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Prescribing practice in a Swiss primary and secondary acute care hospital

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Summary

Questions under study: Little is known about the prescribing behaviour of physicians in hospitals. This analysis, using data based on Computerised Physician Order Entry (CPOE), was performed to evaluate prescription patterns, to analyse possible over-prescribing of drugs and to assess the compliance with therapy-guidelines.

Methods: Within a 12 month period, 68 133 prescriptions in three departments were analysed with respect to drug class, duration of therapy, dosage, administration route, patient's age, patient's length of stay and number of prescriptions per patient.

Results: On average, each patient received 12 drugs. A steady increase in the number of prescribed drugs can be seen between the age of 20 and 85. The median duration of intravenously administered antibiotics was 4.0 days, the median duration of antibiotic therapy was 9.5 days.

Discussion: On average, patients were taking 5 drugs on a regular basis on admission to hospital. This number was doubled during the hospital stay where patients were prescribed 12 drugs on average. On discharge 6 drugs were prescribed and thus a reasonable reduction was made. Surgical and Internal Medicine wards were using very similar drug classes. Concerning the use of low-molecular-weight heparin, guidelines were widely adhered to whereas proton-pump-inhibitors were prescribed too often and the duration of intravenous antibiotic therapy tended to be too long.

Key words: prescribing pattern; hospitalized patients; acute care hospital; computerized physician order entry CPOE; therapy duration; drug therapy; electronic prescription; medication error

Introduction

In Swiss Healthcare – like in many other healthcare systems – more and more efforts are being made to improve quality, reduce errors and optimise processes in modern patient care. Physicians and nurses are getting accustomed to new electronic tools supporting their daily work. Introducing computerised support is a move towards e-healthcare. The implementation of new electronic tools can support work and offers the opportunity to monitor health professionals' behaviour and decisions.

Prescription and administration of drugs are the most frequent interventions in healthcare over all. Only little is known about the prescribing practices of hospital physicians. Since only a small proportion of hospitals worldwide, as in Switzerland, use computerised support during drug prescription (Computerised Physician Order Entry CPOE) and due to the fact that analysis of handwritten prescriptions is time consuming and difficult to perform, the only information currently available on how Swiss physicians prescribe their drugs is based on data of drug consumption in a particular hospital or in Switzerland in general.

As our wards have been using CPOE for more than 3 years (the first starting in 2002, the last in spring 2005) enough data are available to report a reasonable sample of prescriptions based on our daily work.

There are many reasons for introducing CPOE. According to the literature, about 5% of inpatients suffer from medication errors, many of them caused by incorrect or unclear prescriptions [1]. As demonstrated by several studies, the introduction of CPOE leads to a decrease in medication error rates of as much as 55–80% [2] and furthermore, process optimisation is gained for physicians as well as for nurses [3]. Being the first step in modern medication handling, CPOE also offers an opportunity to check the prescription itself, eg, evaluation of drug-drug-interactions and known allergies, proposals of adapted dose regimens during

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renal insufficiency (or even in regard to the diagnoses) and to optimise prescribing practise in a hospital. The aim of this study was to gain an overview as to our physicians' prescribing patterns and thus raising the possibility of modifying the prescription process, analysing how guidelines could be controlled and perhaps even reducing costs by changing our current behaviour. For this reason, drug prescriptions for inpatients (length of stay (LOS) >24 hours) in all departments (Internal medicine, Surgery and Gynaecology) were analysed within a 12 month period. Being an acute care hospital with 220 beds, our hospital is one of the typical non-university hospitals in Switzerland and could therefore be an excellent model for other Swiss hospitals with regard to prescribing patterns.

Materials and methods

Patients and prescriptions

Within a 12 month period, beginning on August 1st 2004 and ending on July 31st 2005, all drug-prescriptions of inpatients were included in the analysis if the drugs were not prescribed as-needed. Given the fact that within the last 3 years all our wards had introduced CPOE into their daily practice, we could analyse the prescriptions in every department. Within our departments we do not subdivide wards with respect to medical specialities: a typical internal-medicine ward covers all possible medical patients as does a surgical ward. The distribution of certain pathologies is assumed to be random amongst the wards within a department. Based on this situation, all prescriptions in every ward were included although 1 surgical and 1 gynaecological ward introduced CPOE during the analysis period (whereas 3 surgical wards and 5 internal medicine wards were already performing CPOE prior to the first day of the examination period).

