become obsolete), lack of customizability resulting in a system that does not meet the needs of users, lack of reliability (e.g. crashes), interconnectivity with existing systems (also includes fear that functioning existing systems may need to be replaced), lack of hardware to support EMR 3. Time (slowing workflow and increasing time) – time to select and implement a system, time to learn how to use a system, time needed to enter data into a system, increase in time spent on care due to disruptions in workload, time to convert existing records into an electronic format 4. Psychological – lack of belief that EMRs improve patient care, fear that EMRs may lead to a loss of professional control over patient information 5. Social – uncertainty about credibility and reliability of vendor, perceived lack of support from other parties (e.g. policy makers, other organizations), perceived impact on dynamics of doctor–patient relationship, perceived lack of support from other staff, lack of support from management 6. Legal – fear that data may be accessible to unauthorized third parties, lack of standards and guidance 7. Organizational – size (larger organizations find it easier to implement EMRs, may be due to better resources), type 8. Change process – organizational culture (needs to be supportive), lack of incentives (i.e. benefits to individual clinicians), lack of participation from other staff, lack of leadership (this includes the role of champions) • Factors are inter-related, some factors (organizational and change process) are mediating others
Gagnon et al. 2010a	Identified nine randomized controlled trials investigating the effectiveness of interventions increasing the use of clinical information retrieval technologies by healthcare professionals Different studies investigated the following types of interventions: educational meetings, educational materials, educational outreach, audit and feedback, multifaceted, and financial One study showed that the introduction of user fees significantly reduced the number of Medline searches Mixed evidence: three studies indicated a positive impact of interventions on use and four did not show significant effects, tendency to improve searching skills and use of electronic databases Overall, educational meetings were the only type of intervention reporting consistent positive effects on adoption
Gagnon et al. 2010b	Review investigating facilitators and barriers to HIT implementation: variety of inter-related technological, human, and organizational factors play a role (factors may belong to more than one category and overlap) Facilitators: perceived benefits/system usefulness, ease of use, compatibility with tasks and work processes, user training and support, champions, user involvement in design/strategy, organizational support and management Barriers: design, technical concerns, familiarity with technology, time consuming nature of use or increased workload, lack of compatibility with existing work practices, interoperability, concerns about validity of resources, cost, legal issues, patient/health professional interaction, applicability to patients, attitude of colleagues toward technology, role boundaries and changes in tasks, material resources
Greenhalgh et al. 2004	The authors drew on several research traditions to develop a multi-faceted model of the socio-cultural dimensions of organizational change in healthcare organizations. They divided existing research traditions into the following three broad categories: • Early diffusion research: including rural sociology, medical sociology, communication studies and marketing • Later diffusion research: including development studies, health promotion, evidence-based medicine • Research from the organization and management literature: including studies of the structural determinants of organizational innovativeness, studies of organizational process, context, and culture, inter-organizational studies, knowledge-based approaches to innovation in organizations, narrative organizational studies, complexity studies and organizational psychology

– Table 1 (*Continued*)

