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Procedia Computer Science 170 (2020) 1053–1058

Procedia Computer Science

www.elsevier.com/locate/procedia

International Workshop on Hospital 4.0 (Hospital),
April 6-9, 2020, Warsaw, Poland

Multichannel Interaction for Healthcare Intelligent Decision Support

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Abstract

Hospital 4.0 enables the paradigm of personalized healthcare services to be increasingly easy and more effective by using emerging technologies. Multichannel interaction services aim precisely to take advantage of this trend by introducing a multichannel interaction model that enables interaction between different health service actors (patients, nurses, doctors, administrative staff, pharmaceutics, technicians) across multiple channels and in different contexts without losing information. In this article, a model is idealized and proposed in which all main the actors that belong to health service are identified. The model aims to present what would be the multichannel interaction in a health context to improve the services provided to patients as well as their relationship with a health organization.

Keywords: Multichannel Interaction, Multichannel Services, Personalized Services, Healthcare Services, Hospital 4.0

1. Introduction

Multichannel interaction services is an approach whereby organizations interact with their customers through multiple channels (direct and indirect) to share/sell products and services. Multichannel customer management (MCR) can be viewed as the design, deployment, coordination, and evaluation of channels to enhance customer value through effective customer acquisition, retention, and development [1], [2]. This approach has proven to have a huge impact on customers relationship with the organization when well planned and executed. A multichannel interaction service is an approach broadly use in areas such as commerce and marketing [3]. This article aims to propose an initial idea of multichannel interaction service in healthcare by exploring and analysing what and how organizations from other areas operate their services in a multichannel environment. With this idea, it's intent to propose a model of multichannel interaction service in healthcare. The model will address all actors of health services provided by the health organization to the patient. Multichannel interaction in healthcare services is the result of the evolution of the

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1877-0509
10.1016/j.procs.2020.03.074

health industry. The health industry has evolved a lot in the last decade such as other industry and now it's on fourth-generation (Hospital 4.0). Hospital 4.0 brings enormous opportunities for innovation, due to the fact this generation take advantage of emergent technologies. A brief introduction to Hospital 4.0 is present in the Background section. Besides the introduction, this article includes 4 sections. The second section 2 (Background) provides an introduction to Hospital 4.0 and brief approach of multichannel interaction services in other areas. This section aims to establish a correlation between the topic Hospital 4.0 and this research theme. The third section 3 contains a deep analysis of multichannel interaction services in healthcare and it represents the main content of this article. This section contains several subsections where are discuss topics related to multichannel interaction services in healthcare. Finally, the last section 4 correspond to the conclusions of the current work and future work to be addressed.

2. Background

Hospital 4.0 can be viewed with full integration between hospital services and technological solutions that involve several types of innovation, such as artificial intelligence (AI), Big Data, robotic surgery, Internet of Things (IoT), Internet of Medical Things (IoMT), medical decision support software among other concepts. Combine all, the idea is to create a much more agile, safe, effective and high-quality environment for both the health professionals involved in hospital process and the main beneficiary of the health services: the patients[4].

The hospital 4.0 paradigm is strongly characterized by the use of IoT to improve health services, which are increasingly focused and targeted on patients rather than the health organization itself. Although this paradigm is relatively new in healthcare, there are already numerous case studies in other industry sectors, and different authors claim that hospital 4.0's main goal is to enable systems with progressive virtualization to enable the personalization of services, real-time health care for patients and especially to bring health professionals closer to patients. Unique and personalized patient services can be achieved with emerging new health technologies such as IoT, cloud computing, new communication networks such as 5G [4], [5]. Hospital 4.0 should follow industry design principles for domain transfer that are already implemented in the fourth generation of the industry. These principles are based on service interoperability, system and data virtualization, decentralization of services and systems, real-time responsiveness, service orientation and modularity. Due to the critical nature of the health sector yet, one can identify other principles that are essences in hospital 4.0 which are security, data protection and resilience of hospital systems [4], [6]–[8].

The way how marketing and commerce organizations interact with their customers across many channels without losing customers attention, motivate us to conduct this research and to apply the same principle in healthcare area [9]. Marketing and commerce organizations have made a huge effort to improve the quality of service offered to their customers. Multichannel services are all about to take advantages of available technologies to ensure targeted customers audience that is presented with the right information across multiple channels [9], [10]. Multichannel interaction services are all about using available technology to ensure your target audience is presented with information or the ability to react to information across multiple channels. Customers expect to receive personalized, relevant communications that capture their attention despite their busy schedule. And, they are more likely to react to your message if it is delivered via their preferred media. In practice, this involves sending the right message, at the right time, via the right channel [10], [11]. The multichannel environment has a big impact to an organization, but it has some challenges that organization must address it, such as data integration, understanding consumer behaviour, channel evaluation, allocation of resources across channels, and coordination of channel strategies [1].

