

Extending the Business-to-Business (B2B) Model Towards a Business-to-Consumer (B2C) Model for Telemonitoring Patients with Chronic Heart Failure (CHF)

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Abstract

Purpose: The purpose of this paper is to describe an alternative approach to telemonitoring patients suffering from Chronic Heart Failure (CHF), i.e. the Business-to-Consumer model (B2C), by extending the current Business-to-Business model (B2B). The B2C model is the one where the customer, in this case the patient, is the payer for the services consumed. We describe and perform an initial evaluation of the extension of the B2B to the B2C model for telemonitoring patients with CHF.

Design/Methodology/Approach: We explored the problems in implementation of telemonitoring via the B2B model by means of a Root Cause Analysis, including the *5-whys* method to help us understand the shortcomings of the B2B approach, and then the *5WH* method to explore whether the B2C is a better strategy. The extension of the model was executed in the Business Model Generation framework. By using qualitative content analysis techniques we supported our argumentation with findings from other studies.

Findings: The B2C model is based on the interplay of four agents – Healthcare Provider, Equipment Manufacturer, Payer/Regulator and Distributor/Promotor – all working together to improve health related outcomes in a jurisdiction. The success of the extended model in telemonitoring CHF hinges on Telemonitoring Center and Telehealth Nurses being repositioned in the out-of-the hospital setting.

Social implications: We believe that penetration of mobile telehealth via the B2C model will allow for greater availability, access and equity in healthcare for patients with CHF.

Originality/Value: We introduced a fourth pillar to the existing B2B model, i.e. Distributors and/or Promotors. The B2C model we propose does not exist currently but might allow for scalability, generalizability and transferability of telemonitoring currently unattained with the B2B model.

Keywords: Telemonitoring; Chronic Heart Failure; Business Model; B2B; B2C;

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Introduction

Population aging is no longer a rich-country phenomenon. In high-income, as well as in middle and low-income countries the populations are getting older, the healthcare workforce is becoming scarce and the cost of care is accounting for an increasing proportion of the Gross Domestic Product (Bodenheimer, 2005; Lee *et al.*, 2010). At the same time, healthcare delivery is fragmented, uncoordinated and not value-based (Porter, 2009; Gomes and Moqaddamerad, 2016).

The greatest burden of disease globally is attributed to chronic diseases, which are expected to continue to contribute the most disability-adjusted life-years (DALYs) through 2020 (Krum *et al.*, 2005). Mathers and Loncar (2006) further investigated the global burden of disease in the years 2020-2030 and found that there will be no change in rank from the first Global Burden of Disease study (Murray and Lopez, 1997), with ischemic heart disease topping the list of the leading causes of death in high-, middle- and low-income countries (15.8%, 14.4% and 13.4% of total deaths, respectively). Ischemic heart disease is “the principal etiology of heart failure in the Western world” (Remme, 2000).

Many patients suffering from chronic diseases are not sufficiently empowered to manage their own disease, they rarely have means to track the disease progression and their understanding of the disease is vague (Krumholz *et al.*, 2002). Moreover, the majority of chronic patients are suffering from multimorbidity, i.e. two or more chronic diseases (Barnett *et al.*, 2012; Oostrom *et al.*, 2014; Ornstein *et al.*, 2013).

Telemonitoring has the potential to support timely detection and slower disease progression in chronic heart failure (Chaudhry *et al.*, 2007). Inglis (2010) defined telemonitoring as “the transmission of physiologic data, such as an electrocardiogram (ECG), blood pressure, weight, respiratory rate, and other information, such as self-care, education, lifestyle modification and medicine administration, using... technology like broadband, satellite, wireless or Bluetooth”.

Today, telemonitoring is mostly implemented via a Business-to-Business model (B2B), usually involving cooperation between a healthcare organization and an equipment manufacturer (Herzlinger *et al.*, 2014).

A business model describes “the rationale of how an organization creates, delivers and captures value” (Osterwalder and Pigneur, 2010). The B2B model in electronic communication has its advantages: 24/7 availability, breaking geographical barriers, selling in batches, organization-wide implementation and elimination of the ‘middleman’ (Botha *et al.*, 2008). However, the key challenges of the current model are well documented too: staffing, project management, provision of support, technology, partnerships, funding and strategy (Joseph *et al.*, 2011).

It has been difficult for telemonitoring introduced via a B2B model to become mainstream, as it seems not to flourish after the pilot testing phase (Willemse *et al.*, 2014). A broad deployment of patient-centric solutions is hampered by barriers, both external, like market forces, and internal, like the medical technology companies’ impotencies (Erhard *et al.*, 2013). The successful model of implementation will have to satisfy the Triple Aim criteria: 1) improve the experience of care, 2) improve the health of patients, and 3) reduce costs (Berwick *et al.*, 2008).

Our analysis concerns patients with chronic heart failure (CHF) because of the severity of the disease and its universality. Based on the Framingham Heart Study, 30-day mortality for these patients is around 10%, 1-year mortality is 20-30%, and 5-year mortality is 45-60% (Levy *et al.*, 2002). In 1928 the New York Heart Association (NYHA) established a chronic heart failure classification that is now used worldwide (Dolgin, 1994), and has divided the patients into four groups according to the severity of the disease expressed in physical limitations and shortness of breath. As CHF is a highly lethal disease, patients need help and encouragement to adhere to the medical regime (Hanyu *et al.*, 1999; WHO, 2011).

Our objective is to describe a new model for the implementation of telemonitoring, i.e. the Business-to-Consumer model (B2C), by extending the current B2B model. B2C model in healthcare is enabled by digital technologies, and the advent of internet, where the customer (i.e. the patient) is the payer for the services consumed. We are keen on exploring whether extending the B2B model to B2C can “support citizens’ and patients’ health and well-being in the home and on the

move ... and enable a virtual healthcare continuum” on an unprecedented scale (Schug, 2014), and if there is a difference to be expected in the speed and scale of implementation of telemonitoring for CHF patients via the extended business model.

