

# Frequency and predictors of drug therapy interruptions after hospital discharge under physician drug budgets in Germany

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## Key words

pharmacoepidemiology – pharmacoconomics – drug discontinuation – hospital discharge – ambulatory care – drug budgets – general internal medicine

**Abstract. Objective:** We sought to study how frequently prescription drug therapy at hospital discharge was discontinued or changed by general practitioners under physician drug budgets in Germany and explore reasons and predictors for such discontinuations. **Methods:** This cohort study was part of a larger project on clinical outcomes of acute hospital care in patients with 5 groups of medical diagnoses, including conditions of the heart, lung and brain, gastroduodenal ulcer disease and diabetes. Patients entered the study cohort at hospital admission and were followed throughout their stay until they had their first encounter with a primary care physician responsible for follow-up treatment after hospital discharge. Nurse practitioners and physicians assessed patient characteristics at admission and discharge. A 1-page questionnaire on continuity of care, including drug therapy, was provided to primary care physicians at the first patient encounter. The primary study endpoint was discontinuation of drug therapy by the primary care physician. Data were analyzed by multivariate logistic regression. **Results:** A total of 3,267 patients in 22 primary care hospitals were eligible for the study. Standardized questionnaires on continuation of drug therapy were returned by 890 patients (27%); 846 patients (95%) used prescription drugs at discharge. Of those, drug therapy was interrupted in 122 (14%). Reasons for discontinuations included excessive costs of drugs in 66 patients (54%), excessive number of drugs prescribed (32, 26%) and differences in judgment on the clinical appropriateness of a drug (23, 19%). In a multivariate logistic regression, gastroduodenal ulcer disease was a significant predictor for discontinuation (OR = 3.1; 95% CI 1.5–6.5). Discontinuation tended to be more likely in older patients (69–76 years vs. ≤ 58: OR = 2.0; 1.0–3.9) but slightly less likely in male patients (OR = 0.7; 0.4–1.1). **Conclusion:** Dis-

continuation of drug therapy after hospital discharge is common. The high costs of prescription drugs were the most common reason. Elderly patients seem to be particularly affected.

## Background

Long-term therapeutic outcome of an episode of hospitalization critically depends on primary care physicians continuing to prescribe drug treatment initiated in the hospital. However, transition from the hospital to ambulatory care has recently been described as a source of treatment changes, interruptions and discontinuations [Jones et al. 1995]. Some studies indicated that medication prescribed for the patient at hospital discharge was frequently changed in primary care [Adl et al. 2001, Cochrane et al. 1992, Duggan et al. 1996, Himmel et al. 1996, Schroder-Bernhardi and Dietlein 2002]. A study in Germany found that 34% of the drugs prescribed at hospital discharge were changed in ambulatory care. Data were based on all patients (n = 130) of a single practice who were discharged from the hospital during 1 year [Himmel et al. 1996]. Other studies found that 2–6 weeks after returning into ambulatory care up to 90% of patients used their medication differently than prescribed at hospital discharge [Adl et al. 2001, Cochrane et al. 1992, Duggan et al. 1996]. However, these data were collected by asking patients about their medication; it remains unknown which of these changes were initiated or approved by their general practitioner (GP). Little in-

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Table 1. Response rate per disease group.

Disease group	Sample of larger study	Responding to questionnaire	Percentage response	95% confidence interval
Brain	463	105	23%	19 – 27
Diabetes mellitus	421	131	31%	27 – 35
Gastroduodenal ulcer disease	215	72	33%	27 – 39
Heart	1,461	386	26%	24 – 28
Lung	514	148	29%	25 – 33
Unknown	193	82	42%	35 – 49
Total	3,267	924	28%	26 – 30

formation is available about why GPs change their patient's discharge medication. A large survey in the UK ( $n = 1,207$  GPs) identified a list of concerns, including lack of knowledge about a patient's discharge medication, a lack of knowledge by GPs about prescribing in specialized areas and the high costs of medication [Sibbald et al. 1992]. Beyond that, it has not been demonstrated whether these general concerns actually lead to interruptions in drug therapy. We sought to study, in a prospective cohort study, the frequency with which GPs changed their patient's discharge medication and to identify predictors for changes or discontinuation.

