

## ORIGINAL ARTICLE

# Evaluation of the quality and appropriateness of medical prescriptions in the hospital discharge report

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## Abstract

**Objectives:** The aim of this research has been to evaluate: (a) the frequency of the use of non-standard terms in medical prescriptions; (b) the proportion of “new drugs of irrelevant therapeutic value” or medication of low therapeutic utility (LTU); and (c) the use of Generic Pharmaceutical Specialties (GPS).

**Materials and methods:** Descriptive transversal observational study with analytical components over the hospital discharge reports issued in a year. The main variables of the results were: a) the proportion of prescriptions with abbreviations, symbols or expressions of non-recommended doses in the discharge report, b) the frequency of prescriptions of pharmaceutical specialties without the relevant contribution (NRPS), c) the proportion of LTU medication in the hospital discharge reports, d) the frequency of GPS or, if they are not available, the Common International Denomination (CID) of the active ingredient in the discharge reports, and e) the mean cost per prescribed medication in the hospital discharge report.

**Results:** A total of 854 discharge reports have been studied containing 4,055 medical prescriptions. A considerable number (38.8%) of the medical prescriptions in the discharge report have used abbreviations and non-recommended symbols for dose expression. The prescription of new drugs of irrelevant therapeutic value reached 2.8% while the prescription of pharmaceutical products of LTU was 2.1%. Only 13.8% of the prescriptions were carried out as an active ingredient. The mean cost per prescription was 17.3 euros ( $SD = 31.34$ ).

**Conclusions:** Appropriateness in the prescription of medication at hospital discharge is considered to be not satisfactory and our results are consistent with other previously published reports. However, there are frequent errors in the prescription of medication and given the demonstrated relationship between errors and possible adverse effects, it is necessary to introduce programs to raise awareness about the importance of the introduction of safe practices in the medical prescriptions of the hospital discharge report.

## Key words

Prescription, Abbreviations, Discharge report

# 1 Introduction

Currently, it is well known that morbidity and the adverse effects resulting from the use of medicine are very high<sup>[1-3]</sup>. The impact of these adverse effects, firstly on morbidity and mortality, and secondly on healthcare costs and their potential preventability (up to 70% of the cases), makes it necessary to adopt measures aimed at improving safety in the use of this kind of medication<sup>[4]</sup>.

In 2003, the National Quality Forum (NQF) published a guide of 30 fundamental practices for reducing healthcare errors<sup>[5]</sup>. The NQF declared that nearly half of the preventable adverse effects related to medication were caused by errors in the prescription process.

The Institute for Safe Medication Practices (ISMP) has insisted on the need to avoid the use of abbreviations and symbols for indicating the names of medications and dose expressions in medical prescriptions, as well as in other documents used by professionals on the medication utilization circuit<sup>[6, 7]</sup>.

In 2002, the Joint Commission on Accreditation of Health Care Organizations (JCAHO), an institution that certifies hospitals worldwide, published a group of specific measures to significantly improve healthcare safety<sup>[8]</sup>: the National Patient Safety Goals (NPSG). These feature recommendations for the standardization of abbreviations, acronyms and symbols which are used in a healthcare service and establish a list of all of those which should not be used, among which are U and UI, in those hospitals that are candidates for accreditation. At present these objectives continue to be necessary and this is reflected in the NPSG<sup>[9]</sup> published in the year 2007.

Koczmar<sup>[10]</sup> asserts that some terms as “units”, “micrograms”, “sub-cutaneous” and “cubic centimeter” should never be abbreviated due to the frequent errors this practice causes. A classic example of adverse event associated to the use of the abbreviation UI was recorded in Canada, where a patient suffered permanent damage after receiving 70 units of insulin instead of the seven prescribed, because the abbreviation U was confused with a 0<sup>[10]</sup>. Lisby<sup>[11]</sup> found that writing errors are 75% of the mistakes found in prescriptions. The most prevalent problems involved the pharmaceutical form, omission of the dose and route of administering the medication. In another study carried out in medical clinics in 60 health care units in the United States it was seen that non-clinical or writing errors were responsible for near 80% of those recorded<sup>[12]</sup>.

Despite, the use of abbreviations is common practice among healthcare professionals and especially in the hospital setting. Therefore, since 2008, for improving prescription quality the Spain National Healthcare Quality System Plan<sup>[13]</sup> has established an indicator to measure the frequency of the use of abbreviations, symbols and expressions of non-recommended doses in medical treatment orders.

The overall quality of the pharmacological prescription has been evaluated in the literature describing the proportion of medication prescribed with scarce or no therapeutic utility<sup>[14, 15]</sup>, defined as meeting one or more of the following criteria: drugs whose therapeutic usefulness has not been proved; insufficient benefit-risk ratio.

