

# Outpatient prescriptions practice and writing quality in a paediatric university hospital

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## Summary

**BACKGROUND:** The writing of prescriptions is an important aspect of medical practice. This activity presents some specific problems given a danger of misinterpretation and dispensing errors in community pharmacies. The objective of this study was to determine the evolution of the prescription practice and writing quality in the outpatient clinics of our paediatric university hospital.

**METHODS:** Copies of prescriptions written by physicians were collected from community pharmacies in the region of our hospital for a two-month period in 2005 and 2010. They were analysed according to standard criteria, including both formal and pharmaceutical aspects.

**RESULTS:** A total of 597 handwritten prescriptions were reviewed in 2005 and 633 in 2010. They contained 1,456 drug prescriptions in 2005 and 1,348 in 2010. Fifteen drugs accounted for 80% of all prescriptions and the most common drugs were paracetamol and ibuprofen. A higher proportion of drugs were prescribed as International Nonproprietary Names (INN) or generics in 2010 (24.7%) compared with 2005 (20.9%). Of the drug prescriptions examined, 55.5% were incomplete in 2005 and 69.2% in 2010. Moreover in 2005, 3.2% were legible only with difficulty, 22.9% were ambiguous, and 3.0% contained an error. These proportions rose respectively to 5.2%, 27.8%, and 6.8% in 2010.

**CONCLUSION:** This study showed that fifteen different drugs represented the majority of prescriptions, and a quarter of them were prescribed as INN or generics in 2010; and that handwritten prescriptions contained numerous omissions and preventable errors. In our hospital computerised prescribing coupled with advanced decision support is eagerly awaited.

**Key words:** drug; prescribing; quality; paediatrics; outpatients

## Introduction

Patient safety is a priority in healthcare systems across the world [1, 2]. Evidence suggests that medication errors could have a higher incidence in infants and children than

in adults [3, 4]. Most drug doses are calculated according to the patient's age, weight (or body surface), and clinical conditions. Another potential for errors is the variety of pharmaceutical forms and dosages available for paediatric patients (suspensions, syrups, tablets, capsules, suppositories, etc.) or sometimes the lack of an appropriate formulation necessitating extemporaneous compounding. Finally, young children cannot reliably self-administer, monitor drug use, and communicate about adverse events.

The paper prescription form is still the main mean of communication between the physician, the patient, and the community pharmacy in most countries. Ideally, a prescription should be legible, precise, complete, and unambiguous in its interpretation. Drug prescribing errors occur at rates as high as 4.2% in paediatric inpatients [5]. Limited work has been carried out to investigate medication errors in paediatric outpatients [6–10].

Since 2001, community pharmacists in Switzerland have the ability to replace original drugs by generic ones for economical reasons. In 2006, the Swiss authorities decided to impose definite incentives to physicians to improve the proportion of generic substitutions [11]. To our knowledge, the influence of these incentives has not been assessed in paediatric outpatients.

This study had two objectives: (1) to determine the evolution of the outpatient prescription practice in our paediatric university hospital during two periods (2005 and 2010), especially regarding generic drugs; (2) to assess the writing quality of the outpatient prescriptions during the same periods.

## Patients and methods

This study was prospectively conducted over a two-month period (from January to March 2005 and from January to March 2010) at the Children's Hospital of Lausanne (HEL, French abbreviations). The protocol was accepted by the local Ethics Committee of the Faculty of Biology and Medicine of the University of Lausanne.

The HEL is a general paediatric teaching hospital attached to the university hospital of Lausanne. Every year, more than 50,000 patients come to the outpatient clinics of the

HEL. Among them, more than 29,000 consult the Emergency Department. The paper prescription form contains only the pre-printed hospital address and phone number and thirty different medical or surgical physicians hand-write the drugs onto prescriptions for the patient's community pharmacy. Every six months since 2004, instruction by a senior pharmacist on good prescribing practice is included in the training programme for junior physicians.