## Methods

This study was part of a larger project investigating outcomes of hospital care. Methods are described in detail elsewhere and in the internet [Eichenlaub et al. 2001, Qualitätsmodell Krankenhaus 2002, Schneeweiss et al. 2000, 2001]. In brief, data were collected in 22 units of internal medicine in 22 primary care hospitals across Germany between September 2000 and May 2001. Patients were recruited at hospital admission and followed throughout their stay. Patients were included if they suffered from 1 of 13 specified diagnoses from 1 of the following 5 disease groups: diabetes, heart, lung, gastrointestinal and brain conditions. Patient characteristics were assessed at admission by health professionals and at hospital discharge with pilot-tested questionnaires [Schneeweiss et al. 2000]. Data included sociodemo-

graphics, diagnosis, disease state, severity of disease, functional status and co-morbidities measured by the Index of CoExisting Diseases (ICED) [Greenfield et al. 1987]. Further, patients were asked to give the physician responsible for follow-up treatment a 1-page questionnaire on continuity of care. This included patients who were not prescribed drug treatment by the hospital at discharge. Physicians were asked to indicate if they continued to prescribe the patient's discharge medication and to provide information on reasons for any changes or discontinuations. This was based on each physician's consideration of what constituted a change or discontinuation.

We calculated proportions and 95% confidence intervals using standard methods [Gardner and Altman 1989]. A multivariate logistic regression model was fitted to the data to quantify associations between patient characteristics and interruptions in drug therapy after hospital discharge. Odds ratios and 95% confidence limits were reported [Hosmer and Lemeshow 2000]. Statistical analysis was performed using SAS (V. 8, SAS Institute, Cary, NC, USA).

## Results

A total of 3,267 patients participated in the study. Questionnaires from physicians responsible for continuing drug treatment after discharge were returned by 924 patients (28%). Comparable response rates were obtained from 5 different groups of diseases (Table 1). Patients for whom responses were available were significantly younger than non-responders (mean age 65.5 years vs. 68.0 years,  $p < 0.0001$ ) and more likely to be discharged to the community (31% vs. 18%,  $p < 0.000$ ).

Table 2 shows sociodemographic characteristics of the 924 responding patients. The majority of patients were over 60 years old and were members of public insurance funds; 386 patients (42%) were admitted with a primary diagnosis of heart disease, and between 72 and 148 patients (8 – 16%) were in each of the other disease categories (Table 1). Information on continuation of drug treatment was available for 890 patients (96%). Drug therapy was required by 846 (95%) of those patients. Patients who did not require drug

Table 2. Characteristics of study patients (n = 924).

	Number of patients or mean	%
<i>Gender</i>		
Male	421	54
Female	356	46
Unknown	147	—
<i>Age (mean age)</i>	65	—
<i>Age categories</i>		
0 – 20	6	1
> 20 – 40	46	6
> 40 – 60	205	25
> 60 – 80	461	57
> 80 – 100	98	12
Unknown	108	—
<i>Living circumstances before admission</i>		
At home	631	78
At home with support	145	18
Nursing home	28	3
Unknown	120	—
<i>Insurance status</i>		
Pensioner	522	63
Social benefit	4	0.5
Other	308	36
Unknown	80	—
<i>Type of insurance</i>		
State funded mandatory	759	96
Private	35	4
Unknown	130	—

therapy after discharge were significantly younger than patients who were prescribed drugs (mean age 57.6 years vs. 66.0 years,  $p < 0.0005$ ). There appeared to be no systematic difference in the likelihood of having drug therapy at the time of discharge among disease groups.

