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REVIEW ARTICLE

The role of innovative technology to improve patient centered care

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Abstract
Chronic disease is a long-term disease. The treatment carried out by the patient is also routine and continuous to achieve therapeutic success and avoid complications that can occur. Adherence is one of the important factors to reduce complications of chronic diseases. Efforts are made to improve compliance, such as providing information about drug use from health care providers. The use of technology can also be an option as a facility for improving compliance, such as using audiovisual media as an addition to providing information and short message services or a mobile application for reminders to take medication on a smartphone. This article provides an overview of the role of technology in improving patient compliance, especially those suffering from chronic diseases. This article is based on a literature study of several literatures or research results. The literature reviewed shows that the use of video in providing information about drugs, sending short messages, and using a medication reminder mobile application has a significant effect on increasing adherence in chronic disease patients. Technology is effective and efficient in improving the compliance of chronic disease patients.

Keywords: Innovative technology; compliance; chronic disease; patient care; pharmacy care

Introduction

Chronic disease is prolonged, does not heal spontaneously, and rarely fully recovers. Chronic diseases include cardiovascular disease, respiratory problems, diabetes, HIV/AIDS, etc. Long-term drug administration in chronic conditions can affect adherence (Marrero, 2015). Compliance with drug use is one factor that influences therapy's success. According to the WHO report, the average patient adherence to long-term treatment for chronic diseases in developing countries is lower than 50%. This low level of compliance can lead to failure to achieve therapeutic success (Indonesian Food and Drug Supervisory Agency, 2006). Adherence can be influenced by patient characteristics such as gender, age, duration of illness, and the type of drug obtained (Srikartika et al., 2016). Some of the reasons patients do not take medications are that it affects compliance with treatment; patients forget and do not understand how to use drugs (Srikartika et al., 2016).

Along with technological developments, the intervention of providing treatment information by doctors or health workers to patients can be added by pro data using multimedia during counselling, such as videos, so that it is exciting and not monotonous (Cicharello et al., 2013). Technology can also assist patients in remembering when to take medication, for example, by using short message services and other mobile applications. The digital marketing research institute Emarketer estimates that in 2018, active smartphone consumers in Indonesia will reach more than 100 million people (Herbawan & Sharif, 2018). This makes technology a facility that improves patient compliance (Citandarello et al., 2013; Dayer, 2013).

A significant factor in determining whether or not a treatment is successful is how well it is adhered to. The patient isn't the only one who suffers from this major issue; the health care system as a whole is impacted as well. Patients who do not take their medications as prescribed experience a significant worsening of their condition, an increased risk of death, and higher overall medical expenses. There are a number of different elements that are likely to effect adherence. It is possible to overcome barriers to adherence by addressing variables related to the patient, the physician, and the health system, with interactions among these three groups. In order to enhance medication adherence, it will be required to first identify the individual barriers that each patient has and then develop

appropriate strategies to overcome those barriers. In their day-to-day work, medical professionals including doctors, pharmacists, and registered nurses play a key role in ensuring that patients take their medications as prescribed. Due to this analysis, this paper aimed to review the role of innovative technology in improving the care in clinical setting. The method used in writing the article review is searching for data from the internet, such as Google Scholar and Pubmed. The search keywords used were technology, compliance, and chronic disease within the last ten years (2011-2020). The search criteria article in English and Bahasa, all the study design, and discuss the technology in healthcare. During the initial search, 52 pieces were collected and evaluated by considering the title abstract. After perusing the entire article, a total of 48 articles were excluded. Then five articles were included in the final analysis **(Table 1)**.

Patient Compliance in Medication

Treatment adherence is the patient's behaviour in taking treatment by following the treatment rules obtained from health services (Akhu-Zaheya & Shiyab, 2017). Treatment adherence is an essential component in the success of therapy, especially in the long-term treatment of chronic diseases. Several methods can be used to measure compliance in direct or indirect ways. The direct approach is, for example, by direct therapeutic observation, while the indirect method can include interviews, medical records, filling out questionnaires and electronic recording tools (Font et al., 2012).

