

A Conceptual Framework to Study Medication Adherence in Older Adults

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ABSTRACT

Background: Adults aged ≥ 50 years often have multiple chronic diseases requiring multiple medications. However, even drugs with well-documented benefits are often not taken as prescribed, for a variety of reasons.

Objective: The objective of this article was to provide background information about medication adherence and its measurement, the development of the conceptual model for use in adherence research, and supportive intervention strategies such as pharmaceutical care by pharmacists to improve chronic medication use in older adults.

Methods: English-language literature published from 1990 to 2000 was searched on MEDLINE, International Pharmaceutical Abstracts, and AARP Ageline using the terms *aged, heart failure, CHF, adherence, chronic heart failure, compliance*, and related terms. The authors used their personal files and libraries to obtain seminal literature and textbooks published before 1990.

Results: Although the cognitive processes needed to manage and take medications decline with aging, the number of prescription and nonprescription medications consumed increases. Other factors such as vision, hearing, health literacy, disability, and social and financial resources may all complicate the ability of older adults to adhere to the pharmacologic prescription.

Conclusions: Many factors are associated with medication adherence and related health outcomes in older adults. Therefore, strategies to improve adherence will need to be multidimensional, including improvements in pharmacy services that consider age-related factors (eg, declining cognitive and physical functions) as well as a variety of environmental and social factors. (*Am J Geriatr Pharmacother.* 2004;2:36-43) Copyright © 2004 Excerpta Medica, Inc.

Key words: aged, conceptual model, medication adherence, outcomes research.

INTRODUCTION

Adults aged ≥ 50 years often have multiple chronic diseases requiring multiple medications.¹ Potential benefits of medications are improved quality of life, preservation of cognitive and physical function, and reduced risks of additional comorbidity and death.¹ Yet, even drugs with well-documented benefits in older adults are often not taken as prescribed.² The reasons for this failure to adhere to the pharmacologic prescription vary. In addition to age-dependent factors such as vision, hearing, and memory, other factors that are likely to be important include environmental, social, and financial support and perceived needs. Collectively, such influences affect older adults' ability

and willingness to take their medications. Studies are in progress to address the relationships among these factors in predicting adherence and, in turn, improve health outcomes.

The objective of this article was to provide background information about medication adherence and its measurement, the development of the conceptual model for use in adherence research, and supportive intervention strategies such as pharmaceutical care by pharmacists to improve chronic medication use in older adults.

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MATERIALS AND METHODS

We searched the electronic versions of the OVID version of MEDLINE, International Pharmaceutical Abstracts, and AARP Ageline to identify English-language articles published from 1990 to 2000 with the key words *aged* (not used for AARP Ageline), *heart failure*, *congestive heart failure*, *chronic heart failure*, *CHF*, *adherence*, and *compliance*, and related terms. While scanning the titles and abstracts, we extracted those articles involving adherence to pharmaceuticals and broad strategies to improve medication adherence. We were especially interested in high-quality studies of pharmaceutical care or other pharmacy-services research.

We collectively used our personal files and libraries to obtain seminal literature and textbooks published prior to 1990. In addition, we used a draft document of an ongoing study³ of an intervention on medication adherence in adults aged ≥ 50 years with heart failure, making use of concepts such as pharmaceutical care by pharmacists and other pharmacy practice components (eg, prescription container labeling, dispensing practices).

MEDICATION ADHERENCE

Inadequate support and supervision of older adults who self-administer long-term drug therapy puts them at risk for long periods of poorly managed treatment and resultant poor outcomes. Notwithstanding the importance of patients' proper self-administration of treatment, ~50% of chronically ill older adults do not adhere to their prescribed medication regimens,^{2,4} and most health care providers are inattentive to patients' pervasive low adherence.⁵ Older adults fail to adhere for a variety of reasons, including the following: forgetfulness or cognitive impairment; lack of understanding of the role their medications play in managing their disease (including over-the-counter [OTC] and herbal medications); inability to manage and reliably self-administer multiple medications; attitudes (eg, ignoring medication advice offered by health care professionals) and beliefs (eg, those influenced by their spirituality and culture); limited access to medications owing to lack of transportation or money; inadequate infrastructure for communicating information pertaining to medications among patients, physicians, pharmacists, and nurses; inaccurate patient drug histories; vague and incomplete documentation of adverse drug effects and drug-drug interactions; and antiquated drug delivery and monitoring processes.¹