A letter was sent to community pharmacists of the region of our hospital, explaining the aim of the study and asking them to photocopy handwritten prescriptions from the HEL. In order not to introduce bias, the prescribers were informed about the study only once prescriptions had been collected. Copies of the prescriptions were sent to the junior investigators (LOR and GS) and senior pharmacist (EDP) and screened separately by them. Only prescriptions of the outpatient clinics of the HEL were analysed.

The criteria set to evaluate the quality of prescriptions were chosen in accordance with the rules of our institution and to the taxonomy of NCC MERP [2]. The formal criteria regarding the prescribers were as follows: date, physician's name, stamp, and signature. The formal criteria regarding the patients were as follows: surname, first name, date of birth or age, gender, weight, and patient's label. The last three criteria were optional. The formal criteria regarding the drug prescriptions were as follows: drug name, pharmaceutical form, strength or concentration, dose, frequency of administration, quantity or number of packages, treatment duration, route of administration, and instructions to patients. The last three criteria were optional, except for antibiotic treatments where duration was mandatory.

Patient's names and drug prescriptions were classified as "legible", "legible with difficulty", or "illegible". If the investigators could not read the prescription (or a part of it), it was considered "legible with difficulty" or "illegible", and the opinion of other colleagues in the pharmacy department was sought. Drug prescriptions were classified as "complete" or "incomplete." In "complete" prescriptions, the following criteria were fulfilled: drug name, pharmaceutical form, strength or concentration, dose, frequency of administration, and quantity or number of packages. In the "incomplete" prescriptions, one (or more) criterion was missing. According to a previous study in our hospital [12], incomplete prescriptions were further classified as "unambiguous" or "ambiguous." Prescriptions were unambiguous when all criteria were present or when one (or more) safety criterion was missing but no misinterpretation was possible. Prescriptions were considered ambiguous when one (or more) safety criterion was missing, and at least one alternative solution existed for correct understanding and execution. Finally, a "prescribing error" was defined as follows: illegible drug, drug out of the market, wrong drug name, wrong pharmaceutical form, wrong strength or concentration, wrong dose or frequency of administration, wrong quantity or number of packages, wrong duration for the treatment, or wrong route of administration. The evaluation of the interventions by community pharmacists was beyond the scope of the study.

The reference information database was the Swiss Drug Compendium [13] and Pharmavista database [14]. The official list of Swiss pharmaceutical specialities was used to

identify drugs reimbursed by insurance and generic drugs [15]. If not available in these databases, drug doses were checked in specific paediatric databases [16, 17]. If the patient's weight was omitted, their age may permit estimated drug doses. Data were collected in a database and summarised using standard descriptive methods. The t-test was used to compare mean numbers of drugs, and the Fisher's exact test was used to compare frequencies [18].

## Results

Of the 127 and 99 community pharmacies contacted, 39 (31%) and 40 (40%), respectively, sent back prescriptions originating with the HEL during the two periods under study. The total of prescriptions analysed was 597 for 2005 and 633 for 2010. They contained 1,456 and 1,348 drug prescriptions, respectively, that is, a mean number of  $2.4 \pm 1.3$  drugs (range: 1–9) in 2005 and  $2.1 \pm 1.1$  drugs (range: 1–7) in 2010 ( $p < 0.0001$ ).

The mean age of the patients was  $5.4 \pm 4.4$  years in 2005 and  $6.2 \pm 4.8$  years in 2010. The majority of patients ranged from 1 to 23 months (27.1% in 2005 and 26.2% in 2010,  $p = 0.75$ ) and from 2 to 11 years (59.5% in 2005 and 56.1% in 2010,  $p = 0.25$ ). The other patients were neonates (0.3% in 2005 and 0.5% in 2010,  $p = 1.0$ ) and adolescents (13.1% in 2005 and 17.2% in 2010,  $p = 0.05$ ).

