

OMNICHANNEL ADOPTION IN HEALTH INFORMATION SYSTEMS FOR PATIENT FOLLOW-UP

Ailton Moreira and Manuel Filipe Santos
ALGORITMI Research Centre / LASI
Azurém Campus, University of Minho, Guimarães, Portugal

ABSTRACT

The evolution of technology and health information systems has allowed patients in home-based care to receive continuous medical monitoring without the necessity to be in-person at the care unit. This evolution brings to discussion many challenges that the care provider faces and must overcome, but on the other side, it brings a lot of benefits to them both patients, health professionals, care providers and to the society in general. Omnichannel strategy in healthcare services is in its early adoption, but it has the potential to overcome many burdens that care providers are facing currently regards remote patient follow-up. This article aims to present the adoption of omnichannel strategy in health information systems regarding remote patient follow-up in home-based care. The omnichannel strategy has the potential to increase the organization's footprint in society, as this type of interaction aims to fill the gap between organizations and their peers.

KEYWORDS

Omnichannel in Healthcare, Remote Monitoring, Patient Follow-Up, Personalized Care Services, Health Information Systems

1. INTRODUCTION

Lately, healthcare institutions have increasingly focused on an omnichannel interaction model in the various services they provide to their patients. Thus, this adoption has brought positive gains for both the healthcare institutions that implemented it, as well as for the patient who enjoys the new healthcare service without having to be in-person at the care unit to receive it (Burri, 2013). The omnichannel strategy adoption has a huge potential in healthcare services, as it would integrate different channels with different services provided to patients and enables the interaction among patients and health professionals more seamlessly (Annis et al., 2020; Moreira et al., 2020). Furthermore, it can automate the collection process and patient clinical data sharing with health professionals remotely as mentioned previously, without the physical presence of the patient at the care unit. With these processes, the data collected can be sent through different channels to health professionals according to their preferences (Cruz et al., 2014; Oleshchuk and Fensli, 2011).

The remote patient follow-up is a practice that has been increasingly adopted in healthcare, especially in patients with implanted pacemakers and implantable cardioverter defibrillators (ICDs) (Varma et al., 2021; Varma and Ricci, 2013) at home-based care. Although this practice has been practiced for some time, it still has many limitations both at a technological and human level, especially in terms of patient compliance (Abdolkhani et al., 2019). Until now all patient health monitoring was carried through a single channel. Generally, patients use a body sensor that retrieves the data and shares it with health professionals and care providers (Lupu et al., 2009). The omnichannel interaction intends to present a solution where there is not only one channel of interaction, but multiple channels of interaction between patients and health professionals, as was the case until now. This approach specifies the existence of several interaction channels all interconnected with each other, in which patients can choose any of these channels to interact with health professionals (Moreira and Santos, 2020). This is a very recent approach, so more studies are still needed to better understand the impact it has on both patients and healthcare professionals (Moreira et al., 2021).

Due to the workload that health professionals have daily, the adoption of an omnichannel strategy in health information systems to follow-up patients in home-based care can have a significant role to play in this situation. The omnichannel strategy has the potential to solve many challenges that health professionals face regarding manual patient monitoring. It will release these health professionals from these manual and exhausting tasks regarding patient monitoring. With the patient clinical data collected from the body sensors, it can be loaded and uploaded through an interaction channel to the care provider where health professionals will analyze the gathered data and make their clinical decision. Thus, the research question identified in this article is: **to what extent can the adoption of an omnichannel interaction strategy for remote patient follow-up translate into more effective and efficient communication between patients and healthcare professionals?**

With the research question identified, this article aims to assess the possibility of the existence and implementation of omnichannel interaction solutions for remote patient follow-up and to study the impact that it may have on the communication process between the different actors.