Because the factors influencing adherence are many and varied, multifaceted, tailored interventions are necessary to improve self-administration of medications,^{5,6}

especially among older adults. Interventions are needed to enhance patient education, improve patients' self-treatment behaviors and skills, facilitate the identification and self-administration of patients' medications, and improve monitoring of their medication use.⁵ In addition to these patient-based interventions, other improvements may facilitate the medication use process, such as documentation of patients' adherence patterns and better communication among providers about these adherence patterns. Unfortunately, few rigorously designed studies have been conducted to determine the effect of interventions to improve the medication-use process on patient outcomes,^{7,8} but such studies are needed critically.⁸⁻¹⁰ Our collective opinion, based on our review of the literature, is that there is a paucity of data addressing the relationship between medication adherence and health outcomes, which emphasizes the need for innovative strategies to assist patients with their medications. We felt that because of their widespread availability, responsibility for educating patients about medications, excellent rapport, and regular contact with elderly patients, pharmacists are well poised to implement strategies aimed at improving adherence.

Measurements of Adherence

No gold standard exists for measuring medication adherence.^{4,11} The most frequently used methods include patient report, pill count, refill adherence, and electronic monitoring using bar code or microchip technologies. Each of these methods has advantages and disadvantages. For example, patient reporting is insensitive but has good specificity: when patients report they are not taking their medications, there is good reason to believe that such is the case.¹² Pill counts provide an overall estimate of patients' medication consumption over time but give no information about the timing of doses. This method is also subject to pill dumping immediately before the day of the pill count.¹³ Refill adherence is commonly used in retail pharmacy and pharmacy benefit management to track the patterns of patient refills using computerized prescription records.^{14,15} Access to refill data permits easy tracking of chronic treatments, but the data are widely dissociated from day-to-day medication consumption.

Electronic monitoring is the most accurate measure of the patients' chronic medication administration; it provides the date and time patients take their medications.^{16,17} Although machine code- or bar code-readable technology has been used to measure adherence,¹⁸ its measurement is confounded by patients' need to remember a secondary activity (scanning a card) in

conjunction with the primary activity (taking a pill). The medication event-monitoring system (MEMS V TrackCap, AARDEX Ltd., Zug, Switzerland) is one of the most popular microchip devices to implement electronic monitoring; this medication adherence method has been reported on in >250 peer-reviewed publications.¹⁹ The MEMS lid contains a digital chip that records the date and time of each opening and closing of the medication container. Our study group chose to use the MEMS lid as the primary assessment of patient medication adherence, but we also assess adherence by self-report and refill data.

PHARMACEUTICAL CARE OF OLDER ADULTS: THE EXAMPLE OF CONGESTIVE HEART FAILURE

It is unclear whether age-associated factors such as declines in cognition are associated with poor adherence or whether difficulties with adherence are mainly a function of the need to manage more medications as a result of greater disease burden.²⁰ There is an increased burden placed on older adults' ability to manage and self-administer a larger number of medications. Complicating the already high number of prescribed drugs is the popularity of OTC^{21,22} and herbal medications.²³ As such, it would appear that elderly individuals would benefit from more support from health care providers regarding their medications. Such support could derive from 2 core functions of pharmacy practice—dispensing and pharmaceutical care. Studies of pharmaceutical care in patients with congestive heart failure (CHF) are few, but their findings are encouraging.²⁴⁻²⁶

CHF is an exemplary disease for illustrating patient-level difficulties associated with adherence. The incidence of CHF increases with aging; in older adults, it is most often the result of a long history of poorly managed hypertension, which often requires multiple medications.²⁷ With the onset of CHF, patients may be required to take as many as ≥ 5 cardiovascular medications in addition to any medications needed for other chronic diseases. With the greater number of medications taken by older adults^{20,21,28} and the increased propensity of these individuals for cognitive impairment,²⁹ older adults with CHF would appear to be at risk for problems with medication adherence.