Methods

Extending the Business-to-Business model (B2B) in telemonitoring of patients with chronic heart failure took three steps: 1) a Root Cause Analysis of problems in implementation of telemonitoring via B2B, 2) possible improvements via the B2C approach, and 3) the creation of the extended business model.

In the Root Cause Analysis section (Williams, 2001) we first applied the *5-whys* method in order to understand the shortcomings of the B2B model in telemonitoring of patients with chronic heart failure, and then the *5-whys-1-how* (5W1H) method for exploring whether the B2C might be a better strategy. The *5-whys* technique is used to explore the cause and effect relationship (Asian Development Bank, 2009) while the 5W1H technique is used to understand the context of the problem, and is called the Kipling Method because those six questions – *Who?*, *What?*, *Where?*, *When?*, *Why?* and *How?* – have been immortalized in a Rudyard Kipling poem published in “Just So Stories” in 1902 (Kipling, 2013). We selected and consulted scientific literature, brainstormed on these questions, and took a *devil’s advocate* perspective to each of the five answers.

The model itself was crafted according to the Business Model Generation framework (Osterwalder and Pigneur, 2010; D’Souza, 2015). We employed this methodology as a proven one in various companies for generating innovative business models (Ahokangas and Myllykoski, 2014). It consists of nine building blocks: Customer Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, and Cost Structure.

We supported our analysis with papers published in peer reviewed journals, covering multiple countries, and where possible in the form of reviews and meta-analyses. We searched for publications in English, since 2000, and in some exceptional cases from the 1990s. In addition, we used online resources of

business literature from the same period (including ideas and concepts from various consultancies, companies, and magazines). As we are presenting a viewpoint article, we tried to support our argumentation with findings from other authors. We opted for a convenience sample (Given, 2008) of papers instead of a more systematic selection. Convenience sampling is a non-probability technique that uses sources because of their accessibility, which introduces bias. We looked for papers that support and oppose our perspective and included both, if found. We used qualitative content analysis techniques for systematization of ideas from other authors, in order to allow for categorization and quantification of presented concepts (Mayring, 2000). We worked with prior formulated, theoretically derived categories of *5-whys* and 5W1H methods, where the qualitative step of the analysis consisted of a methodically “controlled assignment of the category to a passage of text” (Mayring, 2000).

Results

Root Cause Analysis

Shortcomings of the B2B approach

Here we list the barriers of the B2B model to the implementation of telemonitoring. We start from the finding that the prevailing business model is not optimal for telemonitoring of CHF patients (Coye *et al.*, 2009) and investigate further the barriers reported in the literature.

The biggest trial in telehealth to date, the Whole System Demonstrator (WSD), which was carried out in three regions in the UK, lists the following barriers to participation and adoption of telemonitoring: “requirements for technical competence and operation of equipment; threats to identity, independence and self-care; expectations and experiences of disruption to services” (Sanders *et al.*, 2012). If the business model is based on the telemedicine service where equipment is being paid for, which was the case in the WSD, the problems obviously relate to technical and privacy issues.

Willemse *et al.* (2014) list the following three barriers for telemedicine in Belgium: 1) financial constraints, 2) incomplete transmural coordination, cooperation and digital communication and 3) telemonitoring not being integrated in routine care. On the financial constraint

side, the authors postulate lack of equipment (devices were not provided after the pilot phase) and no financial remuneration foreseen for the follow up of telemonitoring. In terms of coordination, cooperation and communication problems they list issues such as industrial partners offering different platforms for data storage; follow-up and coordination only performed in the own organization; no integration of telemonitoring data in patient records; transmural data sharing was not carried out; regular healthcare providers often did not participate. In terms of integration with routine care, telemonitoring was considered to require an additional effort in the pilot projects (Willemse *et al.*, 2014).

Coye *et al.* (2009) examined in greater depth the overview of barriers to the implementation of remote patient telemonitoring. On financial constraints they state that “financial models and assumptions needed to calculate costs and return on investment do not exist” (p. 129). Without detailed calculations of direct and indirect costs, be it healthcare or non-healthcare, no sustainable innovation can be successfully introduced. They continue: “perhaps most difficult of all – there are few models of implementation by individual physicians, large medical groups, or healthcare delivery systems to draw upon” (Coye *et al.*, 2009). Continuing to ask *why?* will eventually lead us to the “principal barriers” to innovation in chronic care: the (poor) effects of benefit design and reimbursement mechanisms (Baron and Cassel, 2008; Bodenheimer, 2008; Boulton *et al.*, 1999).

Medicare/Medicaid, a US national social insurance, “reimburses for telehealth services when the originating site (where the patient is) is in a Health Professional Shortage Area (HPSA) or in a county that is outside of any Metropolitan Statistical Area (MSA), defined by HRSA and the Census Bureau, respectively” (HRSA, 2015). Medicare will reimburse for face-to-face interactions, store-and-forward applications (e.g. remote ECG application) but there is no single accepted reimbursement standard for private payers. The American Telemedicine Association conducted a national online survey of private payer reimbursement in 2012 and found “that private payers have administrative rules regarding telehealth reimbursement that are barriers to services and reimbursement, and that some providers would benefit from being better informed about billing and coding for telehealth services and how

to advocate for telehealth services reimbursement” (Antoniotti *et al.*, 2014). In conclusion, Antoniotti *et al.* (2014) list the major reasons for not billing for services delivered via telemedicine: no Medicaid reimbursement (33%), major payers do not pay (32.4%), practice in urban area (19.3%), services are bundled through contracts (17.4%), could not get support from my organization (4.7%), too risky for penalties for fraud and abuse (4.7%), and other (43.9%).

Improvements via the B2C approach

Extending the B2B model towards the B2C model concerns the improvements in the following aspects: cost-effectiveness (i.e. health for money), modus and timing of introduction, education and self-management.