Author and year	Key findings
	They then further considered factors that can facilitate the successful implementation of innovations and proposed a framework of socio-cultural dimensions that need to be considered in this context. This framework suggests several key aspects, which include: • the nature of the innovation as perceived by end-users • strategies by which potential adopters can be targeted • the role of effective communication in introducing innovations • the importance and nature of both organizational and environmental context • how implementation is done most effectively and change is sustained • the role of external agencies in influencing successful implementation
Gruber et al. 2009	Systematic review investigating processes and outcomes associated with HIT implementation Categorized important outcomes on different levels: system, user, management, and patient outcomes System outcomes: user-friendly, meaningful screens and lists, system performance, functionality, integration with other systems, accessibility, decision tools, data availability User outcomes: acceptance, motivation to use system, confidence and self-efficacy, satisfaction, support, data quality and integrity, sharing of information to improve communication/efficiency and patient care Management outcomes: data for secondary uses and to facilitate decision making/quality control, compliance of staff with standards, leadership, efficiency of care processes and operational processes Patient outcomes: satisfaction regarding relationship with provider, improved communication Important overall factors: attention to clinical context of use, implementation/"go-live"/maintenance phases important, end-user support
Gurses and Xiao 2006	Systematic review investigating information tools that support information exchange and communication through multidisciplinary rounds Divide existing tools into: patient-centric information tools, decision-support tools, process-oriented tools Overall found that information tools improved situational awareness of providers, efficiency, and length of hospital stay Identify a range of needs of clinicians using tools: clinical information needs (e.g. results), decision information needs (e.g. decision tools), social and organizational information needs (e.g. protocols) Authors suggest that positive impact may be improved by using process-oriented information tools: i.e. those that help information organization, communication, and work management Identify a range of technical features that are important: summary and display of up-to-date information, supporting different users, use of mobile technologies to increase flexibility, checklists, supporting informal communication
Keshavjee et al. 2006	Canadian review of what makes EMR implementation successful, developed a framework based on review of qualitative implementation literature, followed principles of systematic review, 125 included qualitative articles • high incidence of failure in EMR implementation • there are several existing models that describe factors for successful implementation but none of these is inclusive enough • technology is implemented over a certain amount of time, people/processes and technology are involved, strong leadership is important, stakeholder communication and engagement is important, implementation is a dynamic and evolving learning process, usability is important Framework: • divides implementation into three time periods: pre-implementation, implementation and post-implementation • any factors identified can be in either one, some, or all of the phases • identified factors can have relationship with each other • factors divided into categories of people, process and technology

– Table 1 (*Continued*)

Author and year	Key findings
	• factors important in the pre-implementation phase: governance (investment in implementation from senior management, includes vision and organizational mission, allocation of resources), leadership (implementation team needs to consist of experienced project manager and champion representing the users, role of implementation team is to be a link between management and users, characteristics of a good manager include: effective planning and communication, participation of stakeholders, conflict resolution, motivation of users, needs to be realistic), involving stakeholders (relates to organizational readiness for change, this needs to be examined and involves addressing user concerns and needs, communicating how the new solution can address and fit in with these needs, communicating the vision, an understanding that change is difficult but can be overcome, address barriers, communicate benefits of the new solution), involve a variety of different stakeholders (to reduce resistance and increase acceptance, system needs to perform to fulfill users' needs, users are important for success of implementation), choosing the software (software needs to fit in with what the organization requires, need to assess cost and usability and supplier-related issues), integration (best if system integrates effectively with existing systems, need to determine how paper records will be entered, issues surrounding standardization), usability (need to consider both hardware and software usability, both need to fit in with existing work processes, EMR systems are often complex resulting in reduced usability, this requires extra time to do some actions and involves intense learning on part of the user, usability can be improved by flexible technology e.g. tablet computers) • factors important in the implementation phase: the new system needs to fit with clinical workflows (this requires a thorough understanding of existing work processes, needs to be iterative), training (needs to be hands-on and close to go-live, needs to be on-going and tailored to different pre-existing levels of experience among users), need to have good working relationship with supplier (supplier needs to incorporate changes suggested by users to improve usability, ideally have staff on-site, helpdesk support, robust contracts necessary, dedicated person in organization often useful to communicate with supplier, can utilize influence of "super users"/local champion), support (on-going support during and after implementation so that arising problems can be dealt with effectively and do not compromise care), communication and feedback (regular meetings with users, allowing users to voice concerns, evaluation of the implementation, dealing with problems, need to be flexible and recognize that technology and organization evolve together), need to address issues surrounding confidentiality and security (consider the relationship between these factors and ease of user access to EMR, need to minimize risks and address both patient and user concerns through appropriate systems and communication) • factors important in the post-implementation phase: recognition that implementation is on-going, is important technical support if things go wrong, on-going training of users and over a prolonged period of time to increase acceptance, on-going input into system usability by users to facilitate adoption incentives (for on-going use of the system, highlight improvements in care and demonstrate to users)
Ludwick and Doucette 2009	Canadian review of EMR adoption in primary care looking at articles from a range of countries with a view to identify lessons learned from EMR implementations (but examined evidence from a range of care settings), found that focus of articles was on sociotechnical factors, similar factors seemed important across care settings, also included grey literature/government and professional bodies literature • Found that sociotechnical factors were most important for successful implementation, important that the new system fits in with existing organizational goals and practices • Barriers were identified to be perceived negative impact on patient safety, privacy, impact on healthcare professional–patient relationship, reservations from users, implementation time needed, cost issues • Mitigating factors: good project management and leadership, training, standardization • Management support and clinical champions were success factors • Design and implementation need to be informed by users • Focus on different user perspectives and needs important • Barriers: user concerns (e.g. changes in work practices) may lead to resistance to adoption, resistance especially strong if users perceive change to be imposed on them, concerns need to be addressed to facilitate implementation • Implementation management important: can either implement using "big bang" or incremental approach, incremental approach better for complex organizations • Need to align system so it fits with existing work processes, users working with suppliers to design systems accordingly important • Users' previous experience with computers important and can influence adoption • The higher the usability of the system (e.g. intuitiveness) the higher adoption rates • Training important: affects adoption, important that length is adequate, support after implementation is adequate and the timing is adequate • Computers can affect the doctor–patient relationship as the consultation is done "through the computer" and conversation flows are interrupted • Found decrease in productivity immediately after implementation, found that once users get used to system there can be productivity improvements but mixed results into whether system results in time savings, no research on exactly how long it takes for organization to get used to system • Cost concerns common barrier to adoption, returns of investment important, maximum benefits only if connected systems across healthcare community, financial support from government can facilitate adoption