Pharmacists are becoming increasingly cognizant of evidence that the way a pharmacy provides its product may improve patient care. Recently, pharmacists have attempted to reorient their work toward improving patient outcomes³⁰ by providing patient education,³¹ monitoring medication use,²⁴ communicating with other health care providers about patients' favorable

and adverse drug experiences,³² and taking active steps to foresee and prevent drug problems.^{33,34} It is possible that changing the means of delivering pharmaceutical care, coupled with improving medication dispensing, could increase adherence and, ultimately, improve patients' outcomes.^{30,33,35} In summary, application of pharmaceutical care to the complicated treatment regimens of patients with CHF appears to have a good theoretical foundation and important clinical implications. From our literature review, we concluded that studies of pharmaceutical care in patients with CHF are few, but the findings are encouraging.²²⁻²⁶

CONSIDERATIONS IN THE DEVELOPMENT OF A CONCEPTUAL MODEL

Medication Use Process

We define the medication use process as the broad drug experience of patients who are taking prescription, OTC, and herbal drugs. The medication use process is dysfunctional for older adults with chronic disease: it can be hampered by the scope of their care, fragmentation of their care, limited knowledge of diseases and medications, attitudes and beliefs, cognitive impairment, poor health literacy, lack of supervised care, and the complicated medication regimens some older adults must manage (often alone).^{1,36} Patients may unwittingly complicate matters by supplementing their physician's drug regimen with a variety of OTC drugs, herbal therapies, and diets that can exacerbate CHF. Because of this often poorly coordinated and complex medication use process, it should not be surprising that many older adults with CHF are overwhelmed by their therapy and often do not adhere to it.^{1,2,37}

Older adults can benefit from careful supervision and monitoring of all of their medication use to improve adherence.³⁸ Appropriately trained pharmacists are well poised to deliver targeted interventions to improve medication adherence, but this has not happened in any systematic way.^{39,40} Sadly, largely owing to organizational constraints (eg, the need to process more prescriptions with fewer pharmacists, lack of remuneration for providing cognitive services to patients), pharmacy practice has not been able to adequately respond to the unique needs of older patients. Packaging and labeling for dispensed medications have changed little in the past 50 years. Patients receive a ubiquitous amber container of pills with a label containing directions that they may or may not be able to read, and colored auxiliary labels with tiny print that further challenge older adults' visual acuity and discrimination ability.^{2,21,41} Furthermore, patients

may be unable to open the medication container lids.^{2,41} Although some patients may receive verbal instructions about their medications from their physicians or pharmacists, more frequently, only a poorly organized, wordy medication information sheet accompanies their medications.

Application to Cognitive and Behavioral Theory

Cognitive and behavioral factors—including forgetfulness, problems in comprehension,²⁹ and low health literacy^{42,43}—contribute to low medication adherence in older adults. Patients have retrospective memory failure that results in forgetting what they have been told about their medications and whether they took them.⁴⁴ Prospective memory failure results in forgetting to take medications.^{11,45} Behavioral devices such as cues to remember to take a medication and recall that a dose has been taken are available to assist older people, but many older adults have not been appropriately trained to use these. Inadequate monitoring of medication use and limited communication among patients, physicians, and pharmacists compound the problem. The intervention we are studying addresses these barriers, as described below.

The Conceptual Model for the Intervention

We focus on the relationship between environmental factors, patient characteristics, and medication adherence as a process that ultimately affects patient outcomes (Figure). No single existing model fits our study plan. Therefore, we developed a framework to integrate several existing models. The intervention being used in an ongoing, 4-year trial seeks to improve comprehension and communication of instruction with the use of explicit pharmacist consultation, patient-specific organization of information with hand-outs designed according to theories of cognitive aging and instruction design, large-print instructions, simple language, and icon-based education materials that correspond to the medication being used by the patient. These strategies address the cognitive declines associated with aging to educate patients *how* to adhere and *why* it is important to do so.⁴⁶ Recognizing that medication adherence is a self-care process affected by many social and behavioral factors, we adapted the behavioral health care utilization model of Phillips et al,⁴⁷ as explained further in another article in this issue.³ This model relates environmental and population characteristics to health behavior, including per-

