

## Improving Interaction in Integrated Chronic Care Management

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**Abstract**—Health and social care services are under increasing pressure to come up with adequate solutions to manage the demand and supply equation. Integrated care is one way to deal with this wicked problem, but new approaches and service implementation strategies are necessary to realize its full value and quality of outcome. Focusing on the four relevant ‘blocks of interaction’ identified by Prahalad and Ramaswamy, the paper examines the key role of information and communication technology (ICT) in facilitating the integrated care effort. It then develops those insights into a set of DART-informed guiding principles of practical use to decision-makers and IS/IT developers in the design of resource integration mechanisms for the management of chronic care settings. The paper uses home care services as a blueprint.

**Keywords**—integrated care, patient experience, chronic patients, healthcare service ecosystem, DART, service logic

### I. INTRODUCTION

Health systems around the world have gradually evolved to better address the changing needs of the populations they serve. In times of continued resource reduction the design of integrated care models is an important strategy for increasing health system performance [1]. Integration has many meanings. For our purpose, integrated care designates a coherent set of methods and models on the funding, administrative, organizational, service delivery and clinical levels designed to create connectivity, alignment and collaboration within and between the cure and care sectors [2]. An integrated care system is therefore a system where collaborative activities between diverse actors and across a range of distant organizations provide desired health outcomes [3].

Improved integration is at the heart of many national and international prescriptions for reforming systems of care and support so that they deliver better health and wellbeing outcomes [4]. Chronic diseases and long-term conditions are a case in point. In the care of frail patients, community resources, policies, and health systems must integrate in a coherent way [5]. This is difficult to achieve; integrated care requires not only tight interdisciplinary teamwork and communication/information exchange with the supporting processes [6]. One common strategy for chronic patients is to build a system to assure the delivery of effective, efficient clinical care and self-management support. Usually ‘health

care systems’ are meant as networks of multiple and interdependent actors, including clinicians, nurses, and allied health professionals. In recent times, a broader notion of “service ecosystem” has emerged, a term highlighting the multiple exchange of value and resources among actors [7]. In chronic care settings there is increasing acknowledgement that key actors are also family members and informal caregivers whose advice and support offer substantial benefits to patients. Such a view gives critical importance to contributions from the user’s sphere [8] in the improvement of the quality of health and social care services.

In general, health care organizations (HCOs) are likely to pursue opportunities to integrate health services or programs that generate appropriate response and significant cost efficiency. However, the existence of organizational boundaries means that service delivery systems still tend to operate in a fragmented (‘silo-based’) way, which can lead to poorly coordinated services and poor outcomes. For example, the separation of health and social care is a common problem in the provision of coordinated long-term care [9]. In sum, there is scope to enhance the patient experience through integrated services and programs.

The above priorities motivate the present paper and provide the conceptual underpinnings for the proposed set of guiding principles for resource integration in the health service ecosystem. The crucial research question addressed here is: *How can Healthcare IT improve interaction and patient experience in chronic care settings?*

The study offers two key contributions. First, it develops a framework built on IS/IT disciplines and service disciplines in order to capture the various theoretical themes and concepts in healthcare in chronic settings. Second, it analyzes the key role of information and communication technology (ICT) in facilitating integrated healthcare, in particular: functional integration (between and among actors), clinical service integration (normalizing the patient’s journey through the system), and information integration (through a unified information management infrastructure) for a coherent source of informed decision-making [10].

The paper then discusses the integrated use of ICT in the healthcare service ecosystem, which not only enables diverse actors and artifacts to interact more effectively and efficiently, but also shapes a more positive experience for the patient.

Informed by DART principles, the paper focuses on the four primary ‘blocks of interaction’ to offer guidance for decision-makers and IS/IT developers. Finally, we highlight a number of key implications of our approach.

## II. THE USE OF ICT IN INTEGRATED CARE

Healthcare Information Technology (HIT) is the implementation of information and communication technology (ICT) in the health information management setting. “Integration” of health and social care and related services (e.g., mental health, housing and transportation) for chronically ill and disabled populations, especially for the frail elderly, is a buzzword of the 1990s [11].

