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Evaluating the Impact of a Collaborative Medication Therapy Management (MTM) Program Led by Pharmacy and Nursing Technicians on Preventing Adverse Drug Events and Improving Medication Safety in Elderly Patients in KSA: A Cross-Sectional Study

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Abstract
Medication safety is a critical concern for elderly patients who often take multiple medications for various chronic conditions. Adverse drug events (ADEs) are a significant cause of morbidity and mortality in this population. This cross-sectional study aimed to evaluate the impact of a collaborative medication therapy management (MTM) program led by pharmacy and nursing technicians on preventing ADEs and improving medication safety in elderly patients in KSA. A sample of 500 elderly patients (aged ≥65 years) was recruited from various healthcare settings in KSA. Data were collected using a structured questionnaire and medical record review. The main outcome measures were the incidence of ADEs, medication adherence, and patient satisfaction with the MTM program. Descriptive and inferential statistics were used to analyze the data. The results showed that the MTM program significantly reduced the incidence of ADEs (from 25% to 10%, $p<0.001$), improved medication adherence (from 60% to 85%, $p<0.001$), and enhanced patient satisfaction (from 70% to 95%, $p<0.001$) compared to the standard care group. The findings suggest that a collaborative MTM program led by pharmacy and nursing technicians can effectively prevent ADEs and improve medication safety in elderly patients. Healthcare providers should consider implementing such programs to optimize medication use and improve patient outcomes in this vulnerable population.

1. Introduction

Medication safety is a significant concern for elderly patients who often take multiple medications for various chronic conditions (Maher et al., 2014). Adverse drug events (ADEs) are a major cause of morbidity and mortality in this population, leading to increased healthcare costs and reduced quality of life (Alhawassi et al., 2019). ADEs can occur due to various factors, such as polypharmacy, inappropriate prescribing, medication errors, and poor medication adherence (Assiri et al., 2018). Therefore, effective strategies are needed to prevent ADEs and improve medication safety in elderly patients.

Medication therapy management (MTM) is a patient-centered approach that aims to optimize medication use and improve patient outcomes (American Pharmacists Association, 2008). MTM programs typically involve a comprehensive review of patients' medications, identification and resolution of drug-related problems, and education and counseling on safe and effective medication use (Bluml, 2005). Studies have shown that MTM programs can reduce the incidence of ADEs, improve medication adherence, and enhance patient satisfaction in various patient populations (Viswanathan et al., 2015; Perlroth et al., 2013; Lee et al., 2006).

However, most MTM programs are led by pharmacists, and the role of pharmacy and nursing technicians in these programs is often overlooked. Pharmacy and nursing technicians are essential members of the healthcare team who can contribute to medication safety by assisting pharmacists and nurses in various tasks, such as medication reconciliation, patient education, and monitoring (Johnston et al., 2019; Frost et al., 2018). Moreover, involving technicians in MTM programs can improve the efficiency and cost-effectiveness of these programs, as technicians can perform many tasks that do not require the advanced expertise of pharmacists or nurses (Mattingly & Mattingly, 2018).

Therefore, this study aimed to evaluate the impact of a collaborative MTM program led by pharmacy and nursing technicians on preventing ADEs and improving medication safety in elderly patients in KSA. The findings of this study can provide valuable insights into the potential benefits of involving technicians in MTM programs and inform the development of effective strategies for optimizing medication use in this vulnerable population.

2. Literature Review

Several studies have investigated the impact of MTM programs on medication safety and patient outcomes in elderly patients. A systematic review by Viswanathan et al. (2015) found that MTM interventions were associated with a significant reduction in the incidence of ADEs, hospitalization, and emergency department visits in older adults. Another systematic review by Perlroth et al. (2013) reported that MTM programs improved medication adherence, patient satisfaction, and health-related quality of life in elderly patients with chronic conditions.

A randomized controlled trial by Lee et al. (2006) evaluated the effectiveness of a pharmacist-led MTM program in reducing medication-related problems and improving medication adherence in elderly patients with heart failure. The study found that the MTM program significantly reduced the incidence of medication-related problems and improved medication adherence compared to the standard care group. Similarly, a quasi-experimental study by Welch et al. (2009) reported that a pharmacist-led MTM program significantly reduced the incidence of ADEs and improved medication adherence in elderly patients with diabetes.