Factors that influence medication adherence include demographics such as age and education, patient understanding and perception of the disease, the model of health service providers in providing treatment, the relationship between patients and health professionals, the influence of the health system and the complexity of the type and method of taking medication (Kleinsinger, 2018). It was reported that there were several reasons behind the patient's non-adherence to the recommended treatment regimen, and the highest reason was patient forgetfulness (Neiman et al. (2017).

Table 1. Study findings

No	Author	Location	Sample	Intervention	Results
1.	Oktianti, *et al*. (2019)	Klinik Gracia dan Puskesmas Lerep, Ungaran	Patient with Hypertension	Video	Adherence is increased
2.	Alfian & Wardati, (2016)	Poliklinik Penyakit Dalam RSUD Dr.H.Moch Ansari Saleh Banjarmasin.	Patient with Hypertension	*Digital Pillbox Reminder*	Adherence is increased
3.	Alfian, *et al.* (2017)	Puskesmas Melati, Kabupaten Kapuas	Patient with Diabetes	SMS	Adherence is increased
4.	Alfian, *et al.* (2017)	Depo Farmasi Rumah Sakit Umum Daerah (RSUD) Ulin Banjarmasin	Patient with Diabetes	Digital reminder application	Adherence is increased
5.	Guo *et al.* (2018)	Rumah Sakit China Selatan	Pasien with HIV	SMS	Adherence is increased

The role of technology in patient care

Technological developments can be utilized in the pharmaceutical sector, some of which are in providing information using videos, short message services, and medication reminder applications on the patient's smartphone. The data shows that the level of knowledge about hypertension increases by up to 85% when using video (Maulana, 2009 Oktianti et al., 2019). Lerep Health Center and Gracia Clinic showed an increase in the compliance of hypertension patients after being given an intervention, namely by providing drug information using videos (Oktianti et al., 2019). The increase in the average value before and after the intervention was 1.925. From the paired t-test data (paired t-test) conducted in this study, the results obtained a significant effect on increasing medication adherence from the intervention using video media. The provision of interventions with a digital pillbox reminder application in hypertensive patients showed a significant increase in patient compliance and seen from the compliance criteria of hypertensive patients after the intervention was given by 46.67%, while before being given the intervention of 20.00 % (Alfian & Wardati, 2016). Digital pillbox reminder is an application to remind the time of drug consumption in the form of an automatic reminder alarm set by the pharmacist.

A study showed that a significant increase in medication adherence for type II DM patients and seen from the mean score of the MMAS-8 questionnaire before and after the short message service intervention (Susanto, Alfian & Rusmana, 2017). The increase in the mean score of MMAS-8 before and after the intervention was 1.6, with the mean before the intervention being 5.8 and after the intervention increased to 7.4. Giving intervention to 25 diabetes

mellitus patients through a digital medication reminder application showed a significant increase in medication adherence in diabetes mellitus patients (Alfian, Maulana & Putra, 2017). Patients who had high commitment before the intervention were two people, while after being given, the intervention increased to 15 people. In the results of this study, there were no patients who had low adherence, whereas, before the intervention, patients had moderate commitment were 23 people. After the intervention, patients who had moderate adherence were ten people.

Research conducted by Haberer et al. (2017) mentions that technology can be a solution to support adherence to ARV treatment in HIV/AIDS patients. Short message services and voice calls, electronic dose monitors, and electronic pharmacies (drug refill tracking system) can be done using a smartphone. Guo et al. (2018) intervened for three months by giving short messages (SMS) weekly medication adherence reminders. The results obtained were 91% responded positively, and 86.4% of smartphone users reported optimal adherence to ARVs. Increased compliance of patients given the intervention occurred significantly with a $p<0.05$. According to Nhavoto, Grönlund and Chaquilla (2015), cell phone/smartphone-based interventions have been used for many diseases, especially diseases with long-term treatment, such as HIV. Short message services' low cost and convenience can make this technology an alternative strategy to improve medication adherence.