People with chronic illnesses and disabilities are an especially vulnerable group, and are the most likely to benefit from integrated care. For both patients and family carers, the nature of these conditions presents difficult challenges in terms, for instance, of arranging care, and following treatment regimens and controlling symptoms. The challenges on the provider’s side are daunting as well. Regardless of context, it is often difficult to obtain comprehensive assessments, to put together service packages, to monitor changes in health status, to work within existing funding constraints, and to coordinate care from a mix of providers through periods of acuity, maintenance, rehabilitation and transition [11].

While the integration of care is laudable in theory, achieving its aims has proven challenging [12], especially for quality care outcomes in chronic care [13].

Both research and empirical experience suggest the necessity for new proposals for ICT architectures that can cost-effectively integrate processes without introducing significant changes to organizational models (which are often subject to legal constraints) [14]. For example, health and social care services are presented in this paper regarding frail people; a review of various ICT projects for integrated care and identified shortcomings in terms of project sustainability are presented [14]. Other shortcomings of commonly offered solutions relate to the narrow focus on service boundaries, organizational and process coordination and the continuity of services involving a patient-centered path to care. Most of the projects reviewed rely on ICT for data collection and retrieval. However, these projects do not mention latent features of ICT solutions that could provide for a longer sustainability.

Other studies have considered principles of services and financial integration as enablers of a sustainable integrated care [15]. In rural settings, case studies have shown that a sustainable integrated care is possible through the implementation of recruiting practices from schools to hospitals, attracting and retaining health care professionals, supported by the development of electronic information systems [16].

For integrated care solutions, such as in the case of the ATTIV@BILI Project, Restifo and colleagues have introduced two key fundamentals: the identification of a single point of contact (a case manager); and the endorsement of multidimensional tools that assess needs and support

identification of care goals. The introduction of a case manager ensures the coordination of service delivery between several providers. Multidimensional tools based on ICT support the process by reducing the transaction costs associated with information sharing and avoiding redundancy and inconsistency of data [17].

In addition, Restifo and colleagues propose to integrate existing health and social care software applications with a middleware system that acts as an orchestrator of processes, messages, queues and communications (ICT applications) and the need for coordination mechanisms between managers and social and healthcare services providers (Organizational) [14]. For instance, the model in question deploys Ambient Intelligence (environmental sensors and interactive media) to facilitate communications between service recipients and caregivers and Body Area Sensors (smart assistive devices for monitoring events and patient health progress) to monitor the patient’s vital signs. Therefore, leveraging the potential of technology to improve the multilevel interactions of the care teams is, in our view, key to ensuring the sustainable delivery of integrated care. In fact, ICT could play a larger and deeper role if implemented succinctly [18], in order to provide a better integration between the use of technology and the administration of quality care.

## III. INTERACTION IN CHRONIC CARE MANAGEMENT

A body of literature recognizes health care as a complex system of interactions between different actors [2]. At the *macro* level are state health authorities, professional associations of doctors and nurses. At the *meso* level actors include hospitals, clinics and local health support agencies. Finally, at the *micro* level there are clinicians and patient working together with nurses and allied health professionals to collaboratively design a health care package, as well as collaborating with family, friends and other patients on these issues [7]. Home care involves the interaction between professionals from different fields and disciplinary sectors, and the interaction between heterogeneous structures to realize the unitary take-up of the socio-health and welfare needs of the service recipient.

Interaction describes the mutual or reciprocal action where two or more parties have an effect upon one another [19]. In a healthcare context, interaction takes place in service encounters. The quality of the interactions between the parties is fundamental for value co-creation [19].

The literature identifies customer experience (or, more generally, user experience) as a focal issue in any type of service context. Interestingly, in service management studies, the idea of service ecosystem has gradually replaced that of network, precisely to highlight the evolving and dynamic nature of the exchange relationships among multiple actors and their respective resources. The biological metaphor, moreover, underscores “the importance of common organizational structures and sets of principles to facilitate resource integration” [20], which is of particular interest for the purposes of this paper.

Thus, the decision to adopt a service ecosystem lens is motivated by the desire to draw a more comprehensive picture of what happens when different actors interact in practice: “[they] integrate and use available resources, guided by the norms and rules of the social context, so enhancing service innovation” [21] p. 6.