3. Multichannel Interaction Service in Healthcare

3.1. Benefits

Multichannel Interaction Services has a lot of benefits both for organization and customers. In this context, the organization can take advantages not only to increase sales but also in business growth. Using a range of different channels to interact with customers, enables a much wider reach, making organizational business potentially and visible to new customer groupings. Organizations that interact with customers through multiple channels can ensure customer loyalty and satisfaction. Similarly, customers enjoy interacting with organizations using channels that are more comfortable and trusting in certain situations [10], [12]. The same principle applies to healthcare. Health organization aims

to interact with their patients across many channels to ensure that their customers are receiving their communications. In the other hand, health patients are more likely to react to the health organization communication when they receive interaction via their preferred channel. Some benefits of multichannel interaction services to the health organization are the ability to increase and speed up the patient relationship by efficiently targeting patients through their preferred channels at the right moment, grow patients satisfaction and loyalty by providing clear and targeted and consistent patients interaction through any channel. Ability to transform regular patients transactions into relevant mechanisms of analyzing and extract valid knowledge with personalized information to offer personalized services to the patients. Health organization who can interact with their patients and offer more fluid and convenient services across many channels will result in better patient experience, and this ends up generating higher levels of patient satisfaction. Satisfied patients have a positive impact on health organization image because they are more likely to recommend health organization services to their friends and families. Health organization can boost operation by merging patient data and streamlining health process to create, produce, deliver and track patient communications across multiple channels. Brand consistency is another benefit that multichannel interaction services have to the health organization, by allowing health organization to take control and manage all the critical and sensitive data both from health organization and their patients [11]. Multichannel interaction has much more benefits to the health organization, and these benefits can increase health organization and improve health services provided to patients. The health organization has to get the ability to interact and communicate with their patients and keep them satisfied [11]. More important then keep the relationship with patients is essential that health organization knows how, when and which channels they should interact with their patients, because patients appreciate receiving this interaction at right time, at the channel that they prefer.

3.2. Challenges

Despite the multichannel interaction services have a lot of benefits both to health organization and patients, it has some challenges that health organization has to overcome to provide a better and secure interaction with their patients. Currently, these challenges are in different levels such as data integration, communications services, integration services and interoperability of different systems [13]. The crucial challenges that health organization has in multichannel interaction environment are data integration across channels because health organization has to decide which patient data they should integrate it across multiple channels to avoid exposing sensitive patient data. Understanding patient behaviour in a multichannel environment is another challenge that health organization should overcome it because it's really important to health organization understand how patients choose channels and what are the impacts that choice has. The channel evaluation allows health organization to retrieved data from different channels and evaluates channels performance to allocate resources in channels that patients are mostly liked to react to organizational communication. Health organization has to establish some key metrics to be able to monitor these channels and evaluate these channels performance. Coordinating channel strategies in a multichannel environment is a very difficult task because health organization has to coordinate their goals across many channels to create synergies between these channels [1], [11], [14]. Other questions raised about the challenges of multichannel interaction service in health environment are the patient's data privacy and health organization data security. The health organization has to identify and find a way of overcoming these issues before starting to implement and use the multichannel interaction paradigm because it would let then better understand and prepare their own IT infrastructure and their strategic plan to the multichannel environment.

3.3. Model Proposal

Based on the principle applied in other areas (marketing and commerce), we intend to propose the following model of multichannel interaction in healthcare. The model is based on the patients (and their election channels of interaction), health professionals, as well as all the technological infrastructure (layers) required to create the multichannel interaction model. The present model becomes a decentralized and focused on the patient (patient-centralized) and not a centralized model focused on the healthcare entity [15], [16]. Following the concept of multichannel interaction applied in commerce, we propose five core actors that must be addressed in a multichannel environment in healthcare: patients, channels, services, health professionals, and providers. They represent the key dimensions of multichannel interaction in healthcare extend in four basic concepts of healthcare services architecture (services, patients, health

professionals, and providers) with the central concept in channel management (channel). In healthcare multichannel environment each patient or group of patients have different needs (diseases), preferences for services, and channel usage [1], [15]–[21].