One of the impediments to wider uptake of telemonitoring is its business model (Acheampong and Vimarlund, 2014) while the other is its cost-effectiveness (Grustam *et al.*, 2014). The evidence that telemonitoring saves costs while improving outcomes is still debated in the literature (Blum and Gottlieb, 2014; Klersy *et al.*, 2011; Upatising *et al.*, 2015), while the optimal business model is yet to be found. Telemonitoring is currently introduced via the not easily scalable B2B approach, and literature does not examine other modalities of implementation or their cost-effectiveness (Acheampong and Vimarlund, 2014; Dijkstra *et al.*, 2006; Griffioen, 2012). Addressing the cost-effectiveness barriers as well as market and consumer barriers (regulations, ease of use, technology, access and coverage, promotion etc.) can lead to scalability.

Telemonitoring of chronic/multimorbid patients today is a time-bound activity. Patients usually stay with the B2B telemonitoring service anywhere from one to eighteen months (Maric *et al.*, 2009), whereas they could continue to use the B2C model for the duration of the disease (i.e. lifetime, as they are paying for the service themselves). An inability to properly manage CHF usually lands those patients in the emergency room (ER) and this significantly shortens their life prospects (Sanghavi *et al.*, 2014). Having access to the telemonitoring service at all times can be highly beneficial to CHF patients as telemonitoring has been shown to reduce mortality, hospital readmission and bed occupancy, even at short intervention and follow-up intervals (Louis *et al.*, 2003).

CHF patients should ideally be approached after an adverse health event (e.g. heart failure, mild infarct, stroke). That is a time when patients are most aware of their health problems and need to actively participate in the hospital discharge process (Hesselink *et al.*, 2014). Currently patients are recruited to clinical studies involving B2B telemedicine systems months after the onset of the disease. In the B2C model patients can be informed about the existence of the service at the point of departure from the healthcare system, or via public health channels (e.g. mass media campaigns). The B2C telemonitoring service should be available at all times to patients in a given jurisdiction.

Patient education is of importance to guarantee adherence. The self-management component of CHF programs (physical activity, drug adherence, diet, etc.) has “a positive effect, although not always significant, on reduction of numbers of all-cause hospital readmitted patients ... decrease in mortality and increasing quality of life” (Ditewig *et al.*, 2010). The educational component of the system allows for empowerment of patients, while the monitoring component helps with early detection of disease worsening. In most B2B cases the education is offered by a nurse – in person or via the telephone and rarely via the device (Maric *et al.*, 2009). This prevents patients from revisiting the message and impedes learning. In the B2C model education is always at hand, which should promote learning and behavioral change.

One of the main problems in telemonitoring is scalability (Zhang *et al.*, 2014), which comes with regulatory issues. The European Commission has indicated in the e-Commerce Directive that “for business-to-business (professional-to-professional) telemedicine services, such as teleradiology, the country of origin principle applies: the service offered by the professional must comply with the rules of the Member State of establishment. In the case of business-to-consumer activities (which might be relevant to telemonitoring services) the contractual obligations are exempted from the country of origin principle: the service might need to comply with the rules of the recipient’s country” (Commission of the European Communities, 2008). This indicates that the telemonitoring provider should be based in the EU jurisdiction most favorable

to eHealth and provide services to other member states via the internal market clause (Vollebregt, 2012). Using mass media to reach consumers, combined with referrals by physicians and pharmacists, might be a way to enroll patients in their thousands without establishing a physical presence in the jurisdiction (as is necessary with B2B today). Thus Business-to-Consumer (B2C) telemonitoring might pave the way to population-wide health monitoring either within or between countries.

The B2C telemonitoring service can be introduced initially as an increment of the B2B model. The B2B model is currently used by technology providers to implement their products in high-income countries. In the US, for example, after the adoption of the “meaningful use of IT in healthcare” initiative, Congress invested billions of dollars in infrastructure building to support three goals: improve quality of care, reduce costs, and increase access and coverage (Buntin *et al.*, 2010). Previous investments in B2B telemonitoring can help with the transition to B2C as systems have been deployed already, and the research findings are available too (Weinstein *et al.*, 2014). The rapid evolution of mobile health apps will be the promotor of B2C telemonitoring and will encourage patients to “accept greater responsibility for their own healthcare either individually or with their healthcare navigators” (Dorsey *et al.*, 2013; Weinstein *et al.*, 2014, p. 185).

Paré *et al.* (2007) found out that: “home telemonitoring of chronic diseases seems to be a promising patient management approach that produces accurate and reliable data, empowers patients, influences their attitudes and behaviors, and potentially improves their medical conditions” (p. 274). However, there is inconclusive evidence of the clinical effectiveness and cost-effectiveness of telemonitoring for CHF patients (Clark *et al.*, 2007; Grustam *et al.*, 2014; Wootton, 2012). While business model and cost-effectiveness are considered to be major barriers to further implementation of telemonitoring in chronic disease management, the enablers are to be found in duration of the intervention, modus and timing of introduction, education, and self-management (Table 1). Extending the B2B model towards B2C might be a way to tackle all those major deficiencies in the telemonitoring service today.

B2B Barriers	B2C Enablers
1) <i>Technical - requirements for technical competence and operation of equipment,</i> 2) <i>Personal - threats to identity, independence and self-care,</i> 3) <i>Organizational - incomplete transmural coordination, cooperation and digital communication, and</i> 4) <i>Financial - poor effects of benefit design and reimbursement mechanisms.</i>	1) <i>Effectiveness - addressing regulations, ease of use, technology, access and coverage, promotion, etc. can lead to scalability,</i> 2) <i>Modus and timing - the service is available at all times, for a lifetime,</i> 3) <i>Education - always at hand, which should promote learning and behavioral change,</i> 4) <i>Self-management - better health outcomes.</i>

Table 1: Summary table of the barriers and enablers in CHF telemonitoring

Business Model Generation

Next, we describe in detail the Business-to-Consumer (B2C) model. We believe that its success hinges on two entities – the Telemonitoring center and Telehealth nurses – being repositioned in the out-of-the hospital setting. We depict the position of the two in the Business Model Canvas (Anon, 2014a). The canvas allows for improved clarity and understanding of this value proposition. Figure 1 presents the extended business model based on the findings generated by the 2 preceding steps - a Root Cause Analysis of problems in implementation of telemonitoring via B2B, and possible improvements via the B2C approach.