#### IV. BUILDING BLOCKS OF INTERACTION IN CHRONIC CARE MANAGEMENT

What we can take away from the above commentary is that [2] value is situated, i.e., it is co-created through “the experience of a specific consumer, at a specific point in time and location”.

According to Prahalad [22] and Prahalad and Ramaswamy [23], the building blocks of the experience-based value creation paradigm are: Dialogue, Access, Risk-Benefits and Transparency (DART). This approach gives technology a broader role. In healthcare settings, technologies are not an end in themselves. Instead, they are ‘experience enablers’ [22]. For example, “miniaturization is not merely a technological breakthrough but could enable experience innovations such as self and remote diagnostics and tracking and monitoring” (p. 175). The two scholars identify four “building blocks of interaction” between the provider and the everyday users that shape and facilitate co-creation experiences: dialogue and communication between stakeholders; the ability of stakeholders to access and share data; the ability to monitor risk-benefits; and, finally, the transparency among stakeholders eliminating information barriers [23].

Recently, Badr and colleagues [24] extended Prahalad and Ramaswamy’s original DART model and devised a set of principles for ICT solutions that promote interaction in the inner circles of the care team. Here, we borrow from this research work to underpin a set of principles for ICT solutions that align the feature functionality to the delivery system for integrated care. These four principles can be summed up as follows:

##### A. Dialogue (D))

Mechanisms enabling integrated care for patients with chronic diseases depend on the use of ICT to enable support for coordination of care and information sharing between professionals and between organizations [24, 25]; this includes the implementation of reminder systems, systems for information sharing and decision-making, and systems to provide an overview of the patient population. A sustainable and less inherently risky care-giving process must close the communication and information exchange gap between the formal and informal care teams in order to enable these to communicate continuously with the primary care providers. This is pivotal to patient outcome and quality of care [26], especially in the early stages of the caregiving journey, when the carers seek recommendations, guidance and endorsement to sources of relevant information. Other examples include the ability to integrate Mobile Health Technologies [27] with the existing user applications adopted by the patient and the circle of care (secure text messaging, monitoring devices,

telemedicine with cloud support and mobile device enabled patient portals) [28].

This building block underpins the first guiding principle:

*Proposition 1. Development of ICT applications with features that enhance the value production of integrated care through functions that improve dialog, communication and coordination capabilities.*

##### B. Access (A)

Ideally, ICT solutions for integrated care will aggregate the data collected from different sources in the care ecosystem and enable its analysis and translation into essential feedback for patient monitoring, alerts and diagnosis, and to provide important treatment information, connecting providers, patients, caregivers, communities, etc., with a strengthened organizational support across the ecosystem [14]. Hence, in order to improve access to crucial information, ICT applications must provide access to data for the understanding of the course of disease and knowledge of treatment information [29]. These tools must be easy to use, with clear displays, visual aids and memory aids, and provide opportunities for training and support [24] with extensions to online assisted literacy resources [30]. Home-based assistive devices would be required to support the wider range of patient potential disabilities affecting their ability to use domestic technology [31]. The selection of an appropriate technology at home must take into account the individual's strengths and weaknesses in areas such as reading, writing, math, spelling, listening, memory, and organization as well as the individual's prior experience with and interest in using assistive technology [32].

Hence, the “Access” building block of interaction underpins the second guiding principle:

*Proposition 2. ICT solutions for integrated care will aggregate the data collected from different sources in the care ecosystem, enable its analysis and translation into essential feedback/treatment information, and be accessible and easy to use for all healthcare ecosystem users.*

##### C. Risk Mitigation (R)

Extant pressure of technology usage skills may introduce data entry errors due to barriers of computer illiteracy [33]. In order to reduce the burden of care on those involved, ICT integrated care applications need to facilitate the closing of the knowledge gap and literacy levels. Elderly problems, such as fall risk, chronic disease, dementia, social isolation and poor medication management, can be significantly reduced by the integration of assistive technologies. The risk of error can be reduced with features such as computerized prescription tools and medication dose calculation devices that indicate the correct intake of prescribed medicine [33]. Other risk mitigation strategies include the deployment of informational tools, including online portals and factsheets with clear and comprehensive instructions and guidelines.

