

Standardized Documentation of Drug Recommendations in Discharge Letters

A Contribution to Quality Management in Cooperative Care

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Summary

Objectives: To analyze the necessity and potential usefulness of a computerized physician order entry (CPOE) system in supporting the writing of pharmacotherapeutic recommendations in discharge letters.

Methods: Systematic analysis of drug recommendations in discharge letters of a hospital providing tertiary care, structured interviews with in-hospital prescribers, and focus groups with general practitioners who admit patients to this hospital.

Results: We analyzed 1800 randomly selected discharge letters, 1205 of which contained pharmacotherapeutic recommendations. The frequencies, structure, and quality of these recommendations varied considerably between departments. Nearly 16% of the recommendations contained both proprietary (brand) and non-proprietary names (active ingredient). Interviewed clinicians expressed interest in CPOE systems that check for contraindications and interactions between drugs, suggest cheaper products, and automatically insert active ingredients when omitted. The focus group sessions confirmed that the pharmacotherapeutic recommendations in current discharge letters do not effectively support daily clinical practice.

Conclusions: Documenting active ingredients as well as brand names in drug therapy recommendations is currently not part of clinical practice. Computerized decision support can help to optimise the structure and communication of therapeutic information across interfaces and can be a quality factor with considerable influence on process quality, outcome quality, and costs of cooperative patient care.

Keywords

Medical informatics, decision support, drug information services, computerized medical records systems, discharge letters

Methods Inf Med 2006; 45: 336–42

1. Introduction

Computerized physician order entry (CPOE) is increasingly discussed in the medical informatics community. Few articles focus on topics of order entry like test ordering [1, 2], or quality aspects like the timeliness of results [2]. The majority of articles deal with medication [3–5] and discuss the topic of patient safety [6]. But especially the role of CPOE in patient safety is currently the subject to debate. While for example in pediatric care a considerable reduction of adverse drug events by 40.9%, of prescription errors by 99.4%, and of rule violations of 97.9% after implementation of a CPOE system has been observed [7], in another pediatric setting CPOE implementation coincided with increased mortality [8]. Indeed, high rates of adverse events may still occur after CPOE implementation [9] and the sources of errors in the computer-supported medication process are numerous [5, 10]. This may explain why negative emotions towards CPOE can frequently be observed [11]. Nevertheless, it is reasonable that CPOE systems can contribute to a higher quality of the medication process if they are well-designed and carefully applied. Decision support for drug selection, dose adjustment and monitoring is necessary [9] to maximize effectiveness and safety.

With the growing trend of treating patients in a cooperative manner ('cooperative care') another aspect of process quality for medication emerges: In the German drug

market we are confronted with a large number (about 56,000) of proprietary medicinal products. These medications include both so called 'originator products' which require a full dossier for marketing authorization, and their 'generic' formulations (i.e. competitor medicinal products containing the same active ingredient that have been marketed after expiry of the patent of the originator). General practitioners, whose patients typically obtain their medication directly from a full-service pharmacy, prescribe brands from the whole market. Hospital pharmacies, however, are smaller in scale and are not able to have this variety of products in stock. The typical tertiary care hospital provides a (often electronic) catalogue that includes approximately 2000 to 3000 products. Due to this difference, challenges for the prescribing physicians may arise when out-patients from general practitioners become in-patients of hospitals which only have restricted local formularies (see Fig. 1, cf. also [12]). As a consequence, in many instances medication is switched to another proprietary product when a patient already on drug therapy is admitted to a hospital. As an example, a patient with congestive heart failure may be maintained on three drugs which have been prescribed by his general practitioner. Upon admission a clinician may have to exchange several drugs either because a given product is not available in the hospital pharmacy or because of a change in the patient's ongoing medical problem. He may also add