The continuity of drug therapy was interrupted for 122 patients (14%). Table 3 shows the reasons why physicians did not continue patients discharge medication. More than half of these changes were due to excessive costs of drugs (66, 54%). In these cases, GPs frequently discontinued expensive medications, changed to less expensive alternative drugs or substituted with generics. Often, prescriptions were changed because physicians felt that too many drugs had been prescribed (32, 26%) or disagreed with the clinical appropriateness of the prescription (23, 19%). Physicians found errors in the discharge medication such as the same drug having been prescribed twice or felt that too many drugs prescribed for the same indication. In some cases physi-

cians disagreed with the medication suggested by the hospital and changed the prescription back to what the patient had been prescribed before hospital admission. Non-compliance by patients was also a reason for a change in drug therapy. A range of other reasons was identified, e.g. physicians being unable to continue discharge medication because they had not received any information on the discharge medication or patients requesting that medications be changed to the ones prescribed before hospital admission. Physicians gave 2 or 3 reasons for change in 31 cases (25%). Among these patients, costs and number of prescribed drugs were mentioned in 13 cases (11%), prescriptions not making sense and an excessive number of drugs prescribed in 9 cases (7%), excessive costs and non-compliance in 6 cases (5%) and an excessive number of many drugs prescribed and non-compliance in 5 cases (4%).

Disease categories, age and gender were studied as potential predictors for interruption of drug therapy. Table 4 presents the results of the multivariate logistic regression. Gastrointestinal ulcer disease was a significant predictor for discontinuation of drug therapy. However, there was no pattern in the reasons GPs gave for discontinuations; in particular, costs did not seem to be the main issue, as there were only 3 such cases (21%). The risk of interruption in drug therapy tended to increase with increasing age, and therapy was slightly less likely to be discontinued in male patients. Several other potential predictors were examined, i.e. comorbidity and functional status of the patient, but did not show a relevant association with treatment discontinuation.

## Discussion

This study investigated the continuation of drug therapy after hospital discharge from 22 primary care hospitals across Germany. A change in drug therapy was reported for a substantial number of patients (122, 14%). However, others have reported that up to 90% of patients experienced interruptions in their discharge medication [Adl et al. 2001, Cochran et al. 1992, Duggan et al. 1996, Himmel et al. 1996]. The majority of these studies have included data on changes that patients

Table 3. Reasons for interruptions of pharmacotherapy (more than one reason were possible).

Reasons	Interruptions (n = 122)	% of interruptions	Reasons for interruptions per disease group					
			Brain (n = 16)	DM (n = 13)	GI (n = 14)	Heart (n = 37)	Lung (n = 23)	Unknown (n = 19)
High costs of medication	66	54	9	8	3	25	14	7
Excessive number of drugs prescribed	32	26	4	5	4	8	4	7
Prescription makes no sense	23	19	3	3	4	4	4	5
Patient non-compliant with drug use	18	15	3	3	2	6	2	2
Adverse drug event	5	4	1	0	0	1	1	2
Other reasons	14	11	0	1	5	4	2	2
Total number of reasons (multiple answers)	158	–	20	20	18	48	27	25

DM = diabetes mellitus, GI = gastro-duodenal ulcer disease.

Table 4. Results of multivariate logistic regression.

Predictor	Odds ratio	95% confidence interval
<i>Disease group</i>		
Brain vs. heart disease	1.4	0.7 – 2.9
Diabetes vs. heart disease	0.9	0.4 – 1.9
Gastro-duodenal vs. heart disease	3.1	1.5 – 6.5
Lung vs. heart disease	1.7	0.9 – 3.1
Gender (male vs. female)	0.7	0.4 – 1.1
<i>Age categories</i>		
77 – 100 vs. ≤ 58	1.7	0.8 – 3.3
69 – 76 vs. ≤ 58	2.0	1.0 – 3.9
59 – 68 vs. ≤ 58	1.6	0.8 – 3.3

themselves made to their drug therapy, e.g. when they used more than the prescribed doses [Adl et al. 2001, Cochrane et al. 1992, Duggan et al. 1996]. It has been found that patients frequently use drugs differently than the prescribed drug regimen [Barat et al. 2001, Bedell et al. 2000], but this is likely to be similar at hospital discharge as at any other time.

