

# Effectiveness of Different Medication Management Approaches on Elders' Medication Adherence

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**This pilot study investigated the effects of three different medication management approaches on medication adherence and resource utilization. Sixty-one participants living in an independent elder community in South Florida were randomly assigned to one of the three medication management approaches: (1) a pillbox method, (2) a voice-activated method, and (3) self-administration of medications as they had in the past. One outcome was measured by recording the number of doses of medications ingested over a 1-, 3-, and 6-month period. Adherence to medications also was measured by the impact on the medical diagnosis. For example, the hypertensive group was defined adherent by a sustained normotensive pressure. Participants' medical records were examined as to the number of physician office visits, hospitalizations, and home health visits.**

**There were significant differences in the mean number of doses missed, with the fewest in the voice-activated group to the highest in the self-administration (control) group. Additionally, the group that self-administered their own medications had more frequent physician office visits and increased hospitalizations. Because the elder population is prone to medication mismanagement for a variety of reasons, nurses are in a unique position to identify populations at risk and suggest interventions that may improve medication adherence.**

*Brian is a 72-year-old retired musician who is being treated for schizophrenia. Forgetting to take his medications resulted in a hospitalization for an acute psychotic episode.*

*Edith is an 80-year-old type 2 diabetic with severe retinopathy. Edith cannot see her medications and depends on familiarity with the size, shape, and color of her pills. When the shape and*

*color of her pills changed, she became confused and started taking a medication that had been discontinued in addition to her new prescriptions. Edith was found unconscious on the floor of her apartment. She was transported to the local hospital, where she spent 12 days, and then was moved to a rehabilitation center for another 28 days.*

These two cases represent medication non-adherence and contribute to the ever-escalating cost of health care in today's geriatric environment. Nonadherence accounts for an estimated \$100 billion dollars in direct and indirect health care costs annually, with over \$30 million estimated to be spent in South Florida alone.<sup>1</sup>

## **Purpose**

The purpose of this pilot study was to investigate the effect of three different medication management approaches on medication adherence. The study also examined the relationship between medication adherence and the utilization of health care resources, including number of physician office visits, hospitalizations, and home health visits.

Three questions were examined: (1) Which of three medication administration approaches is most effective in promoting adherence to prescribed medications? (2) Was there a sustained effect on medication adherence, using one of the medication management approaches, after a 6-month period? and (3) What is the relationship between the medication management approach and the utilization of health care resources?

## **Literature Review**

With an increase in age comes an increase in prescription medication usage. Older persons in general have any of 15 common medical problems for which they take multiple medications.<sup>2</sup> One study found that elders receive an average of 13 different prescriptions per year. Although

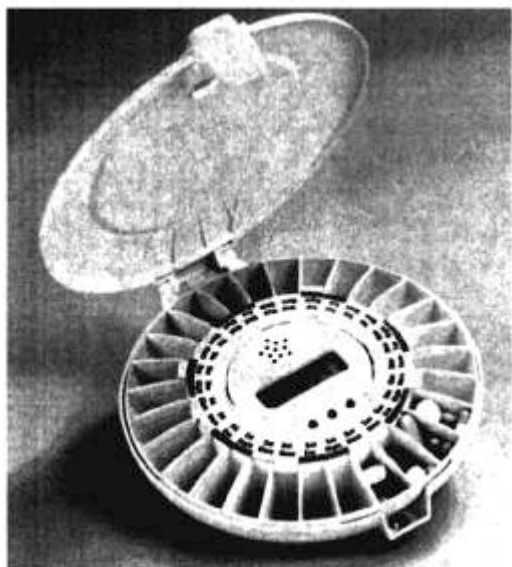


Figure 1. Pre-poured pillbox.

the average American adult takes 2.87 different medications, the number of medications taken simultaneously by elders is considerably higher (7–10 per day).<sup>3</sup>

Reasons for nonadherence include confusion over doses and schedules, forgetfulness in taking the medication, toxic interactions, and excessive financial expense leading to underuse of some drugs.<sup>3,5</sup> In another study of patients receiving antipsychotic medications, patients took an average of 58% of the recommended amount of the medication. Patients taking antidepressant medications took 65% of the recommended amount, and those patients with physical disorders took 76% of the recommended amount of prescribed medications.<sup>4</sup> Yet, another study showed that patients took 40% to 75% of the recommended amount of their medications.<sup>4</sup>

Many studies have been done on improving medication adherence.<sup>6–8</sup> Several studies included controlled systems for administering medications such as a phone reminder system, a beeper system, and other technical approaches. Techniques for improving adherence include better communication between provider and patient, education on medication doses and scheduling, home visits for monitoring medication usage, mechanical aides such as charts and written instructions, timing of medications individualized to the patient's schedule, color-coded pill bottles matched with a weekly pill tray, large readable directions, and a non-child-resistant cap for easy opening of medication bottles.<sup>3</sup> Obviously, although the appropriate use of medications can improve and maintain the health of seniors, the inappropriate use or misuse can lead to adverse side effects, deterioration, and multi-

ple other conditions that may result in more medical visits, hospitalizations, or even death.<sup>9–12</sup>

## Methods

The study sample included 61 participants out of 300 residents of an independent living facility located in South Florida. There were a total of 35 women and 26 men ranging in age from 70 to 100 years, with the mean age of 87 years. Forty clients were randomly assigned to one of two medication management programs, and 21 clients of similar age, gender, and cognition were assigned to a control group.