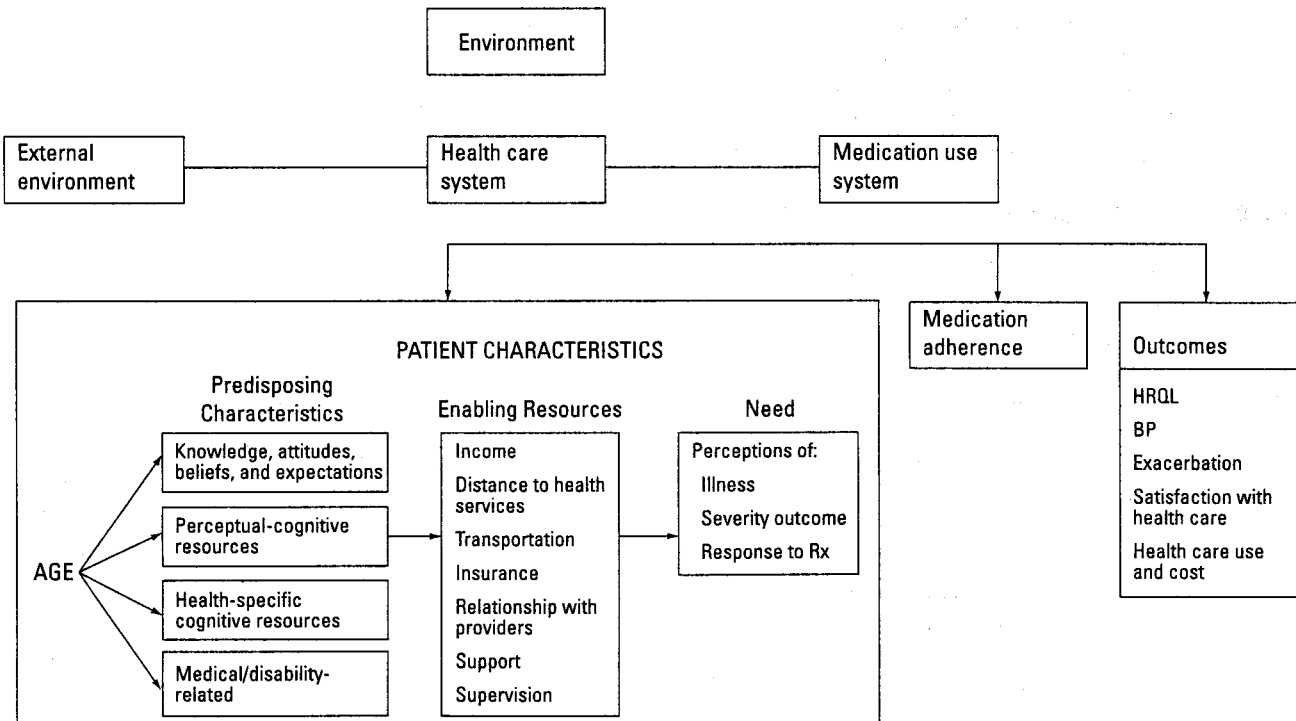


Figure. Study conceptual model. Rx = prescription; HRQL = health-related quality of life; BP = blood pressure.

sonal health choices (eg, medication adherence). Our conceptual model of medication adherence was also influenced by the model of Park and Jones,¹¹ which provides a more elaborate analysis of the patient factors relevant to adherence.

The components of the conceptual framework as they relate to medication adherence of older adults with CHF are described below.

Environment

We define the external environment as the patient's home and community composition and the level of support deriving from these sources. It includes the patient's living conditions, relationships with family and community, level of stress and violence in the community, and economic climate of the immediate community. Even the weather and ambient temperature may affect the ability of older adults to maintain their medication supplies.

Health Care System

This system includes "the policies, resources, organization, and financial arrangements influencing the accessibility, availability, and acceptability of medical care services (eg, physician supply)."⁴⁴ We are specifically interested in the distance patients must travel to obtain medical care, availability of transportation to the health care system for care and medications, insurance status, and need for prescription copayments. Our plan is to improve the infrastructure for communication about medications between patients and providers.

Medication Use System

This is defined as the intervention. It is proposed that improvements to the medication use system will improve medication adherence and, by so doing, will also improve patient health outcomes.

Patient Characteristics

These characteristics, which will be used to tailor the intervention, include predisposing characteristics, enabling resources, and needs.