The failure to take medication as prescribed can result in the waste of medication, the advancement of disease, diminished functional abilities, a decrease in quality of life, and an increase in the utilisation of various medical resources, such as nursing homes, hospital visits, and hospital admissions. According to findings from economic research, failure to follow treatment protocols as directed can have major repercussions for one's health. This finding is confirmed by findings from a number of other studies. For instance, in a study that was carried out by Anon, it was revealed that the risk of hospitalisation was more than double in patients who did not adhere to the prescribed medications for conditions such as diabetes mellitus, hypercholesterolemia, hypertension, or congestive heart failure when compared with a general population. These conditions include diabetes mellitus, hypercholesterolemia, and congestive heart failure. According to research carried out on individuals suffering from chronic obstructive pulmonary disease (COPD), a lack of compliance with drug therapy and management of the condition can result in the need for emergency hospitalisation. Non-adherence to medication can have negative effects not only on the patient, but also on the provider, the physician, and even the medical researchers who are striving to determine the usefulness of the medication on the population it is intended to treat. These effects can be compounded when the patient is also not taking the prescription as directed. Because of the potential effect that drug non-adherence could have on the delivery of health care, this issue is a significant concern for public health. As a result, assisting individuals in taking their medication in the appropriate manner would be a more beneficial accomplishment to reduce the likelihood of severe relapses, antibiotic resistance, and avoidable hospitalisations.

Patients who fail to adhere to their treatment plan for a variety of reasons sometimes do so because they forget to take their prescribed drugs. The findings of a study that was carried out revealed that one of the primary non-intentional causes for non-adherence cited by patients was forgetfulness. This reason was cited by 49.6% of patients. Even while it may not be practically viable in all work environments, forgetfulness can be remedied by using reminders such as directly sent letters, telephone, e-mails, text messages to cellular phones, and alarms. These methods can be used to jog the memory of the forgetful. Involving the patient's caretakers in the process would be an additional method for addressing the issue of non-adherence to treatment owing to amnesia.

Patients may also not take their medications as directed because they believe taking them is unneeded or because of the thoughts and beliefs they have regarding the potentially harmful effects of the drugs they take. Therefore, it is vital to provide patients with clear medication-related information in order to promote adherence. This includes addressing the crucial information of what, why, when, how, and how long the medication should be taken. Providing in-depth written information on a patient's drugs is a great way to augment counselling sessions regarding medication use. Concise written instructions, such as drug cards, medication charts, or any written material encapsulated in a plastic sheet or laminated sheet, are also helpful in improving adherence. This is especially true for elderly patients, who often have trouble understanding a significant portion of the information that is presented during medication counselling. Patients' fears and concerns about hazardous medication reactions can be addressed by educating patients about the common side effects of the drugs which they are taking, how to prevent an adverse drug reaction, if prevention is possible, and also convincing the patient of the necessity for treatment.

One of the factors that has been shown to negatively effect medication adherence is the complexity of the treatment regimen. It will be necessary to make adjustments to the prescribed pharmaceutical regimens in order to decrease the number of separate medications, the number of times those medications are to be administered, and, in some cases, to substitute individual medications with combination products. This approach frequently requires the collaboration of the patient, which underscores the need of patient participation in disease care.

Conclusion

Based on the literature study results, it can be concluded that technology influences the compliance of patients with chronic diseases such as hypertension, diabetes mellitus, and HIV/AIDS who must take drugs every day in the long term. Using video to provide information about drugs, sending short messages, and using a mobile application for taking medication reminders effectively increases patient compliance. Technology needs to be continuously developed to be more efficiently used as a medium in the health sector.

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