The 15 most frequently prescribed drugs in 2005 and 2010 are listed in table 1. They represented about 80% of all drugs. Paracetamol, ibuprofen, and normal saline nose drops were the most used drugs during the two study periods. The most common routes of administration were as follows: oral (47.5% of the total of drugs in 2005, 59.3% in 2010), nasal (18.7% in 2005, 14.8% in 2010), and rectal (15.5% in 2005, 7.2% in 2010).

Of the 1,456 drug prescriptions, 1,110 were reimbursed by the patient's health insurance (76.2%) in 2005, and of the 1,348 drug prescriptions, 1,127 were reimbursed in 2010 (83.6%,  $p < 0.0001$ ). A higher proportion of drugs were prescribed as INN or generics in 2010 (24.7%) compared with those prescribed in 2005 (20.9%,  $p = 0.0168$ ). Twenty drugs were extemporaneous preparations in 2005 and 17, in 2010.

The formal criteria regarding prescribers and patients are presented in table 2. The date of prescriptions and the patient's weight were entered more frequently in 2010. In contrast, the patient's date of birth was missing more often in 2010, and the patient's labels were less used in 2010.

Formal criteria regarding the drug prescriptions are presented in table 3. Amongst them, 185 medicines were prescribed by just giving the name(s) of the drug in 2005. In 2010 this number was 197.

Prescription problems and errors are detailed in table 4. The number of poorly legible, incomplete or ambiguous drug prescriptions and errors significantly increased from 2005 to 2010. The total number of errors rose from 43 in 2005 to 92 in 2010. Amongst those errors, 7 were wrong doses in 2005, and 12 in 2010. Examples of overdosing errors included paracetamol ( $>100$  mg/kg/day for children) and examples of under dosing errors included ibuprofen ( $<5$  mg/kg/dose for children).

## Discussion

In this study carried out in the paediatric outpatient clinics of our hospital during two periods, we showed that (1) fifteen different drugs accounted for 80% of all prescriptions, and a quarter of them were prescribed as INN or generics in 2010; and (2) handwritten prescriptions contained numerous omissions and preventable errors.

One third of community pharmacies responded to our study. We can estimate that the number of analysed prescriptions was representative of the outpatient practice of the HEL during the two periods. The average age of patients was slightly higher in 2010 compared with those in 2005. This difference was mainly due to a higher proportion of teenagers in 2005. The average number of drugs per patient was relatively modest and even decreased in 2010.

**Table 1:** The 15 drugs most frequently prescribed in 2005 and 2010.

2005			2010		
Rank	Drugs	n (%)	Rank	Drugs	n (%)
1	Paracetamol (acetaminophen)	334 (22.9)	1	Ibuprofen	303 (22.5)
2	Ibuprofen	230 (15.8)	2	Paracetamol (acetaminophen)	301 (22.3)
3	Normal saline (nose drops)	159 (10.9)	3	Normal saline (nose drops)	120 (8.9)
4	Chlorhexidine – oxybuprocaine	70 (4.8)	4	Amoxicillin	89 (6.6)
5	Amoxicillin	60 (4.1)	5	Oxymetazoline (nasal)	48 (3.6)
6	Oxomemazine – guaifenesin – sodium benzoate*	46 (3.2)	6	Oral rehydration solution	46 (3.4)
7	Xylometazoline (nasal)	33 (2.3)	7	Salbutamol (albuterol)	34 (2.5)
8	Codeine – phenyltoloxamine*	33 (2.3)	8	Amoxicillin – clavulanic acid	24 (1.8)
9	Mefenamic acid	30 (2.1)	9	Phenoxyethylpenicillin	23 (1.7)
10	Phenylephrine (nasal)*	29 (2.0)	10	Dimethindene	22 (1.6)
11	Amoxicillin – clavulanic acid	29 (2.0)	11	Polymyxin B – neomycin (ocular)	17 (1.3)
12	Salbutamol (albuterol)	28 (1.9)	12	Mefenamic acid	14 (1.0)
13	Oxymetazoline (nasal)	26 (1.8)	13	Xylometazoline (nasal)	14 (1.0)
14	Xylometazoline-carbocysteine (nasal)	24 (1.6)	14	Chamomile extract	13 (1.0)
15	Phenoxyethylpenicillin	23 (1.6)	15	Chlorhexidine – oxybuprocaine	13 (1.0)
	<b>Total (15 drugs)</b>	<b>1,154 (79.3)</b>		<b>Total (15 drugs)</b>	<b>1,081 (80.2)</b>
	<b>Total (all drugs)</b>	<b>1,456 (100.0)</b>		<b>Total (all drugs)</b>	<b>1,348 (100.0)</b>