drugs to treat the acute illness prompting the admission. Hence, multiple changes in drug therapy will occur, some of which are caused by the differences between the respective formularies. Because of the complexity of the prescription process, every change also holds the risk of introducing an error. In Germany, when a patient is discharged from the hospital, the patient's physician writes a discharge letter. This letter summarizes the reasons for hospitalization, the interventions, and results and findings during the hospital stay, and gives recommendations for further therapy to the general practitioner (cf. e.g. [13]) who is in charge of follow-up. Patients are additionally given prescriptions for their discharge medications at the time of discharge. After discharge the clinician has to decide whether the patient should resume treatment with the medication administered before hospitalization and/or continue the medication administered during the hospital stay. Because ambulatory drug therapy is covered by a restricted budget dedicated to the individual general practitioner, general practitioners have a direct incentive to favor well-priced drugs. Since a hospital formulary is rather small and costs are optimized for in-hospital patients, conflicts between discharge medication and (affordable) ambulatory treatments are frequent [14]. Hence, combination therapy after discharge tends to be modified with switches to generic brands or cheaper me-too preparations (competitor drugs that may lack significant therapeutic advantages), or may even be discontinued [14-17].

Similar problems also arise when prescriptions or recommendations only specify a therapy's active ingredients, such as occurs in countries like the United States or Great Britain. For example on the one hand additives (e.g. sulfites) may cause toxic reactions in sensitive patients or they can also lead to interactions with other drugs (e.g. cremophor). On the other hand there are products for which dosing information relates to the active agent as free base (e.g. lithium, phenytoin), as opposed to other products that refer to the salt. In the latter case the same strength of two brands may contain grossly divergent amounts of active compound resulting in considerable changes in exposure.

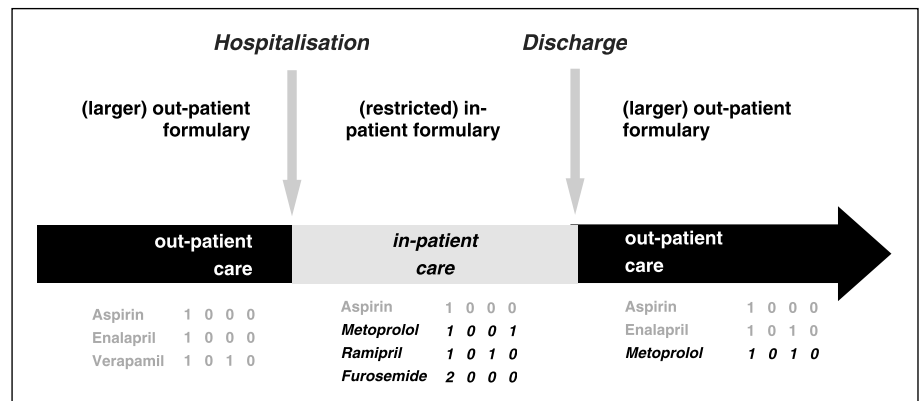


Fig. 1 Typical examples of changes in drug therapy at the interface between in-patient and ambulatory care leading to multiple switches of therapy. Whereas some drugs are maintained across borders, others are started or discontinued. In many cases equivalent drugs are not switched back at discharge even though no medical reason would argue against resumption.

To improve drug prescription at the interface between in-patient and ambulatory care, both factors relating to active ingredient as well as brand name should be considered to duly account for characteristics of the individual patient (Table 1). It therefore appears critical to always recommend active ingredients as well as appropriate brand names. Given the size of the market and the frequency of changes (particularly in pricing), it is a considerable effort for the clinician to find and compile all information for a comprehensive drug recommendation (although this is of major relevance for effectiveness, patient safety, and process quality in general practice).