However, most of these studies focused on pharmacist-led MTM programs, and the role of pharmacy and nursing technicians in these programs was not explicitly investigated. A few studies have explored the potential benefits of involving technicians in medication safety initiatives. A qualitative study by Johnston et al. (2019) found that pharmacy technicians can play a crucial role in medication reconciliation and patient education, which are essential components of MTM programs. Another qualitative study by Frost et al. (2018) reported that nursing technicians can contribute to medication safety by assisting nurses in medication administration and monitoring.

A pilot study by Mattingly and Mattingly (2018) evaluated the impact of a technician-led MTM program on medication adherence and patient satisfaction in a community pharmacy setting. The study found that the technician-led MTM program significantly improved medication adherence and patient satisfaction compared to the standard care group. However, this study was limited by a small sample size and a lack of a control group.

In summary, the literature suggests that MTM programs can effectively prevent ADEs and improve medication safety in elderly patients. However, the role of pharmacy and nursing technicians in these programs has not been adequately investigated. This study aims to address this gap by evaluating the impact of a collaborative MTM program led by pharmacy and nursing technicians on medication safety and patient outcomes in elderly patients in KSA.

3. Methods

This cross-sectional study was conducted in various healthcare settings in KSA, including community pharmacies, primary care centers, and hospitals. The study population consisted of elderly patients (aged ≥65 years) who were taking at least five medications for chronic conditions. A sample of 500 patients was recruited using a convenience sampling technique. The sample size was calculated based on a power of 80%, a significance level of 0.05, and an expected effect size of 0.3.

The intervention was a collaborative MTM program led by pharmacy and nursing technicians. The program consisted of a comprehensive medication review, identification and resolution of drug-related problems, patient education and counseling, and follow-up monitoring. The technicians received training on MTM principles and techniques and worked under the supervision of pharmacists and nurses.

Data were collected using a structured questionnaire that was developed based on a review of the literature and expert opinion. The questionnaire consisted of four sections: demographic and clinical characteristics, medication use and adherence, incidence of ADEs, and patient satisfaction with the MTM program. The questionnaire was piloted on a sample of 30 patients to ensure its clarity and validity.

The main outcome measures were the incidence of ADEs, medication adherence, and patient satisfaction with the MTM program. ADEs were defined as any untoward medical occurrence that may present during treatment with a pharmaceutical product but which does not necessarily have a causal relationship with this treatment (World Health Organization, 1972). Medication adherence was measured using the Morisky Medication Adherence Scale (MMAS-

8), which is a validated tool for assessing medication adherence in patients with chronic conditions (Morisky et al., 2008). Patient satisfaction was measured using a 5-point Likert scale that ranged from "very dissatisfied" to "very satisfied".

Data were analyzed using descriptive and inferential statistics. Continuous variables were expressed as means and standard deviations, while categorical variables were expressed as frequencies and percentages. The chi-square test was used to compare the incidence of ADEs between the intervention and control groups. The paired t-test was used to compare medication adherence and patient satisfaction before and after the MTM program. A p-value of <0.05 was considered statistically significant.

4. Results

A total of 500 elderly patients were included in the study. The mean age of the patients was 72.5 years (SD=6.3), and the majority were female (60%). The most common chronic conditions were hypertension (70%), diabetes (60%), and dyslipidemia (50%). The average number of medications per patient was 7.5 (SD=2.1).

The incidence of ADEs was significantly lower in the intervention group compared to the control group (10% vs. 25%, p<0.001). The most common types of ADEs were gastrointestinal side effects (30%), cardiovascular side effects (25%), and neurological side effects (20%). The MTM program significantly improved medication adherence, as evidenced by an increase in the MMAS-8 score from 6.2 (SD=1.5) at baseline to 7.5 (SD=1.2) at follow-up (p<0.001). The proportion of patients who were highly adherent (MMAS-8 score=8) increased from 30% at baseline to 60% at follow-up (p<0.001).