Therefore, for our context, the “Risk Mitigation” building block underpins the third guiding principle:

*Proposition 3. To reduce the potential of errors and lessen the burden of care for all stakeholders, ICT applications for integrated care must include features that close the knowledge gap and literacy levels.*

#### D. Transparency (T)

In order to motivate the use of technology-based support services among the caregivers, it is not enough to provide them with informational tools to enhance their access to data and knowledge; the carers need to receive adequate training and encouragement to learn the required skills. Patient engagement features need to address any security and privacy issues, allowing patients to control who has access to their records. In fact, one of the founding principles of information sharing in healthcare is that access to patient health records and personal data is restricted to exclusively authorized healthcare providers, otherwise questions of confidentiality may be seen to outweigh the benefits of the quality of care [34]. Further, transparency and leadership commitment would lead to greater consumer engagement along the care continuum [39]. Workflow clarity is a vital component for role definition and understanding for transparency in information flow among the circle of care through secure and clear messaging. ICT-based workflow (case) management tools built around a delivery infrastructure through the relative location of the disciplines provide a baseline for service integration in the sequence through which the patient journey is managed for effective care integration [25]. The varying composition of the care teams, including health and social professionals, nursing, and other practitioners (pharmacy, therapy, etc.) requires coordination and the clear assignment of key roles to ensure continuity and correspondence of services for the patient, which must be executed without the risk of unauthorized breach to sensitive patient data.

This building block underpins the fourth and final guiding principle, directly related to the pillar of transparency in interaction:

*Proposition 4. ICT applications for integrated care will incorporate patient engagement features that allay security and privacy fears, offering transparent access to health records and personal data with the appropriate workflow tools that ensure continuity and correspondence of services for the patient.*

#### V. CONNECTING THE DOTS: THE CONTRIBUTION OF THE DART FRAMEWORK

DART illuminates the patient experience, or the experience that is borne out of all forms of interactions, communications and transactions regarding the service, over time [35]. In contemporary care settings, this experience extends beyond dyadic relationships and is mediated by a vast array of technologies and platforms.

For example Project INTEGRATE, a European Commission funded research program (2012-2016) uses the acronym DHT (Digital Health Technology) to mean “combinations of hardware and software for specific purposes, (e.g. remote monitoring of heart rate) or general

systems (e.g. electronic health record system for a health system, or digital fiber network or internet system for connecting providers)” [36]. However, while early studies have emphasized the pervasive role of ICT as an operand resource (i.e., to help hold together diverse actors and enable collaboration in the health system), a service logic view draws attention toward technology as an operand resource - one that is capable of acting on other resources in value creation at multiple levels - micro, meso and macro - of interaction [20].

Moreover, and more importantly, according to a service logic, ICTs are becoming increasingly a part of new offerings through digitization, which allows the technology to be a trigger of innovation [37] “in varied areas of the health care” [38].

The four building blocks of interaction illustrated above indicate the different approaches open to HCOs that wish to pursue such a comprehensive strategy.

#### VI. AN EMPIRICAL CASE: THE ATTIV@BILI PROJECT

As a use case, we present the architecture developed by ATTIV@BILI, a regional project in Italy tasked to define a coherent health and care architectural system to be used as a pilot case in targeted areas of the Regione Lombardia. In particular, the sphere of interest is the care of frail people (the elderly and people with disabilities), who require a combination of health and social homecare services (integrated care). An analysis of the literature and of selected empirical case studies shows a clear need for new sustainable proposals of ICT architectures capable of cost-effective process integration. Further, there is a need to process (re)engineer the existing structures to align with the new needs. The IS/IT platform developed by the ATTIV@BILI team to support the caregivers and providers integrates current and new technologies. The platform did not require heavy investments in new systems as it was designed to integrate with the smart domotic devices already installed at the patients’ homes or assisted living complexes. ATTIV@BILI integrated care middleware factors in dimensions such as end-to-end services and macro-classes of patients (see the As-Is and To-Be architectures shown in Fig. 1).