Key Partners	Key Activities	Value Propositions	Customer Relationships	Customer Segments
MONITORING & WELLNESS 1) <i>Strategic alliance between payer/regulator and distributor/promotor,</i> 2) <i>Cooperation between healthcare provider and equipment manufacturer,</i> 3) <i>Joint venture between equipment manufacturer and distributor/promotor, and</i> 4) <i>Buyer-supplier relationship between insurer/regulator and healthcare provider</i>	MONITORING 1) <i>Production - Creating the mobile app.</i> 2) <i>Problem solving - Care coordination and bidirectional communication, and</i> 3) <i>Platform/Network - 24/7 unobtrusive telemonitoring</i> WELLNESS 1) <i>Production - Creating the mobile app,</i> 2) <i>Problem solving - Wellness tracking and support</i>	MONITORING 24/7 <i>unobtrusive personalized telemonitoring (disease monitoring, education, serious games and communities) with biweekly calls from a personal care coordinator (telehealth nurse)</i> WELLNESS Wellness tracking (disease tracking, education, serious games and communities)	MONITORING 1) <i>Dedicated personal assistance,</i> 2) <i>Automated alerts and messages, and</i> 3) <i>Communities</i> WELLNESS 1) <i>Automated alerts and messages, and</i> 2) <i>Communities</i>	MONITORING 1) <i>CHF patient after an adverse event,</i> 2) <i>Tech savvy with smartphone and mobile internet, and</i> 3) <i>Able to pay for the service</i> WELLNESS 1) <i>Older than 55 years and at cardiovascular risk,</i> 2) <i>Tech savvy with smartphone and mobile internet, and</i> 3) <i>Able to use the service</i>
	Key Resources MONITORING 1) <i>Physical - Telemonitoring center,</i> 2) <i>Financial - initial investment in the venture,</i> 3) <i>Intellectual - IP and algorithms, and</i> 4) <i>Human - Telehealth nurses</i> WELLNESS 1) <i>Physical - Telemonitoring center,</i> 2) <i>Financial - initial investment in the venture,</i> 3) <i>Intellectual - IP and algorithms</i>		Channels MONITORING & WELLNESS 1) <i>Distribution of the app/service via the established app stores,</i> 2) <i>Communication with patients via telecom operators</i>	
Cost Structure MONITORING 1) <i>Telemonitoring equipment</i> 2) <i>Telecommunication charges</i> 3) <i>Salaries</i> 4) <i>Overhead</i> WELLNESS 1) <i>Backend charges</i> 2) <i>Telecommunication charges</i>		Revenue Stream(s) MONITORING Subscription based (premium model) WELLNESS Free (freemium model)		

Adapted from Business Model Generation (Osterwalder & Pigneur, 2010)

Figure 1: The B2C model of telemonitoring CHF expressed in the Business Model Canvas

Customer Segments

At the very beginning of the business model generation, we need to understand for whom is the value created, to: Mass Market, Niche Market, Segmented, Diversified or Multi-sided Platform (Osterwalder and Pigneur, 2010). Cambridge University Press (2015) explains that “Product ... designed for the mass market is intended to be bought by as many people as possible, not just by people with a lot of money or a special interest”, and Market segment is defined as “a group of possible customers who are similar in their needs, age, education, etc.”. This model concerns CHF patients, as CHF contributes the most to mortality from chronic diseases in the world (WHO, 2011), making this a segmented market.

The newly crafted business model caters for the specific customer segment, i.e. CHF patients with a certain severity of the disease expressed in the New York Heart Association (NYHA) framework (Dolgin, 1994). It is too early to say which class of patients – NYHA class I to IV – can benefit the most from B2C telemonitoring, or whether it is a cost-effective intervention. For the time-being we will consider all NYHA class patients as possible customers. The criteria for the customer are: 1) CHF patient after an adverse event such as a heart attack or stroke for the *monitoring track*, and/or older than 55 years for the *wellness track*, 2) tech savvy with smartphone and mobile internet, and 3) able to pay for the service. In the US 17% of the daily mobile internet users older than 55 years purchased a service or a product via smartphone, and have on average 5.7 paid apps on their devices (Google, 2013). Thus the value proposition, distribution channels, and customer relationships need to be tailored to the specific requirements of this customer segment.

Value Proposition(s)

A Value Proposition “creates value for a Customer Segment through a distinct mix of elements catering to that segment’s needs” (Osterwalder and Pigneur, 2010). The same authors define values as quantitative (e.g. price, speed of service) and qualitative (e.g. design, customer experience). What value can be delivered to the identified customers via the B2C model? Several, from the following categories: Newness, Performance, Customization, Getting the Job Done, Design, Brand/Status, Cost Reduction, Risk Reduction, Accessibility and Convenience/Usability (Osterwalder and Pigneur, 2010).

The key success factors, in terms of customer needs – effectiveness, costs, accessibility, ease of use, credibility – correspond to the value-added characteristics of the B2C model. The duration of intervention, the modus and time of introduction, education and self-management, the effectiveness in terms of better healthcare outcomes, are all important improvement points for B2B, and at the same time value propositions for B2C telemonitoring. The B2C value proposition is inspired by Triple Aim (Berwick *et al.*, 2008) and specified for telemonitoring of patients with CHF from a consumer’s perspective. As such, the key success factors of the B2C model address different aims: Care (e.g. accessibility, ease of use, credibility), Health, and Costs (e.g. cost reduction, effectiveness, scalability).

An example of the B2C telemonitoring service that we will use in this business model generation exercise concerns: 1) a 24/7 unobtrusive personalized telemonitoring service (monitoring, education, games, and communities) with biweekly calls from personal care coordination, or for a wider audience of 55+ years, 2) a wellness tracking app (disease tracking, education, games, and communities). Personalized monitoring entails algorithm pushing nudges, content, education, and scripted interactions to the patient according to the signal reads from the monitoring devices. Personal care coordinator is a dedicated telenurse that monitors the patient via a dashboard, and acts as the “health coach” (supports the patients throughout their patient journey). The personalization on the patient side is driven by the severity of the disease, therapy adherence, willingness to pay, motivation, etc.