\* Out of the market in 2010.

**Table 2:** Formal criteria regarding prescriber and patient whose name appears on prescriptions in 2005 (n = 597) and 2010 (n = 633).

	2005		2010		p
	n	%	n	%	
<b>Prescriber-related information*</b>					
Date	559	93.6	626	98.9	<0.0001
Physician's name (stamp)	594	99.5	630	99.5	1.00
Physician's signature	596	99.8	624	98.6	0.0215
<b>Patient-related information</b>					
Surname	597	100.0	632	99.8	1.00
First name	597	100.0	629	99.4	0.1250
Date of birth	525	87.9	486	76.8	<0.0001
Age or year of birth	584	97.8	587	92.7	<0.0001
Gender**/†	216	36.2	55	8.7	<0.0001
Weight**	137	22.9	222	35.1	<0.0001
Patient's label**	216	36.2	55	8.7	<0.0001

\* Hospital address and phone numbers pre-printed. \*\* Optional. † On the patient's label.

**Table 3:** Formal criteria regarding the drugs appearing on prescriptions in 2005 (n = 1,456) and 2010 (n = 1,348).

Drug-related information	2005		2010		p
	n	%	n	%	
Prescriptions with just the drug names	185	12.7	197	14.6	0.152
Detailed prescriptions	1,271	87.3	1,151	85.4	0.152
Drug name	1,271	100.0	1,151	100.0	1.00
Pharmaceutical form	943	74.2	829	72.0	0.2329
Strength / concentration	828	65.1	588	51.1	<0.0001
Prescribed dose	1,089	85.7	1,008	87.6	0.1891
Frequency of administration	1,256	98.8	1,080	93.8	<0.0001
Quantity / number of packages	1,082	85.1	823	71.5	<0.0001
Treatment duration*	408	32.1	446	38.7	0.0007
Route of administration*	119	9.4	144	12.5	0.0154
Instruction*	181	14.2	104	9.0	<0.0001

\* Optional.

The vast majority of medicines were marketed ones, and very few called for an extemporaneous formulation in a community pharmacy. Comparing our data with those of hospitalised paediatric patients [19], it appears that the latter were prescribed a larger average number of marketed medicines as well as personalised formulations, due to more complex pathologies.

In this study, eleven drugs were common to both periods of the study. We have noted a larger number of prescriptions for ibuprofen in 2010, confirming that this NSAID has become a commonplace drug in paediatrics [20]. After a reassessment of the therapeutic value of antitussive drugs by registration authorities [21], two of them were withdrawn between the two periods and, hence, were no longer prescribed in 2010. During both study periods, more than 3/4 of the prescribed medicines were reimbursed by health insurance companies. Non-reimbursed medicinal products included mainly the physiological rinsing solution and nasal decongestants.

The proportion of drugs prescribed as INN or as generics increased between 2005 and 2010. Nevertheless, the proportion of prescribed generics remains limited for this category of patients (ibuprofen and mefenamic acid tablets, antibiotics), whereas a generic medicine does not exist in Switzerland for a majority of over-the-counter drugs (e.g., paracetamol, ibuprofen syrup). Pharmaceutical companies producing generics focus only on economic aspects and often neglect paediatric needs. It is also interesting to note that when a drug prescribed to hospitalised patients exists in generic form, physicians also tend to prescribe it to outpatients. This is particularly true for antibiotics. However, a branded prescription always remains a deep anchored habit for numerous physicians, and only repeated incentive is expected to change this situation [22].

