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MEDICATION ADHERENCE THROUGH DIGITAL HEALTH INTERVENTIONS: COMPREHENSIVE REVIEW

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Abstract

Electronic medication packaging (EMP) devices may enhance drug adherence, which is expected to impact patients with hypertension, hyperlipidemia, and diabetes. The objective is to examine the correlation between EMP devices and enhanced adherence, as well as to identify and define the typical characteristics of EMP devices. We did a comprehensive assessment of peer-reviewed publications that examined the efficacy of EMP systems. The articles were retrieved from the MEDLINE, EMBASE, PsycINFO, CINAHL, and International Pharmaceutical Abstracts databases. The searches were completed up to June 13, 2014. We identified the correlations between the treatments and adherence, along with other significant discoveries. We evaluated every research for bias by using the Cochrane Handbook for Systematic Reviews of Interventions. We conducted a comprehensive evaluation of the characteristics of EMP devices and therapies. We have found five prevalent features of EMPs: the ability to record dosage events and save a record of adherence, the use of audiovisual reminders to prompt dose, the presence of digital exhibits, continuous monitoring capabilities, and the provision of adherence performance feedback to patients. There are several types of EMP. Nevertheless, there is a scarcity of data supporting the effectiveness of EMP devices, and the studies conducted to test them have shown inconsistent quality. Furthermore, there is evidence of bias in the reporting of this research. Devices that are included into the care delivery system and specifically intended to record dosage events are often linked to enhanced adherence. More rigorous research is required to ascertain the impact, if any, of these cost-effective treatments on drug nonadherence and discover their most effective elements.

Keywords: Electronic medication packaging (EMP), drug adherence, review, drug nonadherence, treatment.

1. Introduction

Medication non-adherence is a prevalent and increasingly acknowledged issue in the provision of healthcare. Medication non-adherence is prevalent among patients with hypertension (28% non-adherence), hyperlipidemia (28%), and diabetes (31%).1-3 Non-compliance has been associated with significant negative health consequences, such as increased risk of stroke in individuals with hypertension, elevated viral load in people with HIV, and greater rates of hospitalization and death in those with heart failure. Medication non-adherence is often seen in resource-limited situations. 4-6 Inadequate compliance has been recognized as a mechanism for the development of treatment resistance in TB, malaria, and HIV.7 Enhanced compliance might potentially reduce death rates associated with chronic noninfectious illnesses, such as cardiovascular disease, which are becoming a growing burden in settings with limited resources.8 Therefore, tackling non-adherence is a global imperative.9

2. Medical interventions

Various interventions such as patient education, self-monitoring systems, family therapy, psychological therapy, telephone follow-up, and other supportive care measures have shown varying levels of success in decreasing medication nonadherence.10 Nevertheless, a significant number of these therapies need substantial resources and the presence of well-coordinated healthcare systems. Utilizing health information technology (HIT) is an alternative method for addressing adherence. Electronic pill monitors may now welcome patients and remind them to take their pills. They can also send notifications to doctors or other caretakers if the patients fail to follow their preprogrammed drug-use regimens.11 These technologies may assist in addressing problematic elements of existing strategies used to promote adherence, such as lack of specific content, inconsistent distribution methods, and impracticality in clinical practice settings.12 Consequently, HIT has the potential to enhance adherence in a cost-effective manner.13

In order to examine the use of a specific kind of health information technology (HIT) in addressing pharmaceutical non-adherence, we carried out a comprehensive evaluation of the relationship between electronic medication packaging (EMP) and medication adherence.14-20 We analyze and delineate prevalent characteristics of EMP devices. EMP refers to the incorporation of electronic devices into the containers used for dispensing tablets, inhalers, or other goods. EMP is suitable for resource-limited settings because to its little need for health care system infrastructure. However, it may also be used as a component of more intricate treatments.

3. Assessments of methodological quality and bias risk

Treatments that solely included interaction with the patient tended to have reduced risks of provider bias. This bias was more prevalent in complicated treatments when physicians themselves delivered the active interventions. EMP effectively reduced the potential for assessor bias in trials where the major outcome relied on electronic adherence data by electronically gathering the data. There was a possibility of bias due to investigators using different measures of adherence for the intervention and control groups. However, this only occurred in 3 trials. Upon visual examination of the funnel plot, it is evident that there is asymmetry, indicating a potential under-representation of smaller studies with lower impact sizes in the existing literature (Figure 1). If it exists, such bias leads to a more positive evaluation of the whole body of data.21

Figure 1. Funnel diagram displaying pseudo 95% confidence limits, categorized by kind of intervention

EMP devices often included digital displays and audiovisual reminders as their primary features. 22, 23, 24, 25, 26, 27, 28 The sole device that utilized real-time monitoring through an

integrated antenna did not exhibit a substantial enhancement in adherence, except when combined with short messaging service (SMS) text reminders. However, it is important to note that the mobile phone aspect of these interventions was not included in this review.28

Frequently, the integrated EMP therapies included the provision of feedback to patients based on their electronically monitored adherence habits. Examples of delivering feedback to patients included presenting patients with a visual representation of their adherence,22 sharing adherence performance with clinicians for use in regular patient interactions,29 and conducting

separate sessions outside of clinical encounters to discuss adherence performance and develop strategies for improvement.30

Several studies suffered from methodological issues, such as nonrandomized designs, and a significant number of them demonstrated gains that did not achieve statistical significance. The broad criteria we used for EMP and research designs resulted in significant variation in our findings and made it impossible to do a meta-analysis. Publication bias is another factor to consider, since the funnel plot suggests that smaller studies with less positive benefits of EMP treatments may not have been submitted to journals for publication. When assessing the findings, we mostly relied on the bigger prospective studies of EMP therapies that satisfied the standard criteria for significance. Furthermore, the majority of research had duration of less than 6 months. Additional data is required to determine the long-term effectiveness of EMP in patients with chronic disease, since EMP, similar to other therapies aimed at improving adherence, may see a decline in its efficacy with time.21,31

This study focused only on papers written in English and did not include research including children. However, future analyses should address the broader problem of medication adherence on a worldwide scale, as well as the specific challenges related to medication adherence in children. This review specifically examined trials that evaluated adherence and eliminated studies that reported health outcomes but did not contain information on adherence. Future investigations should aim to measure the influence of EMP on health outcomes and costs of care, since secondary analyses have shown that studies reporting increased adherence with EMP also shown improved health outcomes.

4. Conclusion

We have discovered that there are several types of EMP, but the information available on each of them is restricted. Additionally, there is inconsistency in the quality of research conducted on EMP devices, with some indications of reporting bias. More rigorous data is required to ascertain the impact, if any, of these inexpensive treatments on the pressing issue of drug nonadherence. Additional research is required to determine the specific elements of these intricate treatments that are responsible for producing results. Ongoing experiments in the United States and globally are currently being conducted to evaluate integrated models of medical care delivery. These models involve the use of patient-centered homes, telemedicine, and other similar tools. Our review indicates that further research is necessary to determine the effectiveness of innovative electronic medication management tools in improving medication adherence in these settings.

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