In the event of an emergency, or during the night when the patient is not supervised by a real person, the clever algorithm flags the situation and logs an automatic call with an emergency service on behalf of the patient (Leijdekkers and Gay, 2008). The telemonitoring service should not be mistaken for an emergency service.

Currently, telemonitoring can be provided via several platforms (e.g. smart and mobile devices, TV, telephone) but is executed in a *one-size-fits-all* fashion. Each patient is unique, and the customization of the service is a crucial part of the value proposition in the B2C approach. This can be done via smart algorithms using educational content, surveys, information

provision, games, etc. – all personal and engaging. Patients are happy when care is tailored to them personally and/or to their individual needs (Minvielle *et al.*, 2014).

The brand power is crucial to service uptake. Aaker (1991) provided a framework for assessing brand equity with four dimensions: brand's perceived quality, brand awareness, brand associations, and brand loyalty. Patients might not be comfortable with IT companies monitoring their health, nor allow "one's biometric indicators [to] be constantly measured, analyzed and displayed publicly on Facebook or Twitter" (Lupton, 2012), but the recently introduced ResearchKit from Apple proves that things are beginning to change – smartphones will track one's health status, and even one's genetic information – and thousands of people have signed up for this already (Regalado, 2015). An established player in the healthcare domain with a strong brand has a fair shot at monitoring wider populations. In this way, the adoption of a new technology can be accelerated (Jin and Li, 2012).

B2C value proposition features cost reduction, risk reduction, accessibility and convenience/usability. It has a similar proposition to B2B, where customers essentially buy "peace of mind", but with more convenience as the service runs on a personal device and is considered "device-agnostic". It also reduces costs for the customer, as there is no need to install the equipment or to run updates. There is no "downtime risk" as the service is hosted in the cloud – the top 10 cloud services have downtime of less than 99.86% (Gagnaire *et al.*, 2012). Convenience is assured by unobtrusive telemonitoring, via third party devices, and seamless connection via a backend, over mobile internet. This value proposition allows accessibility to a first-class healthcare service, which is assured even in the areas where such medical service was previously unheard of. According to the International Telecommunication Union (2014) there are almost 3 billion internet users, two-thirds of them in the developing world, and the number of mobile-broadband subscriptions reached 2.3 billion globally. Smartphones and mobile internet are prerequisites for enjoying 24/7 coverage and medical service via the B2C telemonitoring model. With accessibility comes scalability, a necessary but not sufficient condition.

Channels

Channels are crucial in reaching a designated Customer Segment. Osterwalder and Pigneur (2010) distinguish between direct channels (e.g. sales force, web sales) and indirect channels (e.g. own stores, partner stores, wholesaler), as well as between owned channels and partner channels. Finding the right mix is important for successfully bringing the value proposition to the market.

The focus of the B2C model lies on locking-in the customers with a superb value proposition, by establishing a relationship with the personal health coach (i.e. telehealth nurse) rather than on owning the channels for marketing or distribution. The B2C model in telemonitoring should rely on distribution of the app/service via the established (app)stores, while the communication with patients should be executed in a secure and controlled manner via telecom operators (Deutsche Telekom, 2015; Frost & Sullivan, 2015).

This is a departure from the historical channel for telemonitoring, i.e. hospitals. Several factors that hamper wider deployment of telemonitoring if executed within the hospital setting, i.e. lack of funding, motivation and cooperation between the hospital and the GP (Willemse *et al.*, 2014), can be eradicated by new ways of healthcare delivery. B2C utilizes new channels and customer relationships in order to raise awareness of and extend the reach of telemonitoring.

Customer Relationships

Osterwalder and Pigneur (2010) distinguish between several categories of Customer Relationships, which may coexist in a provider's relationship with a particular Customer Segment: Personal Assistance, Dedicated Personal Assistance, Self-service, Automated Services, Communities, and/or Co-creation.

CHF patients can establish three types of relationships via the B2C model: dedicated, automated and community-based, depending on the choice of the service model, premium monitoring service or freemium wellness service.

Patients who pay, or are sponsored to enroll in the telemonitoring service, can receive dedicated personal assistance from a telehealth nurse (i.e. bimonthly calls and check-ups). Suter *et al.* (2011) find that "during

... assessment calls, telehealth nurses often provide education regarding cause and effect relationships between personal health behaviors and obtained physiological results, serving to reinforce prior teaching regarding disease self-monitoring and self-management” (p. 87), thus unequivocally supporting the crucial role played by telehealth nurses in telemonitoring. Patients/customers who download the app for free, and are on the wellness track can have automated services (e.g. education, games, and reminders). Both segments should enjoy communities, i.e. online forums for exchange of experiences and information in a similar fashion to PatientsLikeMe (Wicks *et al.*, 2010).

Revenue Streams

Revenue Streams represent the cash a company generates for each Customer Segment (Osterwalder and Pigneur, 2010). We believe that the strongest motivation for patients with chronic diseases, the value proposition one is willing to pay for, is “peace of mind” – knowing that someone is looking after you at all times.

Bradford *et al.* (2005) investigated the willingness to pay for telemedicine and found that 30-50% of hypertensive patients are willing to pay at least \$20 per month, while for the CHF patient this number was even higher. Qureshi *et al.* (2006) found that “the majority of those choosing telemedicine (95%) were also willing to pay a median of \$25 (5 to 500 dollars) out of pocket”, while Seto (2008) found that 55% of heart failure patients were willing to pay \$20, and 19% were willing to pay \$40. In a more recent poll of 2019 customers, the result showed that the majority (62%) thinks that a telehealth visit should cost less than an in-person visit, which currently costs \$82 for first-time patients (American Well, 2015). These payments can be a part of two different types of revenue streams: transactional revenues, i.e. one-off payments, and/or recurring revenues.

The B2C approach for telemonitoring chronic diseases revolves around subscription. The app/service can be free for the wellness track (freemium service with videos, education, and tracking of disease progression) and subscription based for the monitoring track (premium service consisting of telemonitoring, coaching, contact with telehealth nurses, and coordination of care).