Exclusion criteria

All prescriptions starting prior to the first day of the study period or not ending before the last day of the study period were excluded as it was not possible to calculate the therapy duration. Furthermore all prescriptions on an as-needed basis were excluded, as well as prescriptions ordered by non-physicians, eg, based on telephone orders or based on drug-removals in the automated medication dispensing system Pyxis® used throughout the hospital. This automated drug dispensing system normally receives all prescriptions from the electronic patient record (EPR) Phoenix®. In case of emergency or in absence of a CPOE, nurses are allowed to remove a drug based on eg, phone-orders by the physician in charge, leading to an automatically generated prescription in the EPR which must then be counter-signed by a physician. As most of these removals without previous prescription are not subsequently used regularly, all of these prescriptions were excluded from the analysis leading to data based on direct prescribing only.

Patients in obstetrics and the intensive care unit ICU were not analysed as CPOE is not performed in these units yet.

Data collection

Based on SQL (structured query language), all available data of prescribed drugs with the above mentioned restrictions were analysed with respect to drug classification, dosage, duration (interval between start and stop date), patient age, length of stay, prescribing physician and department. In addition the medication on admission was compared to the medication on discharge. There were fewer patients analysed than effectively treated in this time period because not every patient was hospitalised on a ward using CPOE and because the length of stay was limited to be above 24 hours.

Diagnoses and guidelines

Data storage of prescriptions and structured diagnoses codes (based on International Classification of Diseases, 10th revision, ICD-10) are made in separate software systems. For this reason a direct match between specific patients' prescriptions and the correlated ICD-10 code was not made within this study. The same sample of patients analysed for prescribing behaviour was however analysed according to ICD-10 codes. This leads to a limitation on general statements on medication frequency in certain clinical situations. Prescribing behaviour is thus not broken down to specific diagnoses. General guidelines for prevention of venous thromboembolism [4, 5], for prevention of stress ulcers [6] and articles on therapy duration of antibiotics [7–9] were used to compare the results as well as possible with current guidelines.

Results

68 133 prescriptions in a total of 5366 patients were analysed. 93% of internal medicine patients, 62% of surgical patients and 16% of gynaecological patients were analysed. As shown in table 1, median patient age in internal medicine, surgery and gynaecology was 76 years (interquartile range IQR 63–83), 63 years (IQR 46-76) and 51 years (IQR 39–65) respectively; median length of stay was considerably higher in internal medicine inpatients than in surgical inpatients (8 vs. 5 days). Overall, median patient age was 70 (IQR 54–80) years. Table 2 shows the distribution of analysed prescriptions and their origin with regard to the departments. The median number of prescriptions per patient was 12 (IQR 7–17). The median number of prescriptions per patient was 13 (IQR 8–18) in internal medicine inpatients as compared to 10 (IQR 7–15) in surgical inpatients. As mentioned above only 375 gynaecological patients were included: the median number of prescriptions per gynaecological patient was 10 (IQR 5–14). 98% of all analysed patients received orally administered drugs whereas 94% received parenterally administered drugs. Only 16% received drugs for inhalation.

For internal medicine inpatients, the number of drugs patients took on a regular basis on admis-

Table 1

Number of patients per department, median age (interquartile range IQR) and median length of stay LOS (interquartile range) are indicated. Due to the exclusion criteria, out of 8885 totally treated inpatients with length of stay LOS >24 hours, only 5366 were analysed.

	Analysed Patient cases (% of hospitalized patients)	Hospitalised Patient cases	Median age (IQR*)	Median Length of Stay LOS in days (IQR*)
Internal Medicine	2521 (93%)	2706	76 (63–83)	8 (5–12)
Surgery/Orthopaedics LOS	2507 (62%)	4033	63 (46–76)	5 (3–9)
Gynaecology	338 (16%)	2146	51 (39–65)	4 (2–6)
Total	5366 (60%)	8885	70 (54–80)	6 (3–10)

* IQR: interquartile range

Table 2

68 133 analysed prescriptions in 5703 patients according to the department (Internal Medicine or Surgery/Gynaecology) and route of administration (oral, parenteral, inhalations, enteral tube feeding). Median number of prescription (interquartile range IQR) per patient case is indicated as well as the percentage according to the total number of cases analysed.