– Table 1 (*Continued*)

Author and year	Key findings
	• Found that with adoption there are improvements in patient safety but there can be initial adverse impact on patient safety due to sociotechnical issues: training and strong management can mitigate • Privacy concerns – but no study actually assessed impact of systems on privacy
Mair et al. 2007	Examined barriers and facilitators to the implementation of HIT and found technology design factors, health professional interactions, and organizational factors to be important Key barriers include: inadequate information management, inadequate inter-agency cooperation, intrusive technology/rigidity of system, cost, lack of testing Key facilitators include: positive inter-agency co-operation, flexibility, ease of use, organizational willingness, ability to order information Other factors: health professional/patient relationships and security
Robert et al. 2010	Review of organizational factors and processes affecting the implementation of HIT Innovation attributes, actors, and organizational contexts are inter-related and have important consequences for implementation and adoption Adoption and implementation needs to be viewed as a process consisting of both formal and informal components Importance of: interactions between groups in organizations, organizational history and decision-making, power relationships, professionalism, influence of social groups, importance of key individuals, relationship between organization and environment in which it is situated Overall, both pre-existing conditions as well as actions to facilitate implementation are important Lack of theoretical grounding in existing evidence base
Yarbrough and Smith 2007	Systematic literature review on technology acceptance by physicians, focus on the Technology Acceptance Model (TAM) in healthcare • Resistance by users is the greatest barrier to EMR implementation • Other barriers: lack of financial incentives to use, lack of empirical evidence of effectiveness, concerns surrounding confidentiality and security • Argue that TAM needs to be expanded to include organizational, system specific and healthcare specific factors • Barriers to acceptance 1. Disruption of existing work practices: systems often slow down care processes and are often viewed as less efficient, especially an increase of physician time on administrative tasks seems to be a barrier, cost of increased time spend by physicians 2. Lack of empirical evidence supporting the effectiveness of systems in relation to cost and quality of care 3. Organizational issues: organizational support including training and resources important, size of organization, local policies, demographic and individual factors such as level of experience with technology and salary status and value placed on relationship with patient, existing norms, needs to be collaborative and emphasis on teamwork 4. System issues: reliability and dependability, flexibility, important that physicians can adapt technology to suit needs and fit circumstances • Some barriers are important only for certain settings and in certain groups of users: e.g. in some healthcare settings cost may be a barrier to individual adoption (e.g. when providers have to pay for the system) but in some instances it may not
Yusof et al. 2007	Identified inter-related critical adoption factors relating to HIT: technology, human, organization information quality, system use and organizational environment Success factors: greater time efficiency for users, system flexibility and information accessibility, continuous user training and support, firm leadership, ease of use, system usefulness, system flexibility, technical support, response time/turnaround time, information accessibility, information relevance, clarity of system purpose, user involvement, user training, user perception, user skills/knowledge, user roles, clinical process, champion/medical sponsorship, internal communication Barrier: hierarchical structure of the organization

interoperable with existing technology in the organization and fits in with existing organizational processes, and the extent to which it can be trialed [55,58]. Given the constantly changing nature, leadership and priorities of complex systems such as health service provision, it is also important that the technology has the potential to be adapted (or customized) to support changing needs and individual/organizational contexts of use [57].