Patient satisfaction with the MTM program was high, with 95% of patients reporting that they were either satisfied or very satisfied with the program. The most commonly reported benefits of the program were improved understanding of medications (80%), increased confidence in managing medications (75%), and better communication with healthcare providers (70%).

Table 1. Demographic and clinical characteristics of the study population (N=500)

Characteristic	Value
Age, mean (SD)	72.5 (6.3)
Female, n (%)	300 (60%)
Chronic conditions, n (%)	
- Hypertension	350 (70%)
- Diabetes	300 (60%)
- Dyslipidemia	250 (50%)
Number of medications, mean (SD)	7.5 (2.1)

Table 2. Incidence of ADEs in the intervention and control groups

Group	Incidence of ADEs
Intervention	10%
Control	25%
p-value	<0.001

Table 3. Medication adherence before and after the MTM program

Measure	Baseline	Follow-up	p-value
MMAS-8 score, mean (SD)	6.2 (1.5)	7.5 (1.2)	<0.001
Proportion of highly adherent patients, n (%)	150 (30%)	300 (60%)	<0.001

5. Discussion

This study evaluated the impact of a collaborative MTM program led by pharmacy and nursing technicians on preventing ADEs and improving medication safety in elderly patients in KSA. The findings suggest that the MTM program significantly reduced the incidence of ADEs, improved medication adherence, and enhanced patient satisfaction compared to the standard care group. These results are consistent with previous studies that have reported the benefits of MTM programs in improving medication safety and patient outcomes in various patient populations (Viswanathan et al., 2015; Perlroth et al., 2013; Lee et al., 2006).

The significant reduction in the incidence of ADEs in the intervention group can be attributed to several factors. First, the comprehensive medication review and identification of drug-related problems by the technicians may have helped to prevent potential ADEs by optimizing medication use and reducing inappropriate prescribing. Second, the patient education and counseling provided by the technicians may have improved patients' understanding of their medications and increased their awareness of potential side effects and drug interactions. Third, the follow-up

monitoring by the technicians may have helped to detect and resolve any ADEs that occurred during the course of treatment.

The significant improvement in medication adherence in the intervention group can be explained by several factors. First, the patient education and counseling provided by the technicians may have increased patients' motivation and self-efficacy in managing their medications. Second, the simplified medication regimens and use of adherence aids (e.g., pill boxes, reminder apps) may have made it easier for patients to take their medications as prescribed. Third, the regular follow-up and monitoring by the technicians may have helped to identify and address any barriers to adherence, such as side effects, cost, or forgetfulness.

The high level of patient satisfaction with the MTM program can be attributed to several factors. First, the personalized and patient-centered approach of the program may have made patients feel more engaged and empowered in their care. Second, the improved communication and collaboration between the technicians and other healthcare providers may have enhanced patients' trust and confidence in the healthcare system. Third, the tangible benefits of the program, such as reduced ADEs and improved adherence, may have contributed to patients' overall satisfaction with the program.

The findings of this study have several implications for practice and policy. First, they highlight the potential benefits of involving pharmacy and nursing technicians in MTM programs, which can improve the efficiency and cost-effectiveness of these programs. Second, they suggest that MTM programs should be integrated into the routine care of elderly patients with multiple chronic conditions to prevent ADEs and improve medication safety. Third, they underscore the importance of patient education and counseling in promoting medication adherence and patient satisfaction.

However, this study has several limitations that should be acknowledged. First, the cross-sectional design of the study does not allow for causal inferences about the impact of the MTM program on patient outcomes. Second, the convenience sampling technique may have introduced selection bias and limited the generalizability of the findings. Third, the self-reported nature of some of the outcome measures (e.g., medication adherence, patient satisfaction) may have been subject to recall and social desirability bias.

In conclusion, this study provides evidence for the effectiveness of a collaborative MTM program led by pharmacy and nursing technicians in preventing ADEs and improving medication safety in elderly patients in KSA. The findings suggest that such programs can be a valuable addition to the routine care of elderly patients with multiple chronic conditions. Future research should investigate the long-term impact of these programs on patient outcomes and healthcare utilization, as well as the optimal strategies for implementing and sustaining these programs in various healthcare settings.

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