Key Resources

Resources allow an enterprise to create and offer a value proposition, reach markets, maintain relationships with customer segments, and earn revenues (Osterwalder and Pigneur, 2010). Key resources in this venture are physical (telemonitoring center), financial (initial investment in the venture), intellectual (IP and algorithms) and human (telehealth nurses). We will explore the crucial two, without which it would be impossible to extend the B2B model towards B2C. Telehealth centers are a new organization of healthcare services for the digital age, ready to handle the complexity of the care-coordination process in telemonitoring, while telehealth nurses are specially trained providers of those services.

Telehealth Nurses

Telehealth nurses are seen as “health-quarterbacks” in charge of organizing and implementing care protocols for chronic/multimorbid patients (Monroe, 2014). Their role is in care-coordination between the patient, the physician, the pharmacist, and the informal caregiver. It should be noted that a proper relationship between the patient and the telehealth nurse should be established and maintained, to prevent confusion for the patient about who is in charge of their wellbeing in the complexity of healthcare (Span, 2015). Effective chronic care management is based on interaction between the healthcare professionals and the patient’s social support network (Klasnja and Pratt, 2012). The patient allows and introduces one or more informal caregivers into the care-coordination chain, while the telehealth nurse manages the stakeholders. This is all possible with the current state of technology.

The telehealth nurse provides a personalized care to patients enrolled in the telemonitoring service. On average, he/she contacts the patient every two weeks, for a 10-minute check-up. This is adequate time for a quick conversation, as patients usually get only 10-15 minutes with their physician once every three months (Kaplan *et al.*, 1995; Oxtoby, 2010). This allows one nurse to monitor and communicate with approximately 50 patients a day, or a maximum of 500 patients per month (with one monthly contact one nurse would be able to monitor almost 1000 patients). This is somewhat similar to the existing telemonitoring service in Hull, UK, where one telemonitoring nurse oversees 200-400 CHF patients

(Anon, 2014b). Telehealth nurses could be trained in order to reach the efficiency level needed to maintain the cost-effectiveness of the B2C model.

Telemonitoring Center

The B2C model introduces another entity to healthcare – a telemonitoring center – in order to provide 24/7 digital monitoring on smartphones (or a mobile device of the user's choice). The telemonitoring center is a physical entity that hosts telehealth nurses and the equipment, and performs two functions: telemonitoring and communication with patients. The monitoring part is automatic/algorithmic and runs in the background, while the communication between the telehealth nurse, the patient and the care team occurs during working hours.

The monitoring service proposed here should personalize the experience for each patient. For patients that have an older set of measuring devices (e.g. weight scale, blood pressure cuff, ECG recorder, pulse oximeter) the measurements should be entered into the app manually. This is usually tedious and error prone, but with the new automated equipment that connects via telephone or internet the transfer of the measurements is automatic and unobtrusive (Chaudhry *et al.*, 2007). The B2C model is device-agnostic as not to restrict the telemonitoring service to device manufacturer silos, and because peripheral measuring devices might soon be commoditized (c.f., Iivari *et al.*, 2016).

The communication system can be built on top of various unifying communication platforms, which allow for video calls, voice calls, instant messaging and presence (Winters and Hanna, 2012). This can be supplemented with email and an SMS/MMS service for sending pictures and educational materials. The Health Insurance Portability and Accountability Act of 1996 (US) demands that telemonitoring networks take precautions in order to prevent third parties from intercepting health-related data (Pecina *et al.*, 2011). There are many existing systems which are HIPAA compliant (i.e. full support of privacy issues) and can be readily deployed around the globe to ensure secure communication with patients.

Key Activities

Key Activities are required in order to create and offer a Value Proposition, to reach markets, maintain Customer Relationships, and earn revenues (Osterwalder and

Pigneur, 2010). Key Activities can be categorized into: Production, Problem solving and Platform/Network.

The monitoring service can reuse the design, algorithms and functions of the established B2B telemonitoring platforms (i.e. physical systems) but adapt them to the B2C context (i.e. cloud services), in order to achieve scale and reach. This represents a departure from a product-oriented to a service-oriented approach. By introducing electronic distributors/promoters into healthcare delivery, the problem of population-wide healthcare coverage for chronic/multimorbid patients can be solved at regional, community, and individual levels (Kahn *et al.*, 2010). Recently one of the major insurers in the US, UnitedHealth, widened telehealth coverage to millions of Americans, finally removing one of the last obstacles to scale (Forbes, 2015).

Evolving the B2B model to seize this opportunity means introducing a new “platform” into healthcare (i.e. the telemonitoring center) that performs key activities: 24/7 unobtrusive telemonitoring of patients with chronic diseases (CHF in this case), bidirectional communication with patients, and care coordination by telehealth nurses.

Key Partnerships

The Key Partnerships describe the network of suppliers and partners that make the business model work (Osterwalder and Pigneur, 2010). In order to take telemonitoring out of the hospital setting and into the telemonitoring center where customers can purchase a telemonitoring solution on their own, there needs to be governance and awareness, in addition to providers of healthcare and equipment manufacturers (Figure 2).

Governments aim to improve the performance of their healthcare systems (Smith *et al.*, 2001) and rely on hospitals and national licensing authorities to provide services and to regulate the healthcare market. Out of 58 countries in the world that currently have Universal Healthcare Coverage (Stuckler *et al.*, 2010) there are developed countries where the government is the payer and the regulator (e.g. Canada where the government pays for 70% of healthcare expenses) and countries where these roles are separated (e.g. the Netherlands). Governance, consisting of payers and regulators, is one of the four pillars that “hold” the B2C model.

People are usually made aware of the existence and availability of the telemonitoring service by physicians or public health authorities, but here we are advocating a new route – informing customers directly via mass media. Targeted mass media campaigns are often used to inform patients about specific health issues or to promote desired behavior – for instance, to increase the uptake of screening, vaccination or healthy nutrition (Coulter and Ellins, 2007), but rarely to inform these people about the availability of certain healthcare services in a jurisdiction. The extension of the B2B model towards B2C mainly involves the introduction of mass media, as a new type of channel for delivering healthcare services. Media, consisting of distributors and promoters, represents another important pillar of the B2C model.