Department Internal Medicine	Administration Oral	Administration Parenteral	Inhalation	Enteral Tube feeding	Total
Prescriptions	22 441	10 218	1 329	174	34 162
Median# prescribed per case (IQR)	8 (5–12)	3 (2–6)	2 (2–2)	2 (1–4)	13 (8–18)
Patient cases# (% of total cases)	2472 (98%)	2301 (91%)	621 (25%)	69 (3%)	2521
Surgery					
Prescriptions	17 589	12 622	472	31	30 714
Median# prescribed per case (IQR)	6 (3–9)	4 (3–6)	2 (1–2)	1 (1–2)	10 (7–15)
Patient cases# (% of total cases)	2444(97%)	2422 (97%)	245 (9%)	16 (1%)	2507
Gynaecology					
Prescriptions	1 707	1 518	29	3	3 257
Median# prescribed per case (IQR)	4 (3–7)	5 (3–6)	2 (1–2)	1 (1–1)	10 (5–14)
Patient cases# (% of total cases)	328 (97%)	325 (96%)	18 (5%)	3 (1%)	338
Total prescriptions analysed	41 737	24 358	1 830	208	68 133
Median# prescribed per case	7 (4–11)	4 (2–6)	2 (2–2)	2 (1–3)	12 (7–17)
Patient cases# (% of total cases)	5572 (98%)	5373 (94%)	902 (16%)	91 (2%)	5366

As patients most often receive at least orally and in addition parenterally administered drugs, the cumulative number of patient cases increases the absolute number of patient cases by far

sion and the number prescribed on discharge were analysed. Out of 2654 internal medicine patients taking at least one drug on a regular basis on admission, the average number of drugs taken was 5 (IQR 3–8). The number of drugs on discharge was 6 (IQR 4–8). When drugs are included that were to be taken for a limited number of days only, the number of prescribed drugs was 6 (IQR 4–9) as well, and including drugs on an as-needed basis the amount was 7 (IQR 5–10).

Table 3a (Internal Medicine) and 3b (Surgery) show the top 25 drug groups used within the hospital. By far the most prescriptions are made for intravenous fluids or colloids, analgesics (including opiates), low molecular weight heparins, acid suppressing agents, laxatives, diuretics and antihypertensive agents followed by antibiotics and sedatives.

Concerning therapy duration, only a few drugs are of interest. Table 4 shows the median duration of orally administered antibiotics and of intravenous formulations. Over the different antibiotic classes a median duration of 4.0 days (interquartile range IQR 2–5) for an intravenous application and 4.0 days (IQR 2–7) for the oral regimen was observed, resulting in a median total duration of 9.5 days in all patients over all antibiotics regardless of indication and antibiotic in question. No difference was seen between internal medicine or surgical patients. The maximal duration of intravenous formulations frequently reach 30 days in patients with severe infections (eg, endocarditis, osteomyelitis, hepatic abscess). The results shown in table 4 represent all prescriptions of these drugs; the orally administered drugs are not exclusively correlated with a prior parenteral formulation.

Analysing ICD-10 codes of patients with risk factors concerning venous thromboembolism or gastrointestinal bleeding showed the following results: a total of 731 internal medicine patients with a main diagnosis (ICD-10) of acute respiratory disease (number analysed: 275), congestive heart failure (224, coronary syndromes not included), patients bedridden due to acute neurological disease (152) and those with severe infection (80) were identified, representing 29% of all patients hospitalised within this period. In the same period, 68% of internal medicine patients and 89% of surgical patients receive low molecular weight heparins LMWH for prophylactic reasons (1720 Internal medicine patients, 2256 surgical patients, in total 3976 out of 5366 patients, data not shown in tables).

Analysing the ICD-10 codes concerning the main diagnosis and major stress factors like ICU-care, myocardial infarction, major surgery or se-

Table 3a

Top 25 drugs prescribed for 2521 Internal medicine patients with number of prescriptions, most frequent generic names and IT-code (Index Therapeuticus). As a patient normally receives more than one prescription for each drug class, the total amount of prescriptions exceeds the number of patients analysed.