Indeed, it would facilitate prescriptions in general practice and reduce breaks and switches in pharmacotherapy if prescribers in hospitals would consider the particularities of the ambulatory setting. To support the whole process of drug and dose selection, an electronic drug information system coupled to knowledge bases for dose individualization (AiDKlinik) has been running at the Heidelberg University Hospital since 2003 [18]. It contains detailed information of all products on the German drug market, including the German summary of product characteristics and public prices. Drugs available in the hospital formulary are highlighted and always displayed first (www.aidklinik.de). Further characteristics of AiDKlinik include: electronic prescribing with interfaces to the local hospital information systems, dosing recommenda-

tions for patients with renal insufficiency, mini expert systems for drug selection in particular patients, and an error-tolerant search feature. We wanted to extend the functionality of AiDKlinik so that it could also assist physicians in the compilation of discharge medication orders, and to tailor this functionality to include the particular needs of interns and residents. Before developing such a system, we needed to evaluate both sides of the in-patient/out-patient continuity of care interface. The goal of this investigation was to answer the following questions:

- How often are drug recommendations in discharge letters formulated as an active ingredient or brand name?
- Does this share differ in the various departments of a large teaching hospital providing tertiary care?
- Do pharmacotherapeutic recommendations in discharge letters oppose the respective standards in general practice?
- What are the requirements for an electronic system that supports the prescription process in discharge letters while considering the needs of physicians on both sides of the interface?

2. Methods

To analyze the different questions we undertook three independent investigations, combined their results in a joint analysis, and de-

Table 1 Relationship between parameters defining a drug in a discharge letter (brand name or active ingredient) and their necessity to be used for clinical decision support, i.e. for tablet splitting it is important to know the brand name; for foreseeing potential allergic reaction it is important to know the active ingredient. (SPC = summary of product characteristics).

Parameter	Decision support functions with respect to ...	Comment
Brand name (link to SPC and galenic specification)	Tablet splitting	Strongly depends on galenic characteristics
	Cost optimization	Legal requirements, package size information
	Allergy to additives	e.g. sulfites
	Drug-food interactions	Often depend on liberation characteristics of the brand and other galenic characteristics
	Incompatibilities (e.g. i.v. formulations)	Strongly depend on galenic formulation and additives
	Indication	Considering diseases and patient populations (e.g. children) with approval in the SPC
	Contraindication	Considering diseases and patient populations (e.g. children) as labelled in the SPC
	Adverse drug reactions	Sometimes depend on galenic formulation (e.g. different for instantly and slowly releasing brands)
Active ingredient	Adverse drug reactions	Often depend on active ingredient, sometimes also on specific salts of an ingredient
	Allergy	
	Drug-lab interactions	e.g. electrolyte co-administration with i.v. antibiotics
	Maximum daily/total allowances	
Parent active ingredient	Therapeutic alternatives	e.g. switch within a drug class
	Drug-drug interactions	
	Dose adjustment	e.g. in renal failure
	Pregnancy warnings	
	Drug use in the elderly	e.g. Beer's criteria
	Pharmacogenetics	

veloped a list of system requirements and an architecture for a computerized tool to support the prescription in discharge letters. The following three methods were applied: manual analysis of discharge letters, structured interviews with clinicians, and focus group interviews with general practitioners.

2.1 Analysis of Discharge Letters

We randomly selected 1800 discharge letters of a hospital providing tertiary care dating from the month before the project started. The sample was weighed according to the number of in-patient cases of individual departments of the hospital. For each drug in each discharge letter we assessed whether the following information on drug

therapy was listed unambiguously: brand name, active ingredient, strength, and dosage schedule.

2.2 Structured Interviews with Clinicians

Each department in this hospital nominates a senior physician as a delegate to the hospital's drug committee, which deals with all matters of drug use in the hospital. In order to collect the views of the delegates, we first developed a guideline for performing a structured interview and then performed a test interview with an independent clinician. After optimization, the interviews were performed, interview result summaries were

sent to the interviewed clinicians, and feedback was requested.

2.3 Focus Group Interviews

Five focus group interviews were prepared and conducted with 25 general practitioners of the region by the Department of General Practice and Health Services Research according to existing guidelines [19]. In accordance with Tang and co-workers [20] a focus group was defined as "a qualitative data collection method used to obtain the views and experience of a group of people in a defined topic area" [20]. Several group discussions are recommended to receive reliable data on a research topic. Focus groups as a research method are becoming increasingly popular in health research. The group interviews conducted in this study focused on the communication of pharmacotherapy at the interface between general practitioners and hospital residents. The focus groups were audio and video taped, transcribed, and analyzed using the software ATLAS.ti (ATLAS.ti – the Knowledge Workbench, 2005).