Regarding partnerships, the new business model can create the strategic alliance between non-competitors – payer/regulator and distributor/promoter – working together to raise awareness and improve the management of chronic diseases in their jurisdiction. It also can create a buyer-supplier relationship between healthcare provider and payer/regulator, as public bodies might

want to procure telemonitoring for certain groups of citizens. On the other end, a joint venture between equipment manufacturer and distributor/promoter can be expected as the B2C model relies heavily on informing the customers/patients about the availability of the service in their jurisdiction. Finally, cooperation – a strategic partnership between competitors – can be established between equipment manufacturer and healthcare provider as they both compete for the same customer/patient in the B2C model.

With the introduction of the B2C model for telemonitoring chronic or multimorbid patients a new way of delivering healthcare services will be achieved. Chronic patients will be “shared” between home telemonitoring (remote management) and traditional in-hospital services, while today Accountable Care Organizations are trying to introduce nurse telephone support and telemonitoring in an attempt to avoid readmission penalties (Burke *et al.*, 2013). This will take place as a symbiosis between the four sectors: healthcare, industry, government and media. Figure 2 depicts the four building-blocks of the B2C model and their relationship

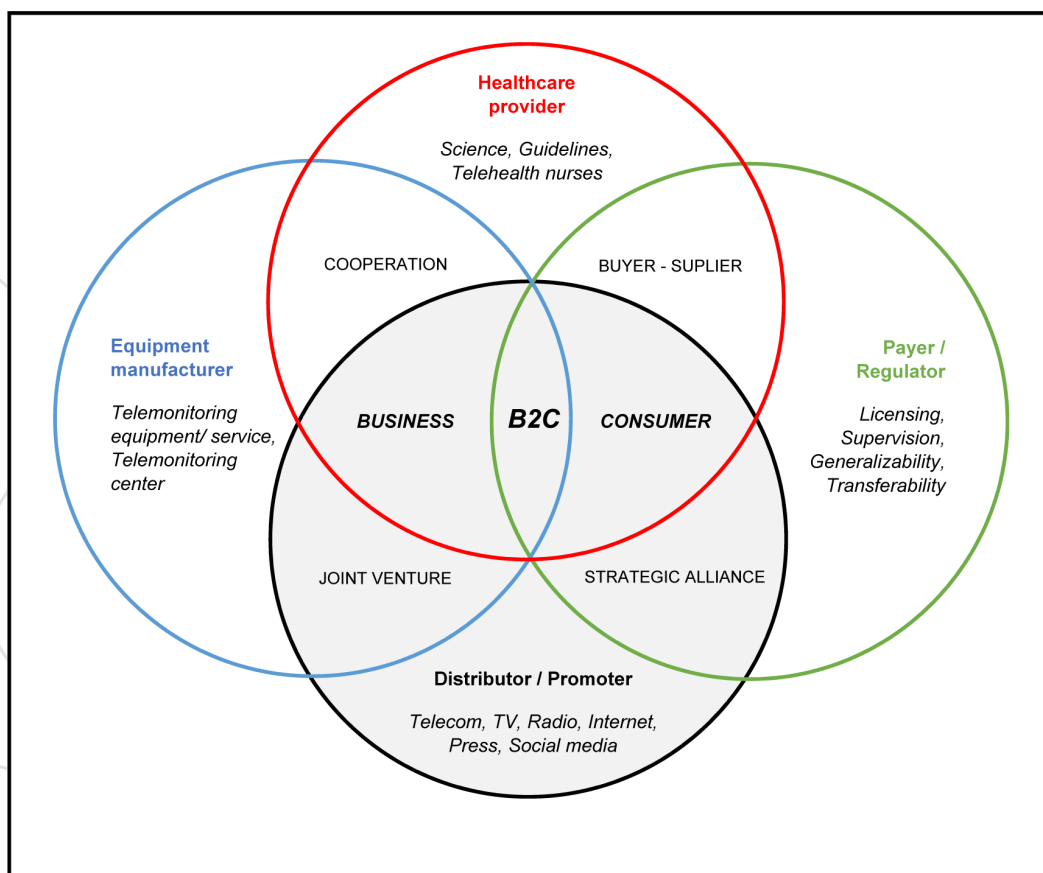


Figure 2: Key partnerships in B2C telemonitoring of patients with chronic diseases in a healthcare system where government is the payer and the regulator

with one another in a healthcare system where the payer and the regulator are the same body, i.e. the government.

Cost Structure

Costing is particularly important in delivering this value proposition to chronic or multimorbid patients. Creating and delivering value, maintaining customer relationships, and generating revenue all incur costs (Osterwalder and Pigneur, 2010). The costs can be fixed or variable, and the business can be cost-driven or value-driven. We believe B2C telemonitoring is value driven because it focuses on value creation for chronic or multimorbid patients, i.e. 24/7 unobtrusive monitoring, peace of mind, coordination of care, creation of communities, education, and help with self-management.

Discussion

The extension of the B2B business model into the B2C model for telemonitoring CHF presented here proposes a synergy between equipment manufacturers, healthcare providers, payers and regulators, distributors and promoters in order to achieve population-wide telemonitoring. It calls for the establishment of a telemonitoring center in an out-of-hospital setting, staffed by telehealth nurses, for reasons of effectiveness and efficacy. In this way telemonitoring can enable care to be provided in various settings (e.g. home, work, on the move), instead of having patients seek care in hospitals and care organizations. The B2C model connects the business side with the consumer side of telemedicine, as shown in Figure 2. It is our belief that extending the B2B model toward the B2C will increase the speed and scale of adoption of this technology in chronic disease management.

We presented our analysis in the Business Model Canvas by Osterwalder and Pigneur (2010) because of the methodological strength it embodies – a mediation between the idea and the customer (Coes, 2014). The advantage of the Canvas is in recognizing the key importance of the value proposition to the end customer of the B2C model – the patient. The limitation is in absence of a strategy portrait, and the relationship of the business model with a possible strategy. Teece (2010) theorized that the two are connected, where strategy follows business modelling. Thus, we tried to present possible strategic partnerships in Figure 2.