Number of prescriptions	Most frequent used products by trade-names (®)	IT code
3341	Saline 0.9%, ringer-lactate, glucose 5%	05.03.20
2943	Paracetamol	01.01.10
2037	Morphine, Fentanyl, Pethidin	01.01.30
1795	Nadroparin	06.03.30
1772	Esomeprazol, Omeprazol	04.99.00
1691	Toresamid, Furosemid	05.01.00
1456	Sodium-picosulfate, Sodium-dihydrogenophosphate	04.08.11
1245	Quinapril, Valsartan	02.07.10
1216	Amoxicillin, Cotrimoxazol, Piperacilin Tazobactam	08.01.93
1153	Acetysalicylic acid	06.03.20
1121	Lorazepam	01.04.10
885	Valerian extract	01.04.20
847	Salbutamol, Ipratropiumbromide	03.04.30
671	Atorvastatin	07.12.00
667	Bisoprolol, Metoprolol	02.03.00
643	Ciprofloxacin, Moxifloxacin	08.01.80
614	Zolpidem, Midazolam, Triazolam	01.30.10
560	Felodipin, Amlodipin	02.06.10
535	Metformin, Gliclazid, Pioglitazon	07.06.20
463	Phenprocoumon	06.03.10
459	Acetylcystein	03.02.00
423	Citalopram, Paroxetin, Clomipramin	01.06.00
335	Dexpanthenol	12.02.40
334	Cefepime	08.01.30
312	Sacharmyces	04.09.00

vere infections, 850 (14%) patients were identified as being reasonable candidates for prophylactic proton pump inhibitor PPI. In fact 66% of all patients (3564 out of 5366, 1450 internal patients, 2114 surgical patients) received a proton-pump inhibitor for prophylactic reasons (patients with therapeutic use of PPI not included).

Discussion

Modern drug therapy is defined by many factors including evidence based medicine, guidelines, increasing data on drug-drug-interactions and enzymatic inductions but also increased quality requirements, increased economic pressure on hospitals (especially publicly funded) and new tools to manage medication processes. One of the cornerstones of up-to-date medication-processing is computeried physician order entry CPOE. Several studies have proven the effectiveness of CPOE as compared to traditional paper based orders, not only concerning medication safety but also concerning drug management and process optimisation. Furthermore, CPOE offers the fundamental possibility to analyse current prescribing pattern and to modify prescription itself eg, raising the possibility for expert systems and decision support tools.

Only little is known about the prescribing practices in Swiss hospitals and we do not know if we sufficiently follow therapy guidelines or whether we could improve our prescribing behaviour for equal benefit in patient safety and cost-effectiveness.

A total of 68133 prescriptions for 5366 inpatients, ordered in our hospital within a 12 month period were analysed. The median number of prescribed drugs per patient was 12 (interquartile range IQR 7–17), median patient age regardless of the department where the patients were hospitalised was 70 years (IQR 54–80). Due to the fact that most internal medicine patients are older (median age 76 versus 63 years in surgical), present nearly always as an urgency or emergency and not as planned admissions and by the nature of internal medicine itself, the median number of prescribed drugs is higher in internal medicine patients than in surgical patients (13 versus 10). Between the age groups 20–25 years and 85–90 years there can be seen a constantly increasing median number of prescriptions from 6 to 16 (figure 1), of 0.5 prescription per age-class (5 years) on average.

Table 3b

Top 25 drugs prescribed for 3174 Surgery/ Gynaecology patients with number of prescriptions, most frequent trade-names (®) and IT-code (Index Therapeuticus). As a patient normally receives more than one prescription for each drug class, the total amount of prescriptions exceeds the number of patients analysed.

Number of prescriptions	Most frequent used products by generic names	IT code
5600	Paracetamol	01.01.10
4336	Saline 0.9%, ringer-lactate, glucose 5%	05.03.20
2958	Nadroparin	06.03.30
2836	Morphine, Fentanyl, Pethidin	01.01.30
2476	Esomeprazol, Omeprazol	04.99.00
2111	Ondansetron	01.09.00
1871	Zolpidem, Midazolam, Triazolam	01.03.10
1157	Sodium-picosulfate, Sodium-dihydrogenophosphate	04.08.11
930	Amoxicillin, Cotrimoxazol, Piperacilin Tazobactam	08.01.93
858	Lorazepam	01.04.10
679	Ciprofloxacin, Moxifloxacin	08.01.80
623	Quinapril, Valsartan	02.07.10
601	Toresamid, Furosemid	05.01.00
467	Scopolaminbutylbromid	04.02.00
449	Acetysalicylic acid	06.03.20
432	Sodiumchloride+Potassiumchloride	05.03.30
428	Valerian extract	01.04.20
394	Bisoprolol, Metoprolol	02.03.00
378	Laxatives	04.08.15
362	Diclofenac, Dexketoprofen	07.10.10
338	Atorvastatin	07.12.00
318	Felodipin, Amlodipin	02.06.10
291	Salbutamol, Ipratropiumbromide	03.04.30
289	Hydroxyethyl starch	06.01.23
240	Irbesartan+HCT	02.07.20

Table 4

Median therapy duration in days (IQR interquartile range), formulation and amount prescribed of antimicrobials used within the period analysed. Administration route, median and maximal/minimal duration are indicated. Order by total numbers of analysed prescriptions.