3. Results

Parts of these data have previously been published in abstract form [21].

3.1 Analysis of Discharge Letters

We analyzed discharge letters from each department involved in in-patient care (a total of 1800 letters). Of these, 1205 discharge letters contained pharmacotherapeutic recommendations (66%) for follow-up treatment. For 188 discharge letters (15.6% of 1205) the drug recommendations contained the name of all active ingredients. This percentage varied among the departments with a range between 0 and 46% (mean \pm standard deviation: 16.6 \pm 13.8%).

The 1205 discharge letters contained information on 5792 drugs, which is an average of 4.7 drugs per discharge letter that contained pharmacotherapeutic recommen-

dations. For 975 of the recommendations, the drug was described by both brand name and active ingredient (16.8%), for 313 the drug was only identified by the name of the active ingredient (5.4%) and for 4504 (77.8%) the drug was only identified by the brand name.

Again considerable differences between different departments were observed. The share of drug recommendations which contain brand name and active ingredient varied in the departments between 0 and 60% ($14.3 \pm 20.1\%$).

Information on the completeness of the dosing regimen is shown in Figure 2. For 81.7% of all drug recommendations, the information on dosage per administration was unambiguous. This varied in the departments between 20 and 100% ($76.1 \pm 21.3\%$). The number of administrations per day was described in 55.6% of the recommendations by a detailed scheme for drug administration, and an additional 30.5% were accompanied by an unambiguous free text description for administration.

3.2 Structured Interviews with Clinicians

There is a typical process for writing discharge letters in Germany. First, the clinician who treated the patient dictates the letter and then the secretarial staff transcribes the dictation. Afterwards there is a correction cycle starting with the resident, later involving a senior physician and often the head of the clinic, and with a final review performed by the clinician who treated the patient. When the letter is signed by all responsible physicians, it is sent to the general practitioner who will continue the patient's ambulatory care. A copy is also archived in the patient record. The members of the hospital drug committee who represented 12 departments treating in-patients and writing discharge letters reported the following supporting measures in place at their departments: departmental guidelines for structure and layout (12 = 100%), integration of patient data from the local hospital information system (12 = 100%), use of standard text elements (auto text, 5 = 41.6%), and template letters for frequent

diagnoses (2 = 16.6%). The departments reported that discharge letters were written either in the evening before discharge (three departments, 25%), immediately after discharge (eight departments, 66.7%), or, in the case of one department, at a later date. Seven departments (58.3%) reported using the brand name as the main drug information while listing the active ingredient in brackets after the brand name. In three (25%) departments the opposite was reported. Two departments typically recommended in most cases the drugs that the patient was taking before his stay in the hospital. Eight departments (66.7%) used their electronic intranet information system as an information source for pharmacotherapeutic recommendations, and eight departments used a paper-based comprehensive German drug market book [22]. These two groups partially overlap, with six departments (50%) using both. Other information sources like guidelines or colleagues were only mentioned in isolated cases.

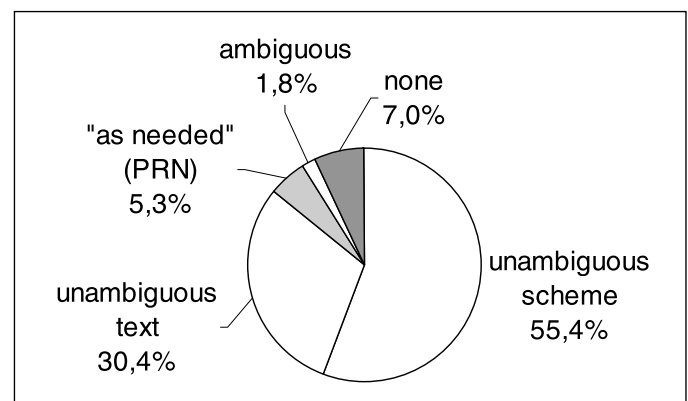
Additional useful support features for electronic drug information systems mentioned by the clinicians included: Alerts for contraindications and drug interactions, automatic display of low-priced alternatives, automatic entry of the active ingredient, as well as comprehensive and up-to-date drug information.

