The Notes section welcomes the following types of contributions: (1) practical innovations or solutions to everyday practice problems, (2) substantial updates or elaborations on work previously published by the same authors, (3) important confirmations of research findings previously published by others, and (4) short research reports, including practice surveys, of modest scope or interest.

Notes should be submitted with AJHP’s manuscript checklist. The text should be concise, and the number of references, tables, and figures should be limited.

Patients’ knowledge of medication care plans after hospital discharge

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Am J Health-Syst Pharm. 1998; 55:1389-93

There is evidence that appropriate medication use is determined primarily by the nature and quality of communication between the practitioner and the patient. Improved communication has been shown to increase the patient’s knowledge and recall of directions, satisfaction, compliance, and speed of recovery. Thus, communication with patients about medications not only helps patients understand how to use their medications appropriately but also helps provide patients with the motivation necessary for correct self-administration. In addition, such communication can provide valuable information to enable practitioners to make better decisions about diagnosis, prescribing, administration, and drug therapy monitoring. Theories of consumer behavior suggest that information must be stored as knowledge before appropriate decisions can be formulated and behaviors performed. We therefore focused on knowledge of medication care plans as a necessary, but not sufficient, step for compliance.

Optimal medication use by patients requires knowledge about medication care plans throughout the continuum of care. Discharge from the hospital is potentially a time of uncertainty and vulnerability for patients. Patients are in many cases given prescriptions for medications that are therapeutically incompatible with, or duplicates of, medications they already have at home. Combined with factors such as the need to clarify whether a prescription is still necessary for the patient, this often results in a delay in therapy and possibly suboptimal therapeutic effects. The integration of the various components of a patient’s therapy at the time of discharge, combined with the patient’s knowledge of those components, could improve quality of care and ultimately generate savings to the health care system.

Pharmacists who practice in a hospital setting have an opportunity to become part of this integration and education process by providing medication counseling before a patient is discharged. Evidence of pharmacists’ positive influence was found by Johnston et al. These authors reported that medication counseling provided to an elderly population by a clinical pharmacist before hospital discharge significantly improved knowledge about medications and thus the opportunity for compliance at home.

Our objective was to identify factors that could affect patients’ knowledge of medication care plans after hospital discharge. We believed that understanding these factors could help us define opportunities for medication counseling by pharmacists at the time of discharge.

We generated the following research question: What are the relationships between patients’ knowledge of their medication care plan after hospital discharge and patient age, number of discharge medicatio-
tions, counseling received from the dispensing pharmacist, and primary reason for hospitalization?

Methods. Study variables. The dependent variable, knowledge of medication care plans, was divided into six parts. Knowledge consisted of a patient's demonstrated understanding of six topics adapted from assessment questions used in the Indian Health Service counseling method.9

Four independent variables, two of which served as control variables, were studied. Patient age was selected because of documented relationships between advanced age and decreased ability to process and remember information,8,10 decreased motivation to obtain information,11 and increased complexity of drug regimens.5 These characteristics of aging can adversely affect patients' knowledge of their medication care plan after discharge from the hospital.

Having an increased number of medications has been shown to adversely affect patients' knowledge and appropriate use of medications.12 The higher amount and complexity of knowledge required as the number of medications increases can result in too much information for a patient to process and remember.13

Counseling received from the dispensing pharmacist was included as a control variable. In Ohio, federal and state laws mandate an offer of pharmacist consultation in community pharmacies. However, these rules do not apply to hospital inpatients.

The last independent variable we selected was primary reason for hospitalization. This was included as a second control variable because the nature of a patient’s hospitalization could influence the knowledge the patient retained about his or her medication care plan. For example, patients who were hospitalized for the birth of a child were more likely to be prescribed short-term medications for pain and constipation than were other patients. Such a difference in therapy type could influence individuals' knowledge of medication care plans.