Generic name	Formulation	Number of analysed prescriptions	Median duration in days (IQR)	Max (days)	Min (days)
Amoxicillin/Clavulanate i.v.	intravenous	587	3 (2–4)	31	1
Ciprofloxacin p.o.	oral	472	4 (2–6)	27	1
Amoxicillin/Clavulanate p.o.	oral	421	5 (2–8)	31	1
Piperacillin/Tazobactam	Intravenous	363	4 (3–7)	27	1
Cefepime	intravenous	348	4 (3–6)	31	1
Metronidazol i.v.	intravenous	198	4 (2–5)	27	1
Fluconazol p.o.	oral	110	5 (3–8)	23	1
Metronidazol p.o.	oral	110	4 (3–7)	16	1
Moxifloxacin	oral	104	5 (3–8)	14	2
Ciprofloxacin i.v.	intravenous	99	2 (2–4)	8	1
Ceftriaxon	intravenous	68	4 (2–6)	12	1
Co-Trimoxazol/Sulfobactam	oral	23	4 (3–5)	12	2
Amikacin	intravenous	7	5 (2–6)	14	2

Apart from the top 5 drug classes, on internal medicine wards diuretics, aspirin-like drugs and ACE-inhibitors are widely used whereas in surgical departments sedatives, hypnotics and laxatives are used more frequently (table 3).

As antibiotics are one of the more expensive drug classes and the risks associated with intravenous application is higher than with oral administration (infection, side effects), there is special interest in the drug-duration and application of antibiotics. Of course the indication for antibiotic treatment and the choice of antimicrobial agent has a great influence on the appropriate duration. Depending on the diagnosis, most guidelines assume that a switch from intravenous to oral antibiotic therapy should in general be possible within 3 days or less [10, 11]. In our setting, the median duration of intravenous application of antibiotics was 4.0 days. As our results are not related to specific diagnoses (further work will be done) and therapies of long duration (eg, endocarditis) are included, the switch from intravenous to oral admin-

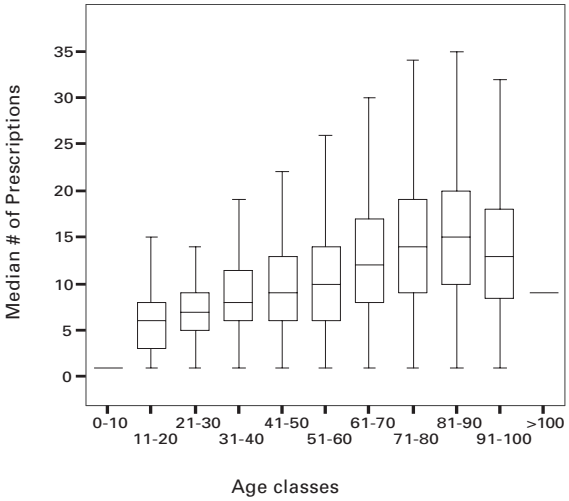

Figure 1

Median number of prescriptions (IQR interquartile) per age class in all patients analysed. The total number of 68 133 prescriptions were analysed concerning age-groups with 5-year-interval. Data are based on >1000 prescriptions per age class between 61 and 90 years, on >300 prescriptions per age class in the groups of 21–50 and 91–100 years and less than 200 prescriptions in the age classes 0–20 and >100 years.

istration may be adequate or could be too late. Nevertheless, intervention studies have shown that guideline-implementation by computerised support or specialised personnel nearly always reduces the median duration of intravenous antibiotic therapy significantly without any disadvantages with respect to outcome, re-hospitalisation or length of stay [7, 8]. Under these circumstances we must assume that our median time of intravenous antibiotic treatment could be reduced and guidelines could be more strictly adhered to.