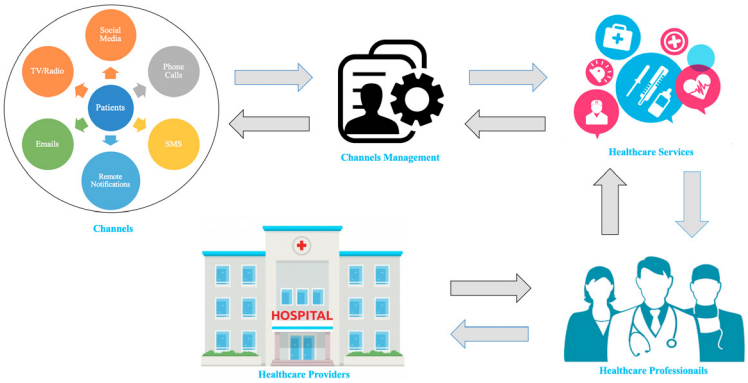

Fig. 1. Multichannel Healthcare Model: A general overview

The model proposed in Figure 1 for multichannel interaction between patients and different healthcare professionals aims to take advantage of emerging technologies that continue hospital 4.0 to provide better quality service to patients. It is noteworthy that this model has a two-way communication model and that it's centred on the needs of patients (patients-centred), and the process can be initiated by both the patient and health professionals. Patients have a variety of channels that can choose the one that best fits their preferences to interact with the healthcare services provided by the health provider. The patient can choose any of the channels available to start the process of interaction with health services and can switch to another channel at any time without losing the interaction previously initiated, i.e. the model allows the patient to continue service in different channels without losing the previous information, continuity of services. Due to the variety of channels, it was necessary to think about a solution to manage these channels. The channel management was then created, which will be the intermediary between the information received from the different channels used by the patients and the services provided by the healthcare provider. This plays an important role as it will make sure that all interaction is received regardless of whether the patient has used one channel or another. After receiving the information, channel management communicates it with the healthcare services and will be delegated to health professionals, i.e., the channel manager is still the link between patient requests and health services offered by health professionals. Healthcare services contain a variety of clinical services offered to patients ranging from primary care, hospital care, outpatient care, home care, emergency care, surgery and outpatient care, and much more services. Health services represent all clinical services that the health facility has available to patients. Health professionals are responsible for providing health services to patients and are present in interaction with patients. Health professionals are doctors, nurses, specialists, technicians, administrative staff, and others. These, in turn, belong to a health organization (hospital).

3.4. SWOT Analysis

Table 1 contains a SWOT analysis of multichannel interaction services in healthcare. In this case, this analysis is used to validate the multichannel interaction services in healthcare. With the validation of the model, the health organization will be more prepared to offer better services in the multichannel interaction environment and avoid certain issues that may be a weakness of the multichannel interaction in health. This analysis was possible by comparing how marketing and commerce organization acts and interact with their customers and by analysing the main characteristic of health services [1], [3], [14], [22]. The multi-channel interaction in health brings numerous advantages and opportunities for both the organization as well as the patient, especially in improving the quality of services provided to patients as well as improving the relationship that the health organization has with the patients. But on the other hand, it should be noted to have a good multi-channel interaction between the health organization and the patients, it

is necessary to overcome some challenges, both technologically, professionally, and above all ethical and legal issues. Given to privacy and data protection issues, health organizations has to define and manage a strategic plan so that sensitive patient and organization data will never be exposed and/or shared with third parties without patient consent.

Table 1. SWOT Analysis of Multichannel Services in Healthcare

Strength	**Weakness**
Improved satisfactions of the patients Better relationship the patients by targeting their preferred channel Increased services provide to patients Extended channels of interaction with patients Patient loyalty	Poor IT Infrastructure Lack of integration and interaction between heterogeneous systems Bad strategy definition for multichannel environment Poor patients targeting across multiple channels Healthcare professional not well prepared for multichannel interaction with patients
Opportunities	**Threats**
Gain new patients by recommendation from others satisfied patients Provide personalized healthcare services to patients Cost reduction Patients monitor and companion across multiple channels	Legal issues, including laws on data protection and privacy Security holes can put in risk the whole integrity of the patients and healthcare data Other's multi-channel services in healthcare models Model subject to approval by international and national healthcare authorities regarding data protection, security and privacy issues

4. Conclusions & Future Works

Multichannel interaction services have a huge impact on the organization, and it can increase in such a way the customer satisfaction with the organization services. When customers are satisfied with organization services, it represents an asset to the organization, that can lead to gain new customers. The same applies to the health organization and its patients. Patients who receive personalized healthcare services through their preferred channel seems to be more satisfied with the health organization. Multichannel interaction in healthcare services can have a significant impact on the relationship between patients and health professionals. This represents a very important step in Hospital 4.0. The model proposed in this paper at the moment is an idealization of what will be the multichannel interaction in health services. This model is part of a project that is under development, so there is a lot of work to be done ahead. The predisposing results show that the model has much potential especially in improving the quality of patient care across multiple channels. As future work, one of the main goals beyond designing the model is to proof-of-concept to validate it properly in the real use environment and to implement the final model. The proof of concept will be held in conjunction with hospital units. The hospital units will be able to evaluate the potential of multichannel interaction of health services with their patients. The approach that the hospital 4.0 paradigm aims to introduce will be fully complemented with the multichannel interaction model proposed in this paper and it should be noted that both have a single purpose in common which the main focus is the patient-centric approach rather than the health organizations as happens in many cases today. Thus, the main focus of these paradigms is the patient and the relationship that the health organization maintains with the patient.

Acknowledgements

The work has been supported by FCT – Fundação para a Ciência e Tecnologia within the Project Scope: UID/CEC/00319/2020.

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