2. BACKGROUND

Omnichannel interaction is an evolution of multichannel interaction. Currently, omnichannel interaction has already been applied in several areas mainly in retail industry, marketing, and e-commerce. The fast pace of advancement of technologies and information systems has continuously allowed the appearance of new and innovative models and solutions for omnichannel interaction in healthcare services (Moreira et al., 2020; Moreira and Santos, 2020). An interesting model of multichannel interaction was proposed by Ailton M. (2020) which is based on three different tiers. These tiers are the patient tier, coordination tier, and care provider tier. Each of the tier has a set of actors/roles to play on the overall model proposed (Moreira et al., 2020). Many retail organizations have been developing and improving their omnichannel interaction models to offer a seamless user experience to their customers across all interaction channels without interruption. Besides, several concepts and techniques were adopted from the retail organization as they shown some maturity regarding the implementation and interaction with customers through multiple channels of interaction continuously.

Many authors have presented several solutions to try to overcome the lack of efficiency in the interaction between patients and health professionals, but the solutions that have been proposed are not easy to implement, and most of the time they didn't have the result that was expected, in a way to make these solutions unfeasible (Archip et al., 2016; Prabhakar and Rajaguru, 2017; Varma et al., 2021). On the other hand, the process of implementing the omnichannel interaction strategy in the different health services has been growing at a very fast pace and with visible results both for the hospitals that implemented this strategy as well as for the patients who started to take advantage of this strategy in their interactions with health professionals. Considering the impact that the multichannel interaction has demonstrated in the healthcare services where they were applied, the same could be perfectly applied in the interaction between health professionals and patients who are in home-based care, to assess the impact that this strategy has in the process of interaction between them.

3. OMNICHANNEL PATIENT FOLLOW-UP

Several authors present in their article different solutions for remote patient monitoring, which are exclusively based on wearable devices or in-body implantable devices that collect clinical data from patients autonomously and automatically and share this data with health professionals (Cruz et al., 2014; Oleshchuk and Fensli, 2011). This practice brought several benefits as it made it possible to monitor patients remotely without having to physically be in hospital units. On the other hand, several limitations that this practice presents were also identified, namely in terms of technology infrastructure and issues related to privacy and security of patients' clinical data.

Data collected through patient remote follow-up automatically by body sensors can be sent over multiple channels of interaction on a scheduled basis from the patient's home to health professionals, thus avoiding the unnecessary in-person visit to the care provider. This is very convenient both for patients and health professionals that are monitoring these patients. Patient follow-up in home-based care has a lot of challenges

that care providers that decided to implement it still need to overcome yet. Besides, it has a huge benefit to care providers, health professionals, and patients. Table 1 presents the main challenges and benefits identified regarding remote patient follow-up in home-based care (Abdolkhani et al., 2019; Anwar et al., 2015; Health Services Research, 2011; Hjelm, 2005; Mohammadzadeh and Safdari, 2014; Neslin et al., 2006; Stone et al., 2002; Ventola, 2014).

Table 1. Challenges and Benefits of Remote Patient Follow-up

Challenges	Benefits
Channels integration	Reduction of workload of health practitioners
Data standardization and synchronization across different channels	Better quality of data across multiple channels
Data sharing across multiple interaction channel	Autonomous patient clinical data recording
Patients' device battery life	Improve communication among patients and care practitioners
Legacy systems integration in an omnichannel services	Continuous patient health monitoring without in-person appointment
Ethical issues regarding data access	Timely decision making by health practitioners based on data gathered

4. OMNICHANNEL PROCESS

The introduction of an omnichannel process in health information system for home-based care can have a significant impact on improving the way that health practitioners interact with patients, by integrating multiple channels of interaction with healthcare systems that are collecting patient clinical data. But, before its implementation care provider must address each of the steps of the omnichannel process first. Following the concepts of the retail industry, in the healthcare field, the same steps can be applied. Figure 1 shows the omnichannel process presented and its cycle process.