In addition to medication changes, we identified how frequently primary care physicians discontinued discharge medications. This definition was based on each physician's consideration of what constituted a change of therapy. Alternative definitions of what constitutes a change to discharge medications is likely to result in rates that are difficult to compare. Most earlier studies have been single-site studies investigating a small number of patients, e.g. 130 patients of a single GP practice [Himmel et al. 1996] or prescriptions

for 50 geriatric [Cochrane et al. 1992] or 192 cardiology patients [Adl et al. 2001] discharged from 1 hospital, whereas more than 900 patients discharged from 22 hospitals were included in our study.

In our study, high drug costs were described as the most important reason to change therapy. This finding reflects the discrepancies between hospital formularies and the out-patient reimbursement structure for drugs. Pharmaceutical companies offer discount prices for their products to hospitals, sometimes with a binding contract of exclusive use. The hospital staff is encouraged to use those drugs even though alternative medications are available for less costs in ambulatory care [Tonks 1994]. A recent study also suggested that physicians in German hospitals commonly underestimated the market costs of brand-name drugs, thereby not necessarily selecting the most cost-effective medication [Schnurrer et al. 2001].

General practitioners in Germany were forced to prescribe low-cost drugs because of physicians' drug budgets at the time of the study. Overspending their drug budgets would have resulted in financial losses [Kiewel 2002]. It has been suggested that the quite crude cost-containment method of budgets affected the quality of prescribing in primary care [Richter-Reichhelm 2000] and may have led to substitution with increased hospitalization rates [Schneeweiss et al. 1998, Schöffski 1996], although findings are of questionable validity [Schneeweiss et al. 1998]. Neither clinical appropriateness nor actual costs of drug therapy were assessed in

our study. However, data strongly suggest that costs of drugs remain a factor associated with prescription drug changes and discontinuation during the vulnerable transition phase from hospital to ambulatory care under physician drug budgets.

Another reason why GPs disagreed with the treatment initiated in the hospital was that they felt that a particular prescription was not necessary/appropriate or that patients were prescribed too many drugs. Some of these changes may have been required because of changes in the patient's health status or prescriber-specific preferences in prescribing. However, data also indicated that a failure in communication between primary and secondary care providers is a source of disagreement about a patient's drug therapy. Surveys show that GPs would like to receive more information on the rationale for the drug therapy, suggested for their patients [Al-Rashid et al. 2001, Munday et al. 1997]. The primary means of communication between the hospital and ambulatory care are discharge letters, but these have been shown to contain insufficient information on a patient's therapy, to be delayed or to be completely absent to a considerable proportion [Himmel et al. 1996, Mageean 1986, Penney 1988].

Patients with gastroduodenal disease and older patients were found to be more likely than other patients to have their drug therapy interrupted. Our data do not support that this is exclusively a cost issue. For example, it can be speculated that patients have more control over their diets once they are discharged and therefore can discontinue gastro protective agents safely. It appears imperative to initiate further studies on the appropriateness of these medication changes since it is well-known that prescribing to older patients is complex due to altered pharmacokinetics and polypharmacy [Kruse 1994] and that they are at increased risk of not being prescribed effective drugs [Kirsten and Knuth 1999].

This study relied on patients to deliver a questionnaire to their primary care physician and then for each physician to send the completed form to the study center, thus opening the study to a potential selection mechanism. The response rates were similar across the different disease groups, but the responding patients were significantly younger than non-responders, were more likely to be discharged

to community and were of better functional status [Schneeweiss et al. 2001]. Our study results, therefore, refer mainly to patients who live at home after hospital discharge rather than to patients who are transferred to other health care facilities such as nursing homes or rehabilitation centers. Our data showed a trend for a higher risk of interruption of drug therapy for older patients. This suggests that our findings are only a lower band of the true magnitude of discontinuations of pharmaceutical treatment after hospital discharge.

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