Participants in the study were capable of following simple directions, had a medication mismanagement episode, and had a hospitalization for medication nonadherence or an illness in which therapeutic accuracy was necessary for its management. These conditions included diabetes, cardiac disease necessitating anticoagulation, a psychiatric diagnosis requiring long-term antipsychotic drugs, complex dosing regimen, or alteration in comprehension and cognition.

The participants were primarily of Jewish descent with 12 to 14 years of education. The number of medications taken daily per elder ranged from 3 to 15 different medications, with dosages from 1 to 4 times daily. Clients were referred to the medication management program by the following sources: family (42.5%), staff (22.5%), self (20%), agency nurses (12.5%), and physician referral (2.5%). Participants had the following diagnoses: heart disease (17.5%), hypertension (17.5%), dementia (17.5%), diabetes (15%), cancer (7.5%), depression (7.5%), Parkinson disease (7.5%), and other miscellaneous diseases (10%).

Three different medication approaches were used. Group 1 used a pre-poured pillbox ( $n = 16$ ) in which individual doses were stored that was pre-filled on a weekly basis (Figure 1). Group 2 used an automated dispenser with a voice-activated message ( $n = 24$ ) that audibly reminded and automatically dispensed individual doses of the medication to the participant (Figure 2). In the control group ( $n = 21$ ), elders dispensed their own medications as they always had been doing.

All participants' records were reviewed before the study to determine whether they had any problems that might be related to nonadherence, such as medication reactions, hypertensive crises, falls, or abnormal prothrombin times. Records were examined again at 1, 3, and 6 months to determine whether there were any relationships between medication adherence and the number of physician visits, hospital admissions, and home visits, as well as the need for transition to a higher level of care.

Medication adherence was measured by the number of doses administered and the impact on the medical diagnosis. The hypertensive group was defined adherent by a sustained normotensive pressure; the cardiac patient on anticoagulant medication was defined adherent by a controlled prothrombin time (PT) with an international ratio (INR) of 2.0 to 3.0; those on antipsychotic drugs were defined adherent by stable therapeutic blood levels and mood stabilization; and elders with diabetes were defined adherent by the stabilization of blood glucose and periodic glycohemoglobin of under 9%.

A major assumption was that clients ingested the medications rather than discarding them. When individual doses of medications were counted at the end of the week, it was assumed that by recording missed doses, the lower number of missed doses meant a higher level of adherence to the medication regimen. The generalizability of this study is limited by the fact that all data were collected in one facility, therefore, any conclusions that are reached may be applicable only to this particular population and sample.

### Findings

The first two research questions examined the effectiveness of three types of medication management approaches with respect to the number of missed doses and the sustained effect on medication adherence. Significant differences were found with the lowest number of missed doses (2 at the 6-month interval) in the voice-activated approach, an increased number of missed doses (12.2 at 6 months) with the pillbox approach, and the highest number of missed doses (17.7 at 6 months) in the self-administration group. After 6 months, the average number of missed doses in the voice-activated group was 1.7, in the pillbox group 15.1, and in the self-administration group 19.7, suggesting that the best method to promote medication adherence is with a voice-activated system of medication administration. A univariate ANOVA showed these differences to be statistically significant ( $F = 20.28$ ,  $df = 2/59$ ,  $P < 0.001$ ).



Figure 2. Automated medication dispenser.

An  $F$  test was done to determine whether there were any significant differences between the intervals with respect to the number of missed doses. Significant differences were found in mean doses missed over the 1-, 3-, and 6-month intervals ( $F = 6.81$ ,  $df = 2/118$ ,  $P < 0.003$ ). In general, mean doses missed were highest in the first interval (month 1) and lower in the two later intervals (months 3 and 6).

The three medication management approaches also were compared with respect to mean doses missed, averaged over intervals using the Games & Howell procedure for pairwise contrasts with unequal group sizes. The voice-activated approach resulted in significantly ( $P < 0.01$ ) fewer missed doses ( $M = 1.7$ ) than the self-administered approach ( $M = 19.7$ ). The voice-activated group also had significantly ( $P < 0.01$ ) fewer missed doses than the pillbox group ( $M = 15.1$ ) (Table 1). There was no significant difference between the self and pillbox administration methods.