Coye *et al.* (2009) compiled an overview of the early business models for chronic disease management, finding that “all of the previous operations” were B2B and have proven unsuccessful in bringing telemonitoring to the masses. In these organizations the patients, i.e. the consumers, were not able to procure the service on their own. Evidently, in the beginning scalability, generalizability and transferability were trumped by implementation problems.

As with most products and services in healthcare, the B2B model is designed with a primary focus on providers. However, the B2C model breaks away from the traditional consideration of providers as key buyers and shifts the attention to patients themselves, recognizing their vital need for convenience, accessibility, and customized education. The B2C model capitalizes on the proliferation of smartphone devices, tablets and the rapid rise of the internet, and offers the solutions directly to patients, while breaking down the barriers created by intermediate functions.

The B2C model bears similarities to the *Blue Ocean Strategy* approach. Challenging an industry’s conventional wisdom about which buyer group to target can lead to *value innovation* – i.e. the creation of innovative value to unlock new demand (Kim and Mauborgne, 2005). According to Kim and Mauborgne (2005) one approach to create a new uncontested market and satisfy demand from a previously overlooked set of buyers is to look across buyer groups. Since the B2C model shifts the perception in terms of the primary buyer group from providers to patients, and offers the latter group additional critical products/service attributes that unlock value, it bears many similarities to a blue ocean strategy.

However, the concept of value is not without problem in healthcare. Welfare economists still follow an influential concept by Hersany (1982, p. 55) that “in deciding what is good and what is bad for a given individual, the ultimate criterion can only be his own wants and his own preferences.” In healthcare value is not expressed only as a personal preference for an outcome, but more typically as a “triple aim” (Berwick *et al.*, 2008): health gain, improving patient’s satisfaction with care, and/or reducing per capita cost of care. The B2C model would most

likely not improve health, but deliver on other two types of value.

The B2C approach might also solve the transferability and generalizability issues in telemonitoring, explored in the Model for Assessment of Telemedicine (Kidholm *et al.*, 2010), by controlling for differences in demography and disease (telemonitoring works in the same way for different age and disease-severity groups), availability of healthcare resources (telemonitoring is available in a whole jurisdiction, irrespective of geography), variation in clinical practice (telemonitoring introduces the same standards of care), alignment of incentives to healthcare professionals and institutions (telemonitoring centers are outside the hospital setting), uniformity of costs and prices (the fee for a telemonitoring service is the same for everyone).

Three key characteristics of a good business model are alignment, self-reinforcement, and robustness (Casadesus-Masanell and Ricart, 2011). The B2C model in telemonitoring of patients with CHF is aligned with the goals of all four stakeholders and represents a middle ground between the business needs and the consumer needs. It is self-reinforcing because allowing patients to procure a telemonitoring service at their own request will help achieve the “triple aim” in healthcare (Berwick *et al.*, 2008) by improving the patient’s experience of care, improving the health of populations and reducing the per capita cost of care. It will increase revenues and innovation in industry, help governments to fight chronic diseases while controlling the budget, and allow media to educate and lock-in customers.

This business model can sustain its effectiveness over a long period by fending off the threats of imitation, as it is difficult to replicate the established telemonitoring center in a jurisdiction, and holdup, as customers cannot exercise their bargaining power due to the interplay of stakeholders. In addition, it helps to avoid slack, as organizational complacency is not to be expected, and substitution, as new products can reduce the customer’s perceived value of this service, but the stakeholders themselves can and should come up with new services (Casadesus-Masanell and Ricart, 2011).

Our analysis is not without flaws or potential bias. We assessed theoretical strengths, the potential

usefulness and the success of extending the B2B model in telemonitoring of chronic diseases. We based our analysis on the convenience sample of published articles (Given, 2008). Potential weaknesses of the B2C model still remain to be identified. As we are not aware of similar studies or business models, convergence validation has not been assessed (Reis and Judd, 2000).

Future research should provide an in-depth assessment of the business model described, and a financial analysis of a fictitious venture that runs on the model presented here. Business modeling, like economic evaluation, should indeed be iterative and maximize the efficiency of R&D in health technology assessment (Sculpher *et al.*, 1997). There needs to be, in a similar fashion to early health technology assessment (Ijzerman and Steuten, 2011), an “early business model assessment”.

The telemonitoring domain is increasingly being democratized and the proliferation of health gadgets will bring a myriad of new telemonitoring apps and services. The (WHO Global Observatory for eHealth, 2011) ascertains that “mHealth can revolutionize health outcomes, providing virtually anyone with a mobile phone with medical expertise and knowledge in real-time” (p. 17). We recommend that decision makers, industry leaders, healthcare professionals, media moguls and patients consider new modalities of healthcare delivery via technology, at a distance.

Conclusion

Telemonitoring is nowadays ubiquitous and cheap, mainly due to the penetration of mobile devices, but the established business models are restricting the speed and scale of the adoption of telemonitoring. We looked into the evolution of the *provider-oriented* approach (B2B) into a *service-oriented* approach (B2C). The cornerstone of the strategy is the value innovation, i.e. the strategic move that creates value for the market, while simultaneously reducing or eliminating features or services that are less valued by the current or future market. The market for the B2B telemonitoring consists of hospitals, while in the B2C model it consists of patients themselves.

In this paper we presented the extended model – B2C – for the telemonitoring of chronic heart failure, which takes into account the healthcare continuum and supports patients’ health and well-being at home and on the move. This is achieved by taking the telemonitoring service out of the hospital setting and into a new entity – the telemonitoring center – and by introducing a fourth pillar to the existing B2B model – distributors and/or promoters. Hence, the patient becomes the customer of the telemonitoring service and the B2C model is born. With this maneuver a difference is to be expected in the speed and scale of implementation of telemonitoring for chronic/multimorbid patients. We believe that the B2C model, in combination with B2B, is key to population-wide telemonitoring in the 21st century.

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