Special attention should be paid to low-molecular-weight heparins (LMWH) and proton-pump-inhibitors (PPI). Both drugs are widely and most probably too often used in medical inpatients [12, 13]. According to guidelines, prophylaxis with LMWH is recommended for nearly all surgical patients without contraindications and except especially those with low-risk surgery and age <40 years and no additional risk factors [4]. On the other hand, prophylaxis for patients with medical conditions is recommended for all acutely ill patients with chronic heart failure or severe respiratory disease and for all bedridden patients with at least one of the following additional risk factors: active cancer, previous venous thromboembolism (VTE), inflammatory bowel disease, acute neurological disease [5]. According to guidelines and the analysis based on ICD-10 codes, only about 29% of internal medicine inpatients should receive LMWH for prophylactic reasons. In contrast to these results, 68% of internal medicine patients and 89% of surgical patients received low molecular-weight heparins LMWH. The gap between guidelines and daily practice remains remarkable and could possibly be reduced by firm compliance with guidelines.

There are only few guidelines and recommendations available on the prophylactic use of acid-suppressing agents in general and especially on PPI. Most recommendations include just a subset of intensive care unit ICU patients and by far not all acutely ill and hospitalised patients [6, 9]. Furthermore, most studies were done with non-PPI drugs like sucralfate, histamine H2 receptor antagonists or pirenzepine and in addition, the majority of recently published prospective studies and a meta-analysis have been unable to demonstrate a reduction in clinically important bleeding with pharmacological agents even in the postoperative period [14]. As most inpatients and especially ICU patients suffer from several stress factors, the prophylactic use of PPI continues to be debated and most often depends on institution-specific guidelines. Analysing the ICD-10 codes concerning the main diagnosis and major stress factors like ICU-care, myocardial infarction or severe infections only about 850 (14%) patients could be identified as being reasonable candidates for prophylactic PPI. As the main diagnosis was most often not the only reason for the choice of prophylaxis, these 14% were definitely not the only patients considered for prophylaxis. In fact, 66% of all patients received a proton-pump inhibitor for prophylactic reasons (patients with therapeutic use of PPI not included). A reduction of drug therapy with PPI for prophylactic reasons should be made for both patient-safety and economic reasons.

In the department of internal medicine, we analysed the number of regular drugs on admission and the number prescribed to patients on discharge. On average, patients took 5 drugs on a regular basis on admission, as compared to 14 drugs during the hospitalisation and to 6 drugs on discharge. In summary, despite the fact that the number of drugs was more than doubled during the acute care of the inpatient, at discharge nearly the same number of prescribed drugs was achieved as on admission reflecting at least a good management of drug prescription regarding the number of prescribed drugs. Furthermore, electronic tools can assist in the switch to the outpatient setting by comparing drug prescription on admission and on discharge and to coordinate with the drugs commonly used by the patients' family physician.

The study has several limitations. First it is a retrospective data analysis, no interventions could be tested. Second, not all departments had equal numbers of patients included. Especially in gynaecology, only 16% of patients were analysed and therefore (despite the fact that even these results show strong similarity to surgical patients) no arguments are given concerning gynaecological patients. On the other hand, nearly all internal medicine patients and most surgical patients could be analysed and, given the fact that all wards care for various patients, no differences between wards should be present emphasising the validity of results. Third, prescriptions were not broken down to diagnoses and therefore only global interpretation can be made concerning diagnosis-related prescribing behaviour.

CPOE not only is a powerful instrument in controlling prescribing-errors, it also gives the unique possibility for analysing prescription practices within a hospital and assisting with the prescribing process. As only limited data on prescribing patterns in Swiss hospitals are available, this

summary gives an overview on the current situation in a medium sized Swiss acute care hospital. In times of growing economic pressure on public funded hospitals and with regard to optimal patient care, these data are the basis for adapting or changing prescribing patterns. As shown above, two drug classes in particular (PPI and to a lesser extent LMWH) are prone to overuse in inpatients whereas the duration of antibiotic therapy for example, could possibly be improved and the reduction of prescribed drugs at hospital discharge compared to the hospitalisation period seems to be well done. More analysis has to be done to improve the medication process – especially diagnosis-related medication behaviour – and in the future, decision support models will give additional possibilities to assist and interfere with drug prescribing.