The above propositions could serve as high-level statements that hopefully would guide the design, implementation and architectural foundation of the ATTIV@BILI project. Evidently, the propositions may be replicated in diverse contexts and adapted to take account of local specificities. The To-Be platform (see right side of Fig. 1) reflects the DART principles, specifically:

- Dialogue: the platform enables the social and health care teams to coordinate patient care and share information;
- Access: the software aggregates the data collected from different sources in the care ecosystem and enables its analysis;
- Risk mitigation: the new technologies integrate seamlessly with the existing systems;

- Transparency: the platform provides the caregivers with improved access to the relevant data and knowledge; training modules, informational tools, factsheets and guidelines. The system offers functionality features designed to engage the patient.

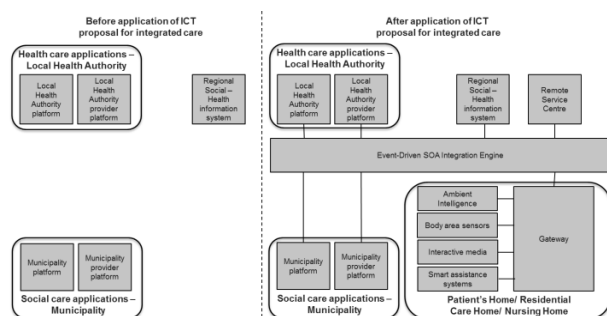


Figure 1: ATTIV@BILI integrated care project

## VII. DISCUSSION

The DART framework is an effective way of identifying the specific capabilities required from HIT applications. These should be patient-centric and focus on engaging the patient through everyday service interactions.

The use of the DART building blocks of interaction in a context such as the ATTIV@BILI Project lays the foundation for integrated health and social care. Distributed software applications that connect to a common gateway (the IS of Regione Lombardia in ATTIV@BILI, for instance) are an effective solution to manage the interaction among the care team. In sum, the middleware becomes a vehicle of provider-led integration, and DART complements the technical approach to integration: in other words, DART is an enabler of user-led co-creation of value.

The study presented pays particular attention to the principles of communication, data management, training and patient engagement. However, these principles are not necessarily exhaustive, which means that future research is needed to tease out any additional principles that can inform the improved guidance and delivery of effective chronic care management. Those principles will then need to be tested and validated in diverse contexts.

It is important to note that the framework and proposals developed in the paper are not an attempt to apply the logic of standardization to the service ecosystem, which would be both impractical and unrealistic, given the high degree of heterogeneity of integrated care practices in place, and the impossibility of forecasting future demands for care. Rather, the principles are to be understood as a common set of rules of the game. In the words of Lusch and Nambisan [20], the principles constitute a sort of "*architecture of participation* in the ecosystem that coordinates actors and their service exchanges" (emphasis in the original, p. 163).

As a result, the principles allow local adaptations without imposing further constraints and can be implemented selectively, e.g., around specific health and social needs, but also to enhance and complement existing tools and platforms.

The DART framework informs and guides the IT/IS developers and decision-makers in the effort to design, deliver, monitor and evaluate integrated care services that align better with the user's needs. For example, applying the DART framework to the ATTIV@BILI Project context may help to pinpoint what differentiates effective from ineffective integration solutions and integration problems. The use of middleware enables the development of an ICT infrastructure that connects remotely delivered services in a sustainable way, i.e., with minimum impact on organizational processes of the relevant providers.

The primary benefit is that solutions are replicable in different contexts and, ideally, at different degrees of integration. Decision-makers can calibrate responses to situations of fragility according to the demand and the existing level of integration of the supply network.

## VIII. CONCLUDING REMARKS

This paper has explored the potential of ICT and service management in integrated care. Drawing on the ideas advanced in HIT research and in service marketing scholarship, we suggest it is time to push beyond a primarily technical view of integration in order to gain a broader understanding of HIT-supported and patient-centered integration in chronic settings.

In a scenario where the continuum of care is populated by multiple actors, the paper has addressed only a limited number of the many complex issues that contribute to the highest realization of value in quality care outcomes. Specifically, it has not examined the socio-economical and/or legislative factors that may favor or restrict open interaction in the circle of care, such as information-sharing and data privacy legislation. Thus, the insights offered here are intended solely to sow the first seeds of the effort to strengthen our understanding of the potential of service logic applied by HCOs.

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