3.3 Focus Group Interviews

The focus group interviewees mentioned that pharmacotherapeutic discharge recom-

mendations generally do not consider the budget constraints for drug prescription in out-patient care. They assumed that hospitals have contracts with pharmaceutical companies so that expensive drugs can be obtained below the sales prices of a public pharmacy. The general practitioners expressed that prescribing after discharge would be easier to them if the active ingredients were consistently mentioned in all pharmacotherapeutic recommendations. The selection of a suitable drug was identified as a problem, whereas dosing of drugs was not mentioned as such by the focus group members. The availability of the discharge letter immediately after patients are discharged from hospital was a major issue in all focus group interviews. A major requirement identified in all focus group interviews was that the primary care physician receives a fax 24 hours prior to discharge that contains the recommended pharmacotherapy, and indicates the appropriate clinician to contact if questions arise after discharge. In addition, unnecessary switches could be avoided and acceptance of treatment changes would be increased if the reasons for changes in medication were also given. Of further help would be if information given to the patient at discharge were printed (and therefore better legible) instead of handwritten. The members of the focus groups also expressed that they would appreciate if discharge letters were written according to the SOAP structure (Subjective findings, Objective findings, Assessment, Plan, cf. e.g. [23]).

Fig. 2 Fraction of 5792 drugs mentioned in 1205 discharge letters with information on dosage regimen (number of administrations per day). In an unambiguous scheme it would be noted by "1-0-1-0" that one tablet should be administered in the morning and one in the evening.



4. Discussion

4.1 Discussion of Results

Our results have confirmed that pharmacotherapeutic recommendations at the interface between primary and secondary care are a frequent source of problems in Germany caused by a process which is not harmonized and far from being adjusted to the needs of either party involved. For clinicians it is a time-consuming task to translate the current in-hospital therapy into a prescription meeting the expectations of the colleague in an entirely different setting. In Germany, for general practitioners, the drug recommendations in discharge summaries can induce an economic burden if treatment costs exceed the constituted budget. Finally, the se-

lection of an appropriate drug for a patient is an important quality factor, because adverse reactions can be avoided and effectiveness can be improved. To meet the expectations of all parties, the drug recommendation in a discharge letter should include the active ingredient as well as examples for brand names. The active ingredient is important to know to facilitate switches between therapeutic alternatives which will also affect cost. But in most cases it will also be important to know corresponding brand names, because brand names are specifically linked to the summary of product characteristics (SPC) that is approved by the local authorities. This statutory document is the legal basis of prescribing and defines important conditions for the safe use of a drug (e.g. approved indications). Brand names are also the link to additives, galenic information, and cost. Table 1 lists drug char-

acteristics which are related to the product or to the active ingredient and which would be useful features of future decision support systems.

A common weakness of the communication of drug therapy in this setting is the lack of using a common thesaurus for the drugs needed by the patient. Since formularies on both sides of the interface between in-patient and out-patient care differ considerably in the number of brands, but differ significantly less with respect to the number of active ingredients, increasing the proportion of recommendations that specify active ingredients as well as brand names would likely help fill this communication gap. A possible standardization effort which is deduced from the results of this study and fulfills the requirements of German legislation is summarized in Figure 3. To support the prescription process at the interface between in-patient and out-patient care according to the suggestion in Figure 3 a CPOE system needs to be integrated into the local information system, and requires decision support and an option for long-term archiving. In order to cope with the sizeable amount of active ingredients, additives, and brand names, different thesauri are needed to match data and knowledge in external resources to the knowledge base of the CPOE system (cf. Fig. 4, Table 1).