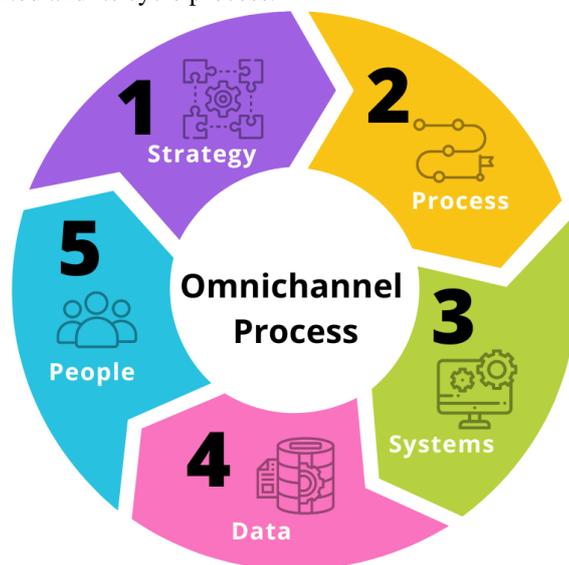


Figure 1. Omnichannel Process

To have a successful implementation of the omnichannel strategy, care providers should study and learn from the omnichannel process that retail industry had implemented. An explanation of each step is provided below (Mike, 2021; Valos, 2009; Vincle, 2019):

- **Strategy** – are the goals and objectives that care providers aim to achieve with omnichannel implementation. The challenges also should be considered when defining the omnichannel strategy.
- **Process** – are all the procedures and workflow regarding the adoption of the omnichannel strategy. It must be designed to be adequately and proactive instead of reactive.
- **Systems** – are all the information and technology necessary to enable to omnichannel strategy to happen. The systems can make or break the care provider adoption successful or unsuccessful.
- **Data** - are all the clinical data exchanged among different channels and healthcare systems.
- **People** – are all the actors that somehow will belong to the interaction process, these actors may include patients and their relatives, nurses, physicians, technicians, administrative staff, etc.

Regarding the patient remote follow-up in home-based care, the care provider should define the right strategy with the right process and systems to be able to get clinical data from patients and share it with health professionals. Successful implementation of the omnichannel strategy in healthcare service still has a long way to go, but the present omnichannel process aims to help care providers adopt the omnichannel strategy in their activities and make these processes less painful. The following section will present a brief discussion regarding the omnichannel adoption in health information system for remote patient follow-up.

5. DISCUSSION

Patients in home-based care need continuous medical follow-up from caregivers. Omnichannel strategy can play an important role in the interaction between patients in home-based care and health professionals, by automatizing the process of collecting clinical data and sending it to care providers which will be processed and presented to a health professional. Thus, this will reduce the workload from health professionals who isn't needed to manually contact the patient to collect patient clinical data, or the patient moves the caregiver for health professionals to collect the data. The omnichannel adoption in healthcare will give a huge relief for health professionals from some repetitive tasks and free up the patient from the need to be physically at care provider to health professionals collect their clinical data.

Besides, patients can use any of the different channels available to them to interact continuously with health professionals. Through the data exchange across omnichannel interaction, it will be processed before it is presented to health professionals. Thus, with the omnichannel strategy, the caregiver will be present with useful information that can help them in their decision-making process. The Figure 2, presents an illustration of omnichannel strategy adoption in healthcare services for remote patient follow-up.