The third question examined the relationship between medication management approaches and the utilization of health care resources. Each individual client was followed over the 6-month period in terms of number of physician office visits, hospitalizations, and home health visits (Table 2). Elders in the voice-activated group had a decrease in the number of physician visits, and fewer required hospitalization

Table 1

#### Number of Missed Doses of Medications in Each Group for Each Time Interval

Time Interval	1 Month	3 Months	6 Months	Mean
Self Administration Group ( $n = 21$ )	22.3	19.0	17.7	19.7
Pillbox Group ( $n = 16$ )	18.6	14.6	12.2	15.1
Voice Activated Group ( $n = 24$ )	3.0	0.3	2.0	1.7
Mean	13.5	10.3	9.9	

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Table 2

## Monitoring the Utilization of Resources

Groups	Prior to the Study	At the End of 6 Months
Self Administration Group (n = 21)	Average physician visits = 1/mo PCP 1/mo Specialist No home health services	No change in physician visits 12 were hospitalized during course of study No home health services
Pillbox Group (n = 16)	Average physician visits = 1.5/mo 7 elders had prior prolonged hospitalizations No home health services	Average physician visits = 1.5/mo 4 elders hospitalized All continued weekly contact with RN No home health services
Voice Activated Group (n = 24)	Average physician visits = 2/mo All 24 had at least one prolonged hospitalization 12 elders had at least 2 hours home health services/day	Average physician visits = 1/mo 3 elders hospitalized for exacerbated CHF/pneumonia 3 elders continued with home health services for ADL assistance

and home health services. The elders who self-administered their own medications had no change in physician office visits and a dramatic increase in the number of hospitalizations. Because of the many factors that may influence the need for health services, comparisons cannot be made across the groups in the number of hospitalizations, physician visits, and home health services. In addition, many elders visit physicians as a social routine, rather than for a deteriorating condition, which may influence the findings.

Elders in the voice-activated group showed improvements in medication adherence within the first month of study and continued across the 6 months. Missed doses of medication were more evident in the self-medicated and pillbox group. On average, the group comparison indicated a significantly higher adherence rate in the voice-activated group. The pillbox group had an average of 30% missed doses per month, whereas the voice-activated dispenser group averaged less than 3% missed doses. Follow-up of the case studies presented at the beginning dramatically illustrates the positive results of both Brian and Edith being in the voice-activated intervention group.

*Brian has not been hospitalized in 10 months; he sees his therapist on a monthly basis and has found a female companion with whom he shares happy moments. His depressive behavior is not as evident, and he also finds pleasure in social activities. Physician reports indicate that his therapeutic blood levels have remained stable.*

*Edith has established a trust that her medications are correct and continues to take them as dispensed. She has had no further problems with medication adherence and continues to live*

*independently in her apartment. Edith remains mentally alert despite of her visual decline and engages in social activities.*

### Conclusions

The elderly population is more prone to medication mismanagement because of confusion over doses and schedules, forgetfulness, toxic interactions, and excessive financial expense leading to underuse of some medications. Non-adherence, polypharmacy, and drug-drug interactions are major contributors to the escalating use of the medical system and account for over 10% of all emergency room visits involving elders. When methods can be implemented that promote adherence to a medication regimen, benefits include a decreased utilization of health care resources such as fewer physician visits, hospitalizations, and home health visits.

Although the voice-activated approach is more effective for medication adherence, it is unrealistic for all persons. Some elders become agitated and even violent if voices are heard with no one in the room. Other reasons that need to be considered include the monthly cost as well as the lack of portability. Certainly cost may not be considered a negative aspect if the benefit of improved medication adherence decreases the utilization of health care resources. Because of its documented effectiveness in promoting medication adherence, the voice-activated approach should be used in populations at risk. Nurses are the ideal persons to recognize these clients and recommend the voice-activated approach to medication administration to assure adherence. In this study, nurses visited each client each

week to refill the medication packs. Participants were comfortable in addressing their questions, concerns, and needs to the nurse assigned to manage their medication program and would check with that nurse before seeking medical attention at the physician's office.

The President's Initiative for Healthy America 2010 focuses on reduction in resource utilization in the geriatric population.<sup>13</sup> Advanced practice nurses and nurses in general are in crucial positions to assist with this goal. Results from this study suggest that with the increasing age and longevity of the current population, nurses can anticipate and focus on clients' needs to assure the effective use of resources while maintaining clients' independence. By focusing on ways to keep the elderly healthy and independent in the new millennium, we will ensure our own healthy future.

### Acknowledgments

The authors thank Dr. Allan Nash, Florida Atlantic University, for his statistical support and guidance.

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Accepted for publication February 1, 2000.

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