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References

1 Leape LL, Brennan TA, Laird NM. The nature of adverse events in hospitalised patients. N Engl J Med 1991;324:377–84.
2 David W. Bates, Jonathan M. Teich, Joshua Lee, Diane Seger, Gilad J. Kuperman, Nell Ma'Luf et al. The Impact of Computerized Physician Order Entry on Medication Error Prevention. JAMIA 1999;6:313–21.
3 Oertle M, Hufschmid E, Lanker B. Kombination von elektronischer Verordnung und elektronischer Medikamentendistribution im Spital: Qualitäts- und Prozessoptimierung bei der Medikation. Swiss Medical Informatics 2005;54;18–22.
4 Geerts WH, Pineo GF, Heit JA, Bergqvist D, Lassen MR, Colwell CW, et al. Prevention of venous thromboembolism: the Seventh ACCP Conference on Antithrombotic and Thrombolytic Therapy. Chest 2004;126(3 Suppl):338S–400S.
5 Alonso Ortiz del Rio C, Medrano Ortega FJ, Romero Alonso A, Villar Conde E, Calderon Sandubete E, Marin Leon I, et al. Prevention of thromboembolic venous disease in medical patients (PRETEMED). Cordoba: Andalusian Society of Internal Medicine (SADEMI); 2003.
6 Tryba M, Cook D. Current guidelines on stress ulcer prophylaxis. Drugs 1997;54:581–96.
7 Vogtlander NP, Van Kasteren ME, Natsch S, Kullberg BJ, Hekster YA, Van der Meer JW . Improving the process of antibiotic therapy in daily practice: interventions to optimize timing, dosage adjustment to renal function, and switch therapy. Arch Intern Med 2004;164:1206–12.
8 McLaughlin CM, Bodasing N, Boyter AC, Fenelon C, Fox JG, Seaton RA. Pharmacy-implemented guidelines on switching from intravenous to oral antibiotics: an intervention study. QJM 2005;98:745–52. Epub 2005 Aug 26.
9 Dellinger RP, Carlet JM, Masur H, Gerlach H, Calandra T, Cohen J, et al. Surviving sepsis campaign guidelines for management of severe sepsis and septic shock. Crit Care Med 2004; 32:858–73.
10 American Thoracic Society: Guidelines for the Management of Adults with Community-acquired Pneumonia Diagnosis, Assessment of Severity, Antimicrobial Therapy, and Prevention Am J Respir Crit Care Med 2001;163:1730–54.
11 Soo Hoo GW, Wen YE, Nguyen TV, Goetz MB. Impact of departmental guidelines in the management of severe hospital-acquired pneumonia. Chest 2005;128:2778–87.
12 Nardino JF, Vender RJ, Herber PN. Am J Gastroterelog. Overuse of acid-suppressive therapy in hospitalized patients 2000;95:3118–22.
13 Niklasson A, Bajor A, Bergendal L, Simren M, Strid H, Bjornsson E. Overuse of acid-suppressive therapy in hospitalized patients with pulmonary disease. Respir Med 2003;97:1143–50.
14 Allen ME, Kopp BJ, Erstad BL. Stress ulcer prophylaxis in the postoperative period. Am J Health Syst Pharm 2004;61:588–96.

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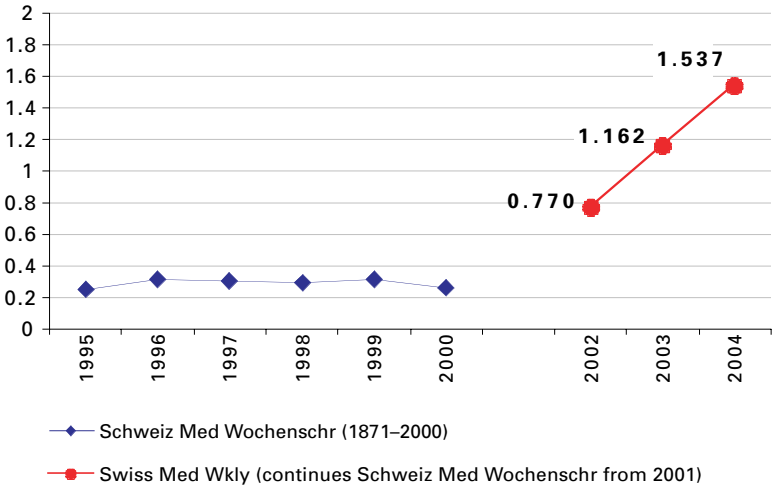

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