3.2. *Social aspects*

A number of social aspects surrounding technological innovation are highlighted throughout the literature as increasing the chances of "successful" implementation. These include information technology literacy and general competencies of users [52,53,55], personal and peer attitudes toward an innovation (including colleagues and patients) [55,58], financial considerations [48,49,58], and the extent to which the technology supports inter-professional roles and working [51]. Conversely, technologies which inadvertently undermine perceived social standing or professional autonomy are likely to be resisted by users [48,53,54,58,60].

On-going involvement of key stakeholders (including management, developers and users) at the conception and design stages, and an opportunity for field testing of early prototypes and open communication channels, can help to ensure that systems are likely to be valued and used by professionals and patients [52,56,58].

3.3. *Organizational factors*

Larger, more complex health systems have proven particularly receptive to the introduction of technological innovation [48]. This is in part because of their large human, organizational and financial capital, but also their complex management structures with great degrees of hierarchy. As such, available evidence highlights the importance of senior leadership and lead professional (or "champion") support, resulting in greater ownership surrounding implementation activities [48,50,52,53,56,58]. These champions frequently need to act as "boundary spanners", bridging the gulfs that often exist between and within information technology staff, management and clinicians [59]. They can also facilitate the re-design of workflows, provide adequate training and support to users, and highlight problematic issues [49].

The initial implementation can be disruptive for organizational functioning and individual ways of working as staff attempt to make sense of new workflows [48,59,60]. Making additional time available to individual users, for example, by proactively reducing workloads during this time period and/or introducing the technology when there are no other major upheavals in the organization, can help to mitigate the risk of unintended consequences [48,52,53,55,58].

Strong organizational leadership and management are necessary to ensure strategic consistency (i.e. to that individuals within organizations are working toward the common goal of successfully utilizing the technology) [48,50,52,53,56]. The literature shows that a pragmatic assessment of the likely benefits and trade-offs needs to be conveyed to users as part of this, including anticipated timeframes [48,52,53]. Additional considerations should comprise the avoidance of "scope creep", interoperability considerations, and the appropriate implementation approach suited to the technology and organization in question (for example, a slow and incremental "soft-landing" or a one-off "big bang") [53,58]. Throughout this process, management also needs to plan for potentially extreme contingencies, such as the technology failing [52].

3.4. *Ensuring "fit" between these technical, social and organizational dimensions*

The three dimensions discussed above are closely related, which means that achieving a certain degree of alignment (or "fit") between them is of prime importance. This alignment may be understood as a certain type of balance that needs to be in place to achieve one or more goals. If the goal is an implementation that satisfies the majority of stakeholders, a system needs to be not only usable (i.e. technically sound) and useful (e.g. fulfilling the needs of users, organizations and/or patients), but it also needs to be appropriately introduced by organizations (e.g. through engaging with, training and responding to the needs and expectations of relevant stakeholders). For instance, Picture Archiving and Communication Systems in United Kingdom secondary care fulfilled all these roles and, as a result, were readily adopted by users and organizations [61]. This point is exemplified in a systematic review by Yusof et al. who, after reviewing 55 studies using the Human (social), Organization and Technology-fit framework, conclude that "*all three technology, human, and organizational factors are equally important, in addition to the fit between them*" [56]. Although it is not particularly useful to be prescriptive about the nature of this "fit", such convergence appears much easier to achieve in relation to the organic, incrementally developed, "home-grown" systems that have been developed for use by relatively small teams/organizations than is possible in the larger more ambitious HIT projects that are now increasingly being parachuted into complex environments [53]. This may be due to the fact that in smaller-scale deployments, technical characteristics are easier to tailor to end-user and organizational needs. It may also be facilitated by greater organizational responsiveness to user needs and more effective communication between various structures and actors.