Study sample. All patients discharged from Grant Medical Center, a large teaching hospital located in downtown Columbus, Ohio, were considered for the study. The study was approved by the institution’s investigational review board. Systematic sampling was performed by using a daily list of all patients discharged from the hospital. Patients were excluded from the study if they (1) were discharged to an extended care facility, (2) had died, (3) had no telephone number recorded in their medical chart, (4) were unable to be contacted by telephone after four attempts, (5) were unable to be contacted within six weeks of discharge from the hospital, or (6) did not give oral consent.

Data collection. A retrospective chart review of all patients was performed to collect each patient's address, telephone number, and age; information about discharge medications; and primary reason for hospitalization. After the chart review, a post card was mailed to each patient notifying him or her of the upcoming telephone call. A telephone survey was conducted with each patient between two and six weeks after discharge. At the beginning of the interview, each patient was informed that participation in the study was voluntary. Patients were asked six questions to determine their knowledge of their medication regimen. Patients were defined as having “demonstrated understanding” if they provided a correct response to the questions for all their discharge medications. To be coded as having knowledge in relation to the question, What medications were you discharged on?, a respondent would have had to correctly provide the names of all his or her discharge medications. This was done because insufficient knowledge about even one medication could result in suboptimal outcomes and present an opportunity for pharmacist intervention. Respondents who read the information directly from the medication's label were not included in the analysis. The responses of these patients were coded as missing data. Some types of knowledge were not applicable to some medications and were also coded as missing data. In addition, patients were asked whether they received counseling from the pharmacist who dispensed their discharge medications. At the time of this study, an outpatient prescription service was not available at the hospital. Discharge medications were prescribed by hospital physicians and obtained from the community pharmacy of the patient's choice.

To pretest the methods, a pilot study was conducted in November 1996 with 53 patients. Data for the final study were collected through February 1997. All patients were assigned a personal identification number for the purpose of confidentiality and ease of data collection for a patient log.

Data analysis. Descriptive summaries were computed for each variable. Means were used to summarize patient age and number of medications. Patient age was categorized into five groups on the basis of an analysis by Wiederholt et al.14: (1) less than 30 years, (2) 30–39 years, (3) 40–54 years, (4) 55–74 years, and (5) 75 years or older. Number of medications was categorized on the basis of the median split of responses. Frequencies and percentages were used to summarize counseling received from the dispensing pharmacist, primary reason for hospitalization, and each of the six components of patient knowledge.

Logistic regression modeling was used to determine which independent variables were the best predictors of patient knowledge about each of the six categories. Potential problems with multicollinearity among independent variables were assessed by computing pertinent correlation coefficients (phi or point biserial correlations) between each pair. Chi-square analysis was used for determining the order in which independent variables were to be added to the model. Goodness of
fit for competing logistic regression models was assessed on the basis of the change in -2 log likelihood and model improvement chi-square statistics. The best-fitting model for each type of knowledge was chosen on the basis of goodness of fit and parsimony of interpretation. After the best-fitting model was determined, the odds ratio and corresponding 95% confidence interval were computed for the regression coefficient of each variable that was determined to be a significant predictor. The level of significance for all statistical tests was 0.05.

Results. A total of 135 patients met the criteria for inclusion in the study and were contacted by telephone; 2 of these refused to participate because they were too ill.

The mean ± S.D. age of respondents was 50.8 ± 19.8 years (range, 15–86); 18.0% were less than 30, 15.8% were 30–39, 23.3% were 40–54, 27.8% were 55–74, and 15.0% were 75 or older. The mean ± S.D. number of discharge medications was 3.5 ± 2.5 (range, 1–14), with 45.1% of respondents taking 1 or 2 medications and 54.9% taking 3 or more medications; 73.4% of the respondents taking 1 or 2 medications were ≤54 years, and 56.1% of the respondents taking 3 or more medications were ≥55 years. Patient counseling by the dispensing pharmacist was reported by 30.8% of respondents; the remaining 69.2% did not receive counseling because it was not given by the pharmacist or because the patient was not the person present at the time of dispensing.