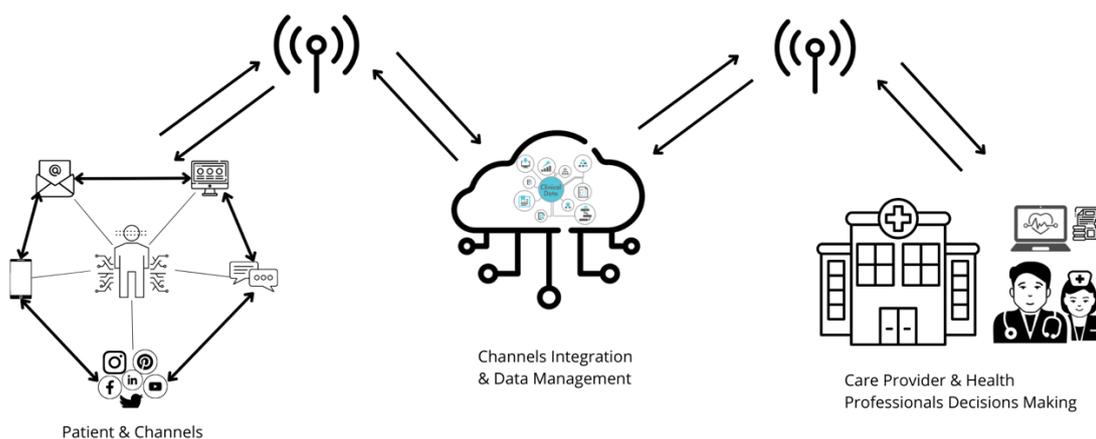


Figure 2. Omnichannel Interaction in Remote Patient Follow-up

The omnichannel strategy enables patient monitoring across multiple interaction channels (see Figure 2) and gives the care professionals more data and options to analyze the collected data and consequently improve the timing that they can take their clinical decision.

A SWOT analysis regarding the adoption of omnichannel interaction in healthcare services for remote patient follow-up is presented below (Caldwell, 2021; Cunha et al., 2020; Mohammadzadeh and Safdari, 2014; Rangaswamy and Bruggen, 2005; Ventola, 2014; Wan et al., 2018).

Table 2. SWOT Analysis of Omnichannel strategy for remote patient follow-up

Strengths	Weaknesses
Patient clinical data available across multiple channels of interaction	Lack and poor of preparation of health professionals to use new technologies to interact with patients in home-based care
Reduce health professional's workload and tasks	Poor implementation of omnichannel strategy
Increase the quality-of-care services provided to patients in home-based care	Data inconsistency across channel can be a huge problem and can make health professionals decision-making even harder
Opportunities	Threats
Improve interaction among patient and health practitioners	Law and regulation regard patient clinical data
Care practitioners can make timely decision-making based on data available in different channels of interaction	Data security and privacy
Improve the quality of work of health professionals	Third-party entities

Following the analysis provided in Table 2 combined with Figure 2, it seems plausible to affirm that the omnichannel strategy can be a viable solution in remote patient follow-up. The adoption of an omnichannel strategy in health information systems for remote patient follow-up can remove many burdens that health professionals face daily and reduce their workload and tasks regarding patient clinical data collection and interaction. Alongside, this strategy brings a new opportunity to health professionals concerning the way that they can monitor and follow-up patients in home-based care across multiple channels of interaction.

Thus, this adoption of omnichannel for remote patient monitoring will allow the patients to be involved and more enrolled in the treatments process and they feel more confident as they have a direct channel to use to interact with a health professional to clarify their worries without the need to be in-person at care provider to interact with a health professional. Currently, the omnichannel strategy in health information systems still is in the early adoption in care services, but it is already demonstrated its potential to care provider who adopts it. The impact and potential of this strategy in home-based care monitoring can be even bigger with the adoption of it, but it will require further research and maturity of omnichannel solutions to take better advantage of it concerning the interaction and communication between patients and health practitioners.

5.1 Results

This paper presents a more theoretical concept of omnichannel interaction in healthcare services, but there are some previous studies already carried out with the implication of multichannel interaction in healthcare services. Omnichannel interaction services are an evolution of multichannel interaction services that aims to combine all available channels of interaction in a single touchpoint to present to its users. To support the work presented in this paper, several studies are referred to in this paper such as A Conceptual Model for Multichannel Interaction in Healthcare Services, and Health Professionals' Decision-Making Based on Multichannel Interaction Services which are already published and available online. Also, some preliminary

studies regarding omnichannel interactions in healthcare services are highly encouraging since they open a brand-new window for patient involvement with health professionals in healthcare services that are provided to them. Additionally, this kind of interaction has a big impact on the activity of health professionals as well as resource allocation and management in health institutions, which is a very flattering indication of the impact of omnichannel approach in health information systems.