There is furthermore a growing realization that a new technology is easier to embed in an organization if there is a reciprocal (or mutually supporting) relationship between technical, social and organizational factors in which new, often unanticipated, ways of working are allowed to emerge [48,52,56,58,60]. This presupposes an acknowledgment that changes in any of these dimensions, be they small or large, may affect the implementation process and the use/design of technology in important ways. In such situations, other factors may therefore have to adapt accordingly to compensate for the change. For example, workarounds employed by users (social) to cope with perceived shortcomings in a technical system (technical) may, in some cases, result in more efficient ways of working. This perspective will be challenging for those pursuing linear implementation strategies, but unless such experimentation and re-invention is allowed and indeed encouraged by organizational strategies (e.g. by making certain workarounds "official") (see Box 4 for examples),

Box 4: Examples of how organizational strategies can support innovative uses of HIT [48,49,52–56,58–60].

General organizational characteristics

Organizational history and decision-making characterized by:

- Supportive organizational culture
- Recognition that technology and the organization evolve together
- A common goal and purpose

Specific organizational strategies

- Educational sessions about innovative uses
- Champions to facilitate innovative uses in different specialties/professions
- Effective communication and feedback about innovative uses throughout planning and implementation
- Involving suppliers and working together to discover and disseminate innovative uses

technology may never fulfill its potential [59]. Although a time-consuming and expensive process, evaluation of unanticipated consequences is therefore important. This should include evaluating consequences which may ultimately prove to be advantageous and also those which may inadvertently increase the risk of harm [52].

3.5. *A chronological perspective: a range of inter-related factors over time*

The literature further shows that technology implementation is characterized by a range of factors which are of varying importance during the diverse stages of implementation. For instance, a systematic review by Keshavjee and colleagues takes a chronological perspective, focusing on the significance of pre-, during- and post-implementation considerations [52]. This shifts the focus toward studying the interplay between these different dimensions at different stages of the implementation journey. Based on a critique of 55 reports of implementations of electronic health record systems, they identified how the focus of management activity changes as implementation proceeds. For example, activity should begin with extensive stakeholder discussions when making key decisions on software procurement in the pre-implementation phase, and follow through to the creation and nurturing of user support groups during the early post-implementation phase [52,56,58]. Extending this chronological view, Gruber and colleagues found that the availability of end-user support during "go-live" was particularly important [50].

4. Discussion

Overall, our review has indicated that appropriate appreciation of the importance of technical, social and organizational considerations is essential in ensuring that technological innovations are not only useful and usable (i.e. care provision)

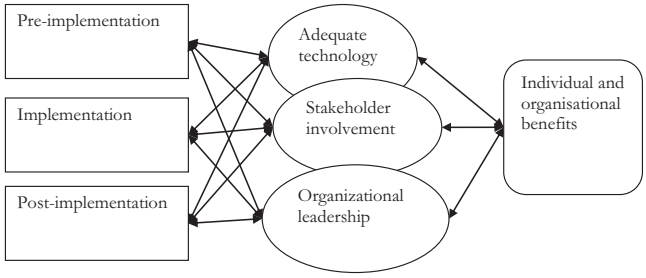

Fig. 2 – Inter-related technical, social and organizational factors over time in HIT innovation.

[48–50,54–56], but that they also support the organizations or systems within which patients and professionals operate (i.e. organizational functioning) [48,59,60]. However, it also needs to be kept in mind that these dimensions are inter-related, resulting in a need to pay attention to the reciprocal relationship of different technical, social and organizational aspects at different stages of implementation. The exact nature of the relationship between these dimensions is less clear, highlighting the need for further work in this area [62]. We depict this graphically in Fig. 2.

We have reviewed, synthesized and interpreted a large body of disparate knowledge of varying methodological quality pertaining to organizational considerations surrounding HIT implementations. This has allowed producing an integrated account of technical, social and organizational dimensions that need to be considered when implementing HIT, drawing on evidence from disparate bodies of knowledge and varying theoretical backgrounds [8,16,22–43]. The factors identified may to some extend help to guide future implementations by, for example, helping to direct attention toward strategic decisions that facilitate involvement of users during the design and implementation process, and provide the opportunity for customization of technologies [63,64]. Such considerations can help to minimize potential adverse effects whilst at the same time maximizing the chances of successful integration with individual workflows and organizational requirements. Table 2 illustrates how the factors identified in this work may be applied to real-life contexts relating to the implementation of HIT in different countries. This shows how the wider strategy can have a bearing on the different dimensions discussed, and how organizational issues can be used to identify, plan for and thereby ameliorate risks associated with HIT implementation.