Predisposing characteristics are preexisting factors that predict medication adherence. Some of these will not be affected by the intervention, including family composition, social structure, and spiritual or religious factors. Following the model of Park and Jones,¹¹ our model posits that age affects adherence through factors such as general and health-specific cognitive resources, and increases in illness and disability. *Perceptual-cognitive resources*, including sensory functioning,⁴⁸ working and

procedural memory,^{11,49} and processing speed, all decline with age and are key factors in a patient's ability to do the following: read, understand, and remember printed or spoken medication instructions; develop a plan for taking multiple medications; and remember to implement the plan (requiring prospective memory). We anticipate that these factors will affect medication adherence.^{11,50-52} Importantly, both the drugs used to treat CHF and hypertension and the worsening of the disease state appear to affect cognition.⁵³⁻⁵⁵

Health-specific cognitive resources include health literacy, communication skills, and prescription-taking skills. Health literacy among the elderly is poor.⁵⁶ Among 3260 Medicare enrollees from a large managed care plan in 4 cities, 33% of English-speaking and 54% of Spanish-speaking respondents had inadequate to marginal health literacy.⁴³ Only 12% of respondents understood the correct timing of dosing medications and only 16% understood how to take a medication on an empty stomach.⁴³ Age differences in health literacy may in turn reflect age-related declines in more general cognitive abilities such as speed of processing.⁵⁷ Patient literacy investigators recommend more visual instructions than textual ones,^{18,56,58} as well as the use of partnerships—including relationships with pharmacists—to improve literacy.^{58,59} The Council on Scientific Affairs of the American Medical Association⁵⁶ emphasizes the relationship between health literacy and aging. Baker et al⁵⁸ demonstrated that patients with inadequate health literacy were at 2-fold greater risk of hospital admission compared with patients with marginal or adequate health literacy. In summary, there is a clear need for pharmaceutical care strategies that are sensitive to health literacy.^{59,60} These include instructions organized by patients' preexisting knowledge about taking medication and the use of explicit, simple icons in such instructions.^{42,61,62}

Despite the patient's predisposition or propensity to adhere to their medications, access to certain *enabling resources*—supportive resources (eg, money or transportation to the pharmacy) and supervision—could improve adherence.^{63,64} The intervention is designed to enhance access to physicians and improve the patient's relationship with providers as it relates to medication use through added supervision by a pharmacist.⁶⁵

Even when patients are predisposed to adhere to their medication regimen and they have access to enabling resources, they must perceive a need to adhere. *Need* is the most proximal result of medication adherence and is measured by the severity of the patient's illness and symptoms, the ability to cope with the illness, and the

ability to manage a complicated medication regimen required by patients with CHF.⁶⁶ Patients are less likely to adhere when they do not perceive the severity of their illness or expect the medication to help.¹¹ Thus, adherence should also depend on factors related to knowledge, attitudes, beliefs, and expectations.⁴⁵

Although the seriousness of disability will not be affected by the intervention, we hypothesize that providing patients with educational materials that are sensitive to literacy levels and perceptual-cognitive problems (including icon-based education) will increase patient recognition and knowledge of their medications.⁶⁷ In addition, sensitizing the pharmacist to and providing training about cognitive, literacy, and sensory impairments is critical. For example, the study pharmacist is trained in verbal techniques to improve comprehension in patients with presbycusis and has been provided with a hearing amplifier (Pocketalker Pro, Williams Sound Corporation, Eden Prairie, Minnesota) to improve patients' ability to hear the pharmacist's instructions. The pharmacist is also trained to discuss medications with patients using the same patient-centered organization as in the printed instructions. To the extent that these strategies enhance overall medication management, patient adherence will improve for all chronic conditions. Improving adherence can ameliorate symptoms and lead to better health-related quality of life.⁶⁸ The pharmacist will also emphasize and reinforce coping skills. We hypothesize that doing so will improve adherence, decrease the risk of exacerbation, and improve health-related quality of life.⁶⁹

CONCLUSIONS

Adherence is an important issue in the management of chronic disease. Because of a greater burden of chronic disease, older adults must regularly self-administer numerous medications. We are currently studying the multidimensional factors associated with medication adherence and health outcomes in older adults with CHF. Our conceptual framework will allow us to ascertain the effects of age-related factors such as declining cognition on adherence as well as a variety of other environmental and social factors. Doing so will provide us with an integrated perspective on a vexing problem in the management of chronic diseases in older adults—namely, medication adherence.

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