6. CONCLUSION

The concepts of omnichannel interaction for health information systems in home-based care for remote patient follow-up presented in this article are a theoretical study of how the omnichannel strategy can be used and impact remote patient follow-up. Besides, the concepts introduced here are still in their very early stage of development and adoption which requires more studies to assess the different topics proposed and discuss in this article to evaluate the impact of omnichannel interaction health information systems in home-based care with the more practical use case. As stated before, the adoption of the omnichannel strategy in home-based care still has a very long way ahead that must be addressed both by researchers and care providers who decide to adopt it. On the other hand, this adoption will bring to discussion more issues that care providers still need to overcome such as data protection and privacy of patients in home-based care, among many other ethical issues related to omnichannel interaction in general and in healthcare field. As the proposed research question to this article, it aimed to study the viability of omnichannel strategy adoption in health information systems for home-based care and how this approach can contribute to a better and more effective interaction between the different actors involved and to the society. So far, was possible to address and accomplished the proposed research questions, but more studies should be carried out with more practical use cases to address the presented practice and take more lessons from omnichannel in home-based care.

ACKNOWLEDGEMENT

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

REFERENCES

- Abdolkhani, R., Gray, K., Borda, A., DeSouza, R., 2019. Patient-generated health data management and quality challenges in remote patient monitoring. *JAMIA Open* 2, 471–478. <https://doi.org/10.1093/JAMIAOPEN/OOZ036>
- Annis, T., Pleasants, S., Hultman, G., Lindemann, E., Thompson, J.A., Billecke, S., Badlani, S., Melton, G.B., 2020. Rapid implementation of a COVID-19 remote patient monitoring program. *Journal of the American Medical Informatics Association* 1326–1330. <https://doi.org/10.1093/jamia/ocaa097>
- Anwar, M., Joshi, J., Tan, J., 2015. Anytime, anywhere access to secure, privacy-aware healthcare services: Issues, approaches and challenges. *Health Policy Technol.* <https://doi.org/10.1016/j.hlpt.2015.08.007>
- Archip, A., Botezatu, N., Șerban, E., Herghelegiu, P.C., Zală, A., 2016. An IoT based system for remote patient monitoring. *Proceedings of the 2016 17th International Carpathian Control Conference, ICC 2016* 1–6. <https://doi.org/10.1109/CARPATIANCC.2016.7501056>
- Burri, H., 2013. Remote follow-up and continuous remote monitoring, distinguished. *Europace* 15. <https://doi.org/10.1093/europace/eut071>
- Caldwell, A., 2021. What Is Omnichannel? Benefits and Strategies [WWW Document]. URL <https://www.netsuite.com/portal/resource/articles/ecommerce/omnichannel.shtml>
- Cruz, J., Brooks, D., Marques, A., 2014. Home telemonitoring in COPD: A systematic review of methodologies and patients' adherence. *Int J Med Inform* 83, 249–263. <https://doi.org/10.1016/J.IJMEDINF.2014.01.008>
- Cunha, C., Gomes, J.P., Fernandes, J., Morais, E.P., 2020. Building smart rural regions: challenges and opportunities. *Advances in Intelligent Systems and Computing* 1161, 579–589. <https://doi.org/10.1007/978-3-030-45697-9>
- Health Services Research, 2011. Health services research: helping tackle Europe's health care challenges.