However, the complex relationship between different technical, social and organizational dimensions identified in this work means that there is no prescriptive approach to "successful" implementation [52,56]. The emergence of unintended consequences may mean that strategies need to be adapted on an on-going basis. This is likely to require a careful balancing between organizational demands (e.g. resources), social demands (e.g. user requirements) and technical demands (e.g. interoperability and performance) [65].

We used a comprehensive strategy for searching the major medical databases to identify work of high quality. However, despite going beyond searching the relevant quantitative literature, we cannot in any way claim that our searches are,

Table 2 – An illustration of how wider strategic factors across countries may be associated with dimensions identified in this review.

	United Kingdom	United States of America	Australia
Strategy	Initially a central procurement of standardized HIT systems	Centrally funded incentives to promote implementation of a range of certified systems	Government investment and guidance combined with local systems choice
Technology	Chosen by government, so may lack essential technological characteristics useful for individuals and organizations	Some degree of systems choice so more likely to satisfy user and organizational needs, but danger that technology is chosen based on incentives as opposed to needs	Some degree of systems choice so more likely to satisfy user and organizational needs
User involvement	Limited by standardized software design	Limited by organizational drivers to choose technology (e.g. financial incentives)	Dependent on individual organizational strategies
Organizational leadership	Limited by heavy governmental involvement in strategic directions	Significant potential of organizational leadership in mitigating risks associated with HIT implementation and adoption	Significant potential of organizational leadership in mitigating risks associated with HIT implementation and adoption

given the very poor indexing of this literature, comprehensive. For example, as our focus was on assessing processes involved in the implementation of medical technologies, we did not search non-medical databases directly related to the topic areas of interest. Overall, much of the available evidence concerning organizational issues in relation to HIT innovations is anecdotal and retrospective in nature stemming from single organizational experiences of implementing a specific application. These tend to be descriptive accounts, without much attention to relevant theoretical considerations, which makes drawing generalizable lessons from such reports difficult [66]. Nevertheless, we have provided a starting point for the development of best practice guidelines for implementation, although this will need to be empirically tested and refined in future work. More in-depth work is also likely to bring to the fore additional wider contextual factors that go beyond the immediate organizational environment, such as for example intra-organizational relationships and political developments (see Table 2) [67].

5. Conclusions

Despite some previous work, organizational issues have not received appropriate attention in the literature to date [68], which may be due to them being experienced in different ways by different actors. As a result, they are difficult to measure objectively, difficult to predict and time consuming to plan for. Nonetheless, organizational issues are coming to the forefront of the HIT agenda due to a general consensus within the field that technological innovation is not designed, developed or deployed in a vacuum.

The numerous disciplines or bodies of knowledge which contribute to the study of technical, social and organizational issues are rich in potential to facilitate implementation and adoption of innovations in increasingly complex health service systems [69]. Research employing expertise in these fields is therefore central to furthering knowledge on organizational adoption and generalizable best practices for implementation.

Authors' contributions

AS conceived this work and together with KC led on drafting this review. AS and KC are guarantors.

Conflicts of interests

All authors declare that they have no conflict of interest.

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Summary points

What was already known on the topic?

- The study of organizational issues in health information technology innovations is a multi-disciplinary field utilizing bodies of knowledge from organizational psychology, change management, and human factors.
- There is a general consensus that organizational issues can both facilitate and inhibit the implementation and adoption of technological innovation in healthcare, particularly those innovations that are likely to have a major discernible impact on care processes.

What this study added to our knowledge?

- While there is at present no overarching conceptual framework in relation to the implementation and adoption of health information technology innovations, research consistently emphasizes the importance of technical, social and organizational factors, and the inter-relationships between these.
- Early and on-going user involvement, relative advantage of the technology and early demonstrable benefits, a close fit with organizational priorities and processes, training and support, and effective leadership and change management seem to be particularly important.
- This work has enabled us to produce an integrated account of technical, social and organizational dimensions that need to be considered when implementing HIT, drawing on evidence from disparate bodies of knowledge and a range of relevant theoretical perspectives.

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