The primary reasons for hospitalization in descending order of occurrence were vascular or coronary problem, 30.1%; obstetrics or gynecologic event, 27.1%; infectious disease, 12.0%; orthopedic problem, 6.8%; ophthalmic problem, 6.0%; spinal or neurologic problem, 5.3%; gastrointestinal problem, 5.3%; respiratory problem, 5.3%; cancer, 1.5%; and renal problem, 0.8%. Because of the relatively large percentage of patients whose primary reason for hospitalization was related to obstetrics-gynecology (OB–GYN) and the unique nature of this hospital stay, the control variable “primary reason for hospitalization” was divided into two groups: OB–GYN and other.

Of the six specific knowledge types, knowledge of how to take the medications was displayed by the highest percentage of respondents (82.1%) (Table 1). The results also show, however, that ≤25.0% of the respondents displayed knowledge about what to expect from their medications, what to avoid while taking them, and lifestyle changes that needed to be made. None of the correlation coefficients for the independent variables had an absolute value of ≥0.30 except for the correlation between primary reason for hospitalization and age (rpb = 0.64). Given the relatively small samples used for the logistic regression, we decided to view with suspicion any model that

![Table 1](https://via.placeholder.com/150)

<table>
<thead>
<tr>
<th>Question Representing Type of Knowledge (Order of Question in Interview)</th>
<th>% Respondents Who Demonstrated Knowledge for All Discharge Medications</th>
<th>Model with Best Fit</th>
<th>Predictor Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>How were you told to take the medication? (3)</td>
<td>123</td>
<td>82.1</td>
<td>NUM</td>
</tr>
<tr>
<td>What were you told the medication was for? (2)</td>
<td>129</td>
<td>78.3</td>
<td>AGE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AGE 30–39&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>AGE 40–54&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>AGE 55–74&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>What medications were you discharged on? (1)</td>
<td>123</td>
<td>55.3</td>
<td>NUM</td>
</tr>
<tr>
<td>What were you told to expect from the medication, for example, side effects you were told to look out for? (4)</td>
<td>132</td>
<td>25.0</td>
<td>NUM</td>
</tr>
<tr>
<td>What were you told to avoid with this medication, for example, sunlight or certain foods? (5)</td>
<td>95</td>
<td>24.2</td>
<td>None</td>
</tr>
<tr>
<td>Do you know any lifestyle changes you will need to make with this medication, such as diet? (6)</td>
<td>27</td>
<td>18.5</td>
<td>None</td>
</tr>
</tbody>
</table>

<sup>a</sup>Does not total to 133 because of missing data.
<sup>b</sup>The independent variable in the logistic regression model with the best fit (p < 0.001).
<sup>c</sup>CI = confidence interval.
<sup>d</sup>Reference category for comparisons was three or more medications.
<sup>e</sup>Reference category for comparisons was age of ≥75 years.
contained both primary reason for hospitalization and age.\textsuperscript{15}

Logistic regression models of the associations between the four independent variables and the six parts of patients' knowledge of medication care plans showed that four of these parts differed according to number of medications prescribed at discharge or patient age (Table 1). The best predictor of patients' knowledge of how to take their discharge medications was number of medications prescribed at discharge. Patients prescribed only one or two medications at discharge were 5.38 times more likely to be knowledgeable than those prescribed three or more medications. Patient age was the best predictor of knowledge about the purpose of the medications. Patients \textgtr=55 years old had the most problems with this part of medication knowledge. Number of medications at discharge was the best predictor of knowledge about the names of discharge medications and what to expect. For each type of knowledge of medication care plans, respondents who took three or more medications were more likely to have deficits in knowledge than were the other respondents. None of the four independent variables significantly affected patients' knowledge of what to avoid while taking their discharge medications. The number of usable cases for knowledge about lifestyle changes was insufficient for logistic regression analysis. A majority of the patients were prescribed medications for which lifestyle changes did not apply.