- Hjelm, N.M., 2005. Benefits and drawbacks of telemedicine. *J Telemed Telecare* 11, 60–70. <https://doi.org/10.1258/1357633053499886>
- Lupu, R.G., Stan, A., Ungureanu, F., 2009. Patient monitoring: Wearable device for patient monitoring. *Lecture Notes in Electrical Engineering* 39 LNEE, 659–668. https://doi.org/10.1007/978-90-481-2311-7_56
- Mike, P., 2021. Building an Omnichannel Healthcare Strategy.
- Mohammadzadeh, N., Safdari, R., 2014. Patient monitoring in mobile health: Opportunities and challenges. *Acta Informatica Medica*. <https://doi.org/10.5455/aim.2014.22.263-267>
- Moreira, A., Guimarães, T., Santos, M.F., 2020. A conceptual model for multichannel interaction in healthcare services, in: *Procedia Computer Science*. Elsevier B.V., pp. 534–539. <https://doi.org/10.1016/j.procs.2020.10.074>
- Moreira, A., Miranda, R., Santos, M.F., 2021. Health Professional's Decision-Making Based on Multichannel Interaction Services. *Procedia Comput Sci* 184, 899–904. <https://doi.org/10.1016/J.PROCS.2021.03.112>
- Moreira, A., Santos, M.F., 2020. Multichannel Interaction for Healthcare Intelligent Decision Support, in: *Procedia Computer Science*. <https://doi.org/10.1016/j.procs.2020.03.074>
- Neslin, S.A., Grewal, D., Leghorn, R., Shankar, V., Teerling, M.L., Thomas, J.S., Verhoef, P.C., 2006. Challenges and opportunities in multichannel customer management. *J Serv Res*. <https://doi.org/10.1177/1094670506293559>
- Oleshchuk, V., Fensli, R., 2011. Remote Patient Monitoring Within a Future 5G Infrastructure. *Wireless Pers Commun* 57, 431–439. <https://doi.org/10.1007/s11277-010-0078-5>
- Prabhakar, S.K., Rajaguru, H., 2017. Development of Patient Remote Monitoring System for Epilepsy Classification. *IFMBE Proc* 61, 80–87. https://doi.org/10.1007/978-981-10-4220-1_16
- Rangaswamy, A., Bruggen, G.H. van, 2005. Opportunities and challenges in multichannel marketing: An introduction to the special issue. *Journal of Interactive Marketing* 19, 5–11. <https://doi.org/10.1002/dir.20037>
- Stone, M., Hobbs, M., Khaleeli, M., 2002. Multichannel customer management: The benefits and challenges. *Journal of Database Marketing & Customer Strategy Management* 10, 39–52. <https://doi.org/10.1057/palgrave.jdm.3240093>
- Valos, M.J., 2009. Structure, people and process challenges of multichannel marketing: Insights from marketers. *Journal of Database Marketing and Customer Strategy Management* 16, 197–206. <https://doi.org/10.1057/dbm.2009.21>
- Varma, N., Love, C.J., Michalski, J., Epstein, A.E., 2021. Alert-Based ICD Follow-Up: A Model of Digitally Driven Remote Patient Monitoring. *JACC Clin Electrophysiol* 7, 976–987. <https://doi.org/10.1016/J.JACEP.2021.01.008>
- Varma, N., Ricci, R. pietro, 2013. Telemedicine and cardiac implants: What is the benefit? *Eur Heart J* 34, 1885–1893. <https://doi.org/10.1093/EURHEARTJ/EHS388>
- Ventola, C.L., 2014. Mobile devices and apps for health care professionals: uses and benefits. *P T* 39, 356–64.
- Vinle, 2019. 7 advantages of an omnichannel strategy | Vinle.
- Wan, J., Gu, X., Chen, L., Wang, J., 2018. Internet of Things for Ambient Assisted Living: Challenges and Future Opportunities, in: *Proceedings - 2017 International Conference on Cyber-Enabled Distributed Computing and Knowledge Discovery, CyberC 2017*. <https://doi.org/10.1109/CyberC.2017.83>