When analyzing the discharge letters we found that dosage information is often incomplete and ambiguous. According to the results of our focus groups this was, however, not a critical weakness, and did not cause problems in general practice. Moreover and more important for the general practitioner, the results of our qualitative research revealed that clinicians rarely use active ingredients, and prefer prescribing brand names. Indeed all interviewed representatives of the departments in the hospital drug committee thought that active ingredients are always either mentioned in brackets after the brand name, or are mentioned with first priority, which was only true in a minority of the cases when analyzed objectively. There are several ways to increase the use of active ingredients in daily practice, but the least effort and training hours are encountered if a strategy is adopted whereby active ingredients and

Active ingredient (brand name and low-price alternative if available)	Strength	Dosing scheme	Comment
Ramipril (e.g. Delix® 5 or Ramipril® AL 5mg Tabl.)	5 mg	1-0-0-1	Switched from enalapril because of longer duration of action
Acetylsalicylic acid (e.g. Aspirin® N 100 mg or ASS 100 Hexal®)	100 mg	1-0-0-0	
Metoprololsuccinate (e.g. Beloc-Zok® Retardtbl.)	47.5 mg	1-0-0-0	Started due to progression of heart failure; increase dose cautiously
Furosemide (e.g. Lasix® 40mg or Furosemid-ratiopharm®40mg)	40 mg	2-0-0-0	Started due to progression of heart failure; reduce dose once recompensated

Fig. 3 Suggested standardization of pharmacotherapeutic recommendations in discharge letters considering the German law and suggestions of general practitioners participating in the focus groups.

brand names are both accepted, and if either is missing, is automatically added to the text. Without doubt, this is a task that can be readily and more efficiently solved by a computer system than by physicians in a hectic environment.

4.2 Limitations of the Study

We weighted the sample size according to the numbers of cases of each department and therefore assume that the sample was representative. We did, however, only analyze discharge letters of one month assuming that they reflect a rather typical situation for this hospital. This may have introduced a bias, but had the considerable advantage of being closely linked in time with corresponding interviews of physicians writing the letters and those receiving them.

Another potential bias may have been introduced by selecting interview partners only from the hospital drug committee who mostly were senior physicians and consultants. We might have obtained divergent results if we had drawn a representative sample of interns or junior residents who might have had more direct insight into the actual prescribing habits. We preferred, however, to have interview partners from each department who have an overview of all aspects of the drug prescription process in their department.

4.3 Perspective

For efficient cooperative care it is necessary to improve the interfaces for drug therapy between in-patient and out-patient care. This could start with a structured history of the out-patient drug therapy at the time of admission. Reliable and comprehensive information on previous drug exposure is necessary for being able to continue relevant drug therapy, and to avoid withdrawal syndromes and drug interactions. Such information is also required if the patient is to be returned to pre-admission medication regimens after discharge. Efforts toward a patient-centered electronic health record [24-26], and in particular the function of electronic prescriptions [12, 27] on the