Formal data concerning the prescribers were filled in a rather satisfactorily manner. For 2010, we have even noted an improvement as far as the prescription date was concerned. Formal data about patients were also specified in a rather comprehensive manner, except for weight, which is critical information in paediatrics. Data on medicines were less satisfactory, more than half of the prescriptions being incomplete. Such gaps rendered numerous prescriptions ambiguous and created a danger of misinterpretation by community pharmacists. As far as formal aspects are

concerned, our results compare well with those of Kennedy and Littenberg [23], and are more comprehensive than those of Paul et al. [24] obtained with adult outpatients.

In the present study, many names of patients were poorly legible, and one drug was completely illegible. Such a situation is often encountered in community pharmacies, obliging pharmacists to seek the opinion of one or more colleagues. In comparison, Kaushal et al. found 670 illegibility errors in 1,782 patients with 2,259 prescriptions (29.7%) [10].

In our study the number of errors more than doubled between 2005 and 2010. One third of such errors were caused by changes in marketed medicines, some being withdrawn or having changed their trade name. The increase could also be due to the fast turnover of junior physicians, to their more important workload, and to the fact that a higher proportion of them were non-native French-speakers, or even have not been trained in Switzerland, thus requiring a longer period to adapt to local practice. Most of the prescription errors do not put patients at risk and could be easily avoided by consulting appropriate databases. A direct comparison of our study with similar studies is difficult because of differences in methodology, with percentages of errors varying from 2.2% to 81% [5–10].

Omissions and errors oblige community pharmacists to complete or correct errors by consulting with the physician, the patient, or their parents. This results in a loss of time and possibly delays in delivery, especially if the physician is out of reach. Computerised prescription coupled with advanced decision support is a well-known strategy that decreases the danger of medication errors [9]. Recently, Moniz et al. showed that the electronic transmission of prescriptions to community pharmacies led to a decrease in such errors [25].

Our study had three limitations. First, the analysis of the prescriptions was restricted to written documents. Oral instructions of the physicians to patients or their parents remained unknown. Second, it covered only the winter period. Other classes of drugs could have been prescribed in summer. Third, this study focuses mainly on prescription problems and errors and was not designed to detect adverse drug events or dispensing errors in community pharmacies nor administration errors by patients or parents. Other stud-

**Table 4:** Prescription problems and errors.

Criteria	2005	2010	p
	n (%)	n (%)	
Poorly legible patient's name*	55 (9.2)	72 (11.4)	0.2239
Poorly legible drug prescription**	47 (3.2)	70 (5.2)	0.0105
Incomplete drug prescription**	808 (55.5)	933 (69.2)	<0.0001
Ambiguous drug prescription**	333 (22.9)	375 (27.8)	0.0027
No of drug prescriptions containing an error**	43 (3.0)	92 (6.8)	<0.0001
Illegible drug name	0	1	
Drug out of the market	4	16	
Wrong name	0	20	
Wrong pharmaceutical form	6	9	
Wrong strength / concentration	15	11	
Wrong dose or frequency of administration	7	12	
Wrong quantity / no of packages+	11	23	

\* n = 597 (2005) and 633 (2010); \*\* n = 1,456 (2005) and 1,348 (2010); + duration of treatment specified in the prescriptions.

ies are definitely needed to understand the effect these distinct steps in the use of medicines by outpatients. In conclusion, this study clearly showed that fifteen different drugs (or associations of drugs) represented 80% of the total of prescriptions, with a quarter being prescribed as INN or generics in 2010, and that handwritten prescriptions contained numerous omissions and preventable errors. Furthermore, the formal quality of the prescriptions decreased from 2005 to 2010 despite regular courses on good prescription practice being given to physicians. Computerised prescriptions coupled with advanced decision support to achieve a major safety benefit is, therefore, eagerly awaited.

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