

## Effect of a Pharmacist Medication Review in Elderly Patients Discharged From the Hospital

During hospital admission, several changes in a patient's drug regimen are often introduced. After discharge, patients frequently do not know which drugs to take, and 20% of the patients experience an adverse event.<sup>1,2</sup> Medication review is a successful intervention to improve medication safety.<sup>3</sup> We studied the effect of medication review consisting of medication analysis, treatment analysis, patient interview, and counseling by community pharmacists and pharmacy technicians on the occurrence of drug-related problems (DRPs) among elderly patients discharged from the hospital.

**Methods.** We performed a randomized, controlled intervention study in patients 60 years or older using at least 5 prescribed drugs and discharged from the hospital, with DRPs as the main outcome measure. The method has been described in detail previously.<sup>4</sup> Pharmacies were electronically randomized as a control or intervention pharmacy.

**Intervention and Control Groups.** Twenty-four community pharmacists at the intervention pharmacies performed a medication review, including medication analysis, treatment analysis, patient interview, and counseling. Two clinical pharmacologists (J.G.H.) developed a checklist of different types of DRPs, which has been developed based on review of the literature and experts in the field. A face-validity procedure was performed by 12 clinical pharmacologists. Drug-related problems were categorized using the Pharmaceutical Care Network Eu-

rope DRP-score form.<sup>5</sup> A general practitioner was consulted about the chronic diseases of the patient and the DRPs identified. Pharmacy technicians interviewed and counseled patients at discharge from the hospital. The effects and adverse effects of the medication were inventoried by means of a semistructured protocol.

In the control group, identified DRPs were registered by the 2 clinical pharmacologists at baseline and after 1 year. Control pharmacies provided usual care according to the Dutch Pharmacy Standard.<sup>4</sup>

**Statistical Analysis.** Linear regression analyses were performed adjusting for confounders. Subgroup analyses were used to investigate the effectiveness of the intervention in specific patient groups.  $P < .05$  was considered statistically significant.

**Results.** Of the 489 eligible patients, 340 (69.5%) agreed to participate. We included 180 and 160 patients in the intervention and control group, respectively. There were no significant differences in patient characteristics between the 2 groups. At baseline, there were more patient perceived DRPs in the intervention group. At the 12-month follow-up, 13 and 8 patients in the intervention and control group, respectively, did not have an interview or DRP assessment.

**Effect on the Occurrence of DRPs.** The total number of DRPs at baseline and at follow-up were 253 and 437, respectively, in the control group and 271 and 689, respectively, in the intervention group. The mean number of DRPs identified with the medication analysis decreased from baseline to follow-up in the intervention group from 1.51 to 1.37. In the control group, the number of DRPs increased from 1.58 (baseline) to 1.62 (follow-up). The mean number of DRPs identified with the patient interview in the intervention group decreased from 3.88 (baseline) to 2.33 (follow-up). In the control group, the mean number of DRPs increased from 2.73 (baseline) to 2.80 (follow-up).

The proportion of patients with an increased, unchanged, or decreased number of DRPs after follow-up (compared with baseline) in the intervention group was significantly different from the control group (**Table**). This effect was also significant for the specific DRPs "clear indication but no medication" and "fear of adverse effects" (Table).

**Regression and Subgroup Analyses.** Linear regression analysis show that both medication analysis and patient interview resulted in a significant reduction of DRPs after follow-up. After adjusting for age, sex, number of drugs, and baseline DRPs, the reduction of DRPs identified with the patient interview was not significant.

Subgroup analyses showed that the reduction of DRPs identified with medication analysis was significantly more pronounced among patients with hypertension ( $P = .01$ ) and heart failure ( $P = .001$ ). The reduction of DRPs identified with patient interview was significantly more pronounced among patients with hypertension ( $P = .04$ ).

**Comment.** We demonstrated that pharmacist-led medication review is an effective method to reduce DRPs, in particular "no drug but clear indication" and "fear of adverse effects," among elderly patients discharged from the hospital. The beneficial effect of the medication analysis was more pronounced in patients with heart failure or hypertension.

**Table. Proportion of Patients With an Increased, Unchanged, or Decreased Number of DRPs After Follow-up in the Intervention and Control Groups**

Variable	Increased/Unchanged/ Decreased, % <sup>a</sup>	
	Intervention	Control
Medication analysis		
Total DRPs	8.4/69.0/22.6	20.2/61.7/18.1 <sup>b</sup>
Interactions	2.6/88.4/9.0	2.7/85.9/11.4
No drug but clear indication	6.4/83.2/10.3	16.1/75.8/8.1 <sup>b</sup>
Dose too low	1.9/96.1/1.9	5.4/91.9/2.7
No clear indication for drug use	0.0/99.4/0.6	0.0/97.3/2.7
Unnecessary long-duration treatment	4.5/89.7/5.8	8.0/87.9/4.1
Incorrect drug choice	1.3/94.8/3.9	5.4/91.3/3.4
Double medication	0.0/97.4/2.6	0.0/99.3/0.7
Contraindication	0.0/99.4/0.6	0.0/97.3/2.7
Patient interview		
Total DRPs	23.5/20.6/55.9	38.6/19.0/40.8 <sup>b</sup>
No knowledge of drugs	18.3/48.9/32.5	22.6/49.6/27.7
Ineffectiveness	0.7/95.7/3.5	2.2/91.2/6.6
Adverse effects	12.0/52.5/35.4	24.8/40.9/34.3
Not satisfied with medication	9.9/74.5/17.1	13.0/68.6/18.2
Fear of adverse effects	5.7/78.0/16.3	14.6/73.3/11.7 <sup>b</sup>

Abbreviation: DRPs, drug-related problems.