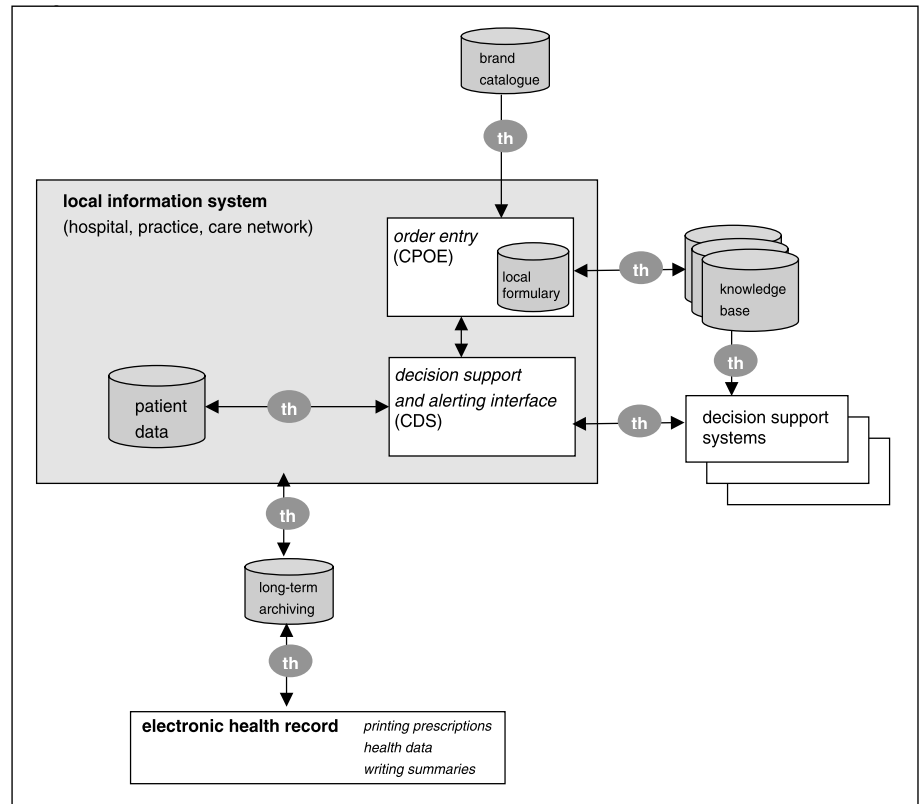


Fig. 4 Integration of CPOE-systems in the local information system and communication with external sources via thesauri. The local CPOE interface process contains a local formulary which has to be mapped to the official brand catalogue and knowledge resources like catalogues with drugs that should not be administered to pregnant women. The local decision support functions (CDS) processes patient data and gives alerts using knowledge functions from external decision support systems, for example dosing for patients with renal insufficiency. The prescription results have to be stored in a long-term archive with shared access for authorized partners and – if available – in an electronic health record (or at least a health card).

eHealth-Card for patient care in Germany could make this information available, although it will not cover all drug exposures as long as it does not include non-prescription drugs. Thorough information could not only influence pharmacotherapy during the hospital stay, but also could positively impact the utility of the recommendations in the discharge letter. Prescribing divergent drugs can decrease both compliance and ease of handling for the patient, and thus can increase costs. Up-to-now valid algorithms to integrate previously administered drugs into therapy recommendations are not available. Also, suggesting alternative drug therapies is difficult because there is no consensus as to which drugs can be regarded as therapeutically equivalent. Both should be areas of future research relevant for efficient health care of high quality.

5. Conclusion

Documenting active ingredients and brand names in pharmacotherapeutic recommendations in discharge letters is currently not part of clinical practice in Germany. In most cases drugs are recommended by their brand name. Our results have shown that this cannot be avoided, even when an electronic drug information platform is available, as long as it is not fully interlinked with and integrated in the process of writing discharge letters.

Experiences from other nations have shown that specifying active ingredients alone is also not sufficient to provide high-quality pharmacotherapeutic recommendations. Therefore CPOE-systems should offer support in prescribing active ingredients as well as brand names and dosage

schemes. Electronic support for pharmacotherapy in discharge letters could then become a quality factor for process quality in a hospital, with considerable influence on the outcome quality and costs of cooperative patient care.

Acknowledgments

The project was a project of the medical informatics program Heidelberg/Heilbronn [28] within the framework of the practicum 'information management in healthcare' [29]. We gratefully acknowledge the work of our students who planned and conducted the project under supervision of the authors. They were: A. Allgeier, F. Botsoe, B. Dabelow, S. Ganzinger, A. Isik, K. Kessel, T. Knobloch, N. Koc, S. Krafft, S. Kroll, A. Kwewok, J. Lemke, S. Linsner, O. Mayer Laha, M. Mehrwald, S. Rempp, T. Rühling, B. Saussen, L. Schnelle, A. Schwelling, A. Schweppenheiser, H. Storf, O. Tchuitcheu, M. Todorova, S. Wadenpohl, A. Wicht, M. Wiesner.

We thank the physicians in the interviews and in the focus groups for their helpful statements as well as Cornelia Mahler for helpful comments on an earlier version of the manuscript.

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