**Discussion.** Some limitations of this study should be noted. Although Grant Medical Center serves a relatively diverse cross section of patients from Ohio and adjoining states, the results of this study cannot be assumed to be representative of all patients in the United States. In addition, the time between discharge and the patient being contacted may have been a limitation. In some cases, the period for conducting telephone interviews was extended to six weeks. Patients may no longer have been taking medications prescribed at discharge (e.g., analgesics, antibiotics). Some patients may have returned to see their physician within this period and have had a change in medication regimen. Also, the prenotification postcard may have prompted patients to become more aware of their medications, although the postcard gave no indication of the nature of the questions to be asked during the interview. Receipt of counseling from a dispensing pharmacist was self-reported by patients, and no assessment was made concerning the quality of any counseling received. Finally, additional independent variables that might be important predictors of patient knowledge (e.g., concomitant diseases, cognitive status) were not considered.

As expected, patients' overall knowledge of their medication care plan after hospital discharge was not perfect. More than 75% of the patients in this study demonstrated knowledge about how to take their medications and the purpose of their medications. Only slightly more than half could name their discharge medications, and 25% or fewer could correctly describe what to expect from their medications, what to avoid while taking the medications, and what lifestyle changes they needed to make.

Prescription drug labels and written information that accompanies prescription drugs can provide a useful reference about how to take medications, the purpose of the medications, and the name of each medication. However, information about what to expect, what to avoid, and what lifestyle changes are needed is not so readily available. Pharmacists could provide a valuable service to patients by collecting patient-specific information and then advising patients on what to expect, what to avoid, and what lifestyle changes to make.

Providing such information to patients being discharged from hospitals can be challenging because of other patient concerns (e.g., transportation, financial issues, quality-of-life adjustments, recuperation). Green et al.\textsuperscript{5} identified several factors important to medication education and behavioral change: relevance, individualization, feedback, reinforcement, and facilitation. It is beyond the scope of this article to discuss each factor, but such a patient-education resource can be useful for developing discharge counseling and follow-up strategies.

Our results suggest that, as pharmacists become more involved in discharge counseling about medications, the age of the patient and the number of discharge medications prescribed can be useful indicators of the level of counseling a patient might need. For example, patients taking three or more medications are less likely than patients taking only one medication to know how to take their medications, the names of the drugs, and what to expect. These patients are candidates for intensive counseling, detailed written information, and follow-up telephone consultation to help them understand, remember, and comply with their medication regimen.

The results of this study showed that patients 55 years or older are less likely than younger patients to know the purpose of their medications. Older patients are more likely to have complex or multiple diseases, making it more difficult to remember which medications serve which purpose. For example, a young patient taking two medications might be using one for pain and another as a stool softener. An older patient taking two medications might be using one to treat cardiac arrhythmia and the other for high blood pressure. The more complex medical conditions might make it more difficult for the older patient to remember information about the medications. It should be noted that older patients are discharged with a greater number of prescriptions, on average, than younger patients. Given that most of the patients taking three
or more medications were ≥55 years, we interpret the results of our logistic regression as suggesting that the source of challenges in medication administration for some older patients might be the large number of medications they take and not necessarily the patients' lack of ability or motivation to understand the medication care plan. We expect that the results of this study will increase the awareness of opportunities for hospital pharmacists to provide discharge counseling. Patients 55 years or older and patients who are prescribed three or more medications at discharge could benefit most from pharmacist counseling about medication care plans at the time of discharge. In some instances, this may be the only oral instruction a patient receives upon discharge. As pharmacists strive to make themselves permanent and accepted parts of a patient's health care team, other health care practitioners may view medication counseling at discharge as an appropriate role for pharmacists. As more services move to the outpatient arena, this role may become even more prominent. Existing barriers to discharge counseling, such as lack of time and unwillingness to counsel, will need to be addressed, however.

**Conclusion.** Among patients discharged from a large teaching hospital, there was a significant negative relationship between patient age and knowledge about the purpose of discharge medications. There were also significant negative relationships between the number of discharge medications and knowledge about how to take the medications, the names of the medications, and what to expect from the medications.

**References**