<sup>a</sup>Percentage of patients in which DRPs are increased/unchanged/decreased.

<sup>b</sup> $P < .05$ ,  $\chi^2$  using linear by linear association.

Medication review, patient counseling, and telephone follow-up reduced the rate of adverse effects in this patient population.<sup>2,6,7</sup> However, the effect on specific patient-perceived DRPs after hospital discharge has not been studied.

Although the checklist was not validated, it was developed on the basis of literature search and a face validity procedure with experts. Patient-perceived DRPs at baseline were significantly higher in the intervention group than in the control group. We adjusted for this difference in our analysis. Control pharmacists could have become more conscious of the possibility of DRPs, thereby becoming more observant and active in resolving DRPs. This may have led to an underestimation of the effect of the intervention.

Abeer Ahmad, MSc  
Giel Nijpels, MD, PhD  
Jacqueline M. Dekker, PhD  
Piet J. Kostense, PhD  
Jacqueline G. Hugtenburg, PhD

**Published Online:** August 6, 2012. doi:10.1001/archinternmed.2012.2816

**Author Affiliations:** Departments of Clinical Pharmacology and Pharmacy (Ms Ahmad and Dr Hugtenburg), General Practice (Dr Nijpels), and Epidemiology and Biostatistics (Drs Dekker and Kostense), EMGO Institute for Health and Care Research, VU University Medical Center, Amsterdam, the Netherlands.

**Correspondence:** Ms Ahmad, Department of Clinical Pharmacology and Pharmacy, VU University Medical Center, Van Der Boechorststraat 7, 1081 BT Amsterdam, the Netherlands (a.ahmad@vumc.nl).

**Author Contributions:** *Study concept and design:* Ahmad, Nijpels, Dekker, and Hugtenburg. *Acquisition of data:* Ahmad and Hugtenburg. *Analysis and interpretation of data:* Ahmad, Nijpels, Kostense, and Hugtenburg. *Drafting of the manuscript:* Ahmad and Hugtenburg. *Critical revision of the manuscript for important intellectual content:* Nijpels, Dekker, Kostense, and Hugtenburg. *Statistical analysis:* Ahmad, Nijpels, and Kostense. *Obtained funding:* Hugtenburg. *Administrative, technical, and material support:* Ahmad. *Study supervision:* Nijpels, Dekker, and Hugtenburg.

**Financial Disclosure:** None reported.

**Trial Registration:** trialregister.nl Identifier: NTR1194

**Previous Presentation:** This manuscript was presented at the International Conference on Pharmacoepidemiology and Therapeutic Risk Management; August 14-17, 2011; Chicago, Illinois.

**Additional Contributions:** Maria Ruth Mast, MSc, assisted with data collection and in the development of a checklist of different types of drug-related problems used in the study.

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## Last Orders: Follow-up of Tests Ordered on the Day of Hospital Discharge

Failure to follow up test results contributes to patient harm, affecting between 20% and 61% of inpatient tests.<sup>1,2</sup> Such missed results are clinically significant, with the potential to affect patient care.<sup>3-5</sup> One factor that might shape test follow-up is the time available for review during admission. Tests requested early in an admission have more chance of being reviewed than those that are requested later in the hospital stay. Tests ordered on the day of discharge have a very limited chance of being reviewed. If time available for review is indeed a determinant of follow-up rates, there may be a potential to target the tests with limited review and increase the opportunity to improve follow-up rates. Previous studies have not accounted for this factor in their data analyses. In this study, we examined the risk for missed follow-up given

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the time available for follow-up. We hypothesized that test follow-up was a function of the opportunity for follow-up, measured as the number of admission days available for test review. We focused on tests ordered on the day of discharge, because this class of tests provides a unique opportunity for targeted intervention.

**Methods.** The study was conducted at a 370-bed metropolitan teaching hospital. Clinical pathology tests performed on inpatients between February and June 2011 were extracted from a computerized test-reporting system, excluding tests associated with deceased patients and tests communicated directly to the ordering physician. The prevalence of missed laboratory tests was determined by inspecting electronic time stamps that were generated when the tests were viewed and was calculated as the proportion of tests that were not reviewed at patient discharge or 2 months after discharge. All data were de-identified. The study was approved by the University of New South Wales, Sydney, Australia, as well as the hospital's research ethics committee.

**Results.** A total of 733 891 individual tests were performed across 6736 inpatient admissions, with 662 858 meeting the inclusion criteria. Of these, 3.1% (n=20 449) were not reviewed at discharge, decreasing to 1.5% (n=10 043) 2 months after discharge (eTable 1; <http://www.archinternmed.com>). A total of 37.7% (n=25 422) of all inpatient admissions had 1 or more missed results before discharge, decreasing to 28.0% (n=1886) 2 months after discharge.