Non recommended associations, such as those in which the combination of two or more drugs provides no greater benefit than their individual use, or drugs incorporating an ingredient of low therapeutic usefulness.

The proportion of new drugs of irrelevant therapeutic value (NDITV), also known as innovatory specialities, that are of little practical benefit but which are prescribed in hospital discharge notes is also an indicator of prescription quality. Drugs are considered as such if they have been introduced in the preceding three years and have not been demonstrated to provide improvements over already available drugs<sup>[14, 15]</sup>.

Generic pharmaceutical specialties have been gradually introduced into Spain as part of policies to control healthcare spending. In all the programs the rational use of medication includes strategies to increase the prescription of these generic

specialties. In this study, the appropriateness of the prescription has been estimated using the measurement of Generic Pharmaceutical Specialties (GPS) or if it is not available, using an active ingredient.

### 1.1 Justification of the study

An evaluation of quality and appropriateness of medical prescriptions in hospital discharge is quite important to direct healthcare providers and managers in hospitals as well as the scientific community and society in general. Firstly, the study will provide information about the usage of NDITV, the prescription frequency of low therapeutic utility (LTU) medication and the use of generic medications in the study hospital. Secondly the study will identify the aspects that could facilitate corrective measures to reduce the risk associated with medication use for improving the quality of the prescription.

In the review of the bibliography we have not found any previous studies identifying the frequency with which abbreviations, symbols and expressions of non-recommended dose designation are used (associated with medication errors) in the discharge report of patients admitted to a hospital. In this respect this study is innovative in its attempt to bridge this gap in our knowledge.

### 1.2 Objectives

To determine the frequency with which abbreviations, symbols or expressions of non-recommended dose are used (associated with medication errors) in the discharge report of patients in a university general hospital.

To analyze the quality of medical prescriptions in discharge reports in a university general hospital, by the study of the utilization of "NDITV", and medication of LTU and the measurement of prescribed specialties such as GPS.

## 2 Materials and method

An observational study has been conducted with an analysis of the medical prescriptions included in hospital discharge reports made by the staff of the Reina Sofia University General Hospital in Murcia (southeaster Spain). The period of the study was 12 months and 11,331 external discharges were made.

All the prescriptions in external discharge reports were included in the study for patients admitted to the hospital for more than 48 hours between July 1st 2007 and June 30th 2008. The following prescriptions were excluded from the study: those contained in internal discharge reports (transfers), those in discharge reports of the emergency department (less than 48 hours admittance) and those in discharge reports corresponding to patients with a discharge report already selected for this study in the reference period.

Randomized stratified sampling was accomplished in proportion to the discharge volume in each hospital service (see the Table). The sample size was calculated according to the resultant parameter (proportion of generic prescriptions). A confidence level of 95 was selected and an estimated precision of  $\pm 2\%$  ( $e = 0.02$ ) with an error type I of 0.05 and a power of 0.80. Assuming that the expected proportion of generic drugs was 10% and that total population size was 11,331 discharge reports, it was necessary to have a sample of 804 discharge reports. An additional 10% of discharge notes was added to compensate for the discharge notes that did not fulfil the criteria for inclusion in the study or which did not include a medical prescription. The final sample was 854 discharge reports.

The main quantitative variables of the results were: a) the proportion of prescriptions with abbreviations, symbols or expressions of non-recommended doses in the discharge report, b) the frequency of prescriptions of pharmaceutical specialties without the relevant contribution (NRPS), c) the proportion of low use therapeutic medication in the hospital discharge reports, d) the frequency of GPS or, if they are not available, the Common International Denomination (CID) of

the active ingredient in the discharge reports, and e) the mean cost per prescribed medication in the hospital discharge report.

**Table.** Randomized stratified sampling carried out in proportion to the discharge volume in each hospital service

Item	Discharge Reports (July 2007 - June 2008)				
	Discharges	Deceases	Internal	External	Sample size
General Surgery	1,712	34	90	1,588	115
Digestive	461	14	42	405	29
Internal Medicine	2,087	183	129	1,775	131
Gynecology	389	0	11	378	30
Urology	817	6	23	788	64
Traumatology	948	17	23	908	72
Cardiology	1,201	22	56	1,123	79
Short Stay Unit	1,338	4	42	1,292	98
Intensive Care Unit	638	74	455	109	0
Psychiatry	363	1	6	356	28
Pneumology	527	25	33	469	35
Neurology	879	28	38	813	68
Infectious diseases	550	32	21	497	38
Detox Unit	155	0	2	153	11
Otorhinolaryngology	389	0	8	381	31
Ophthalmology	24	0	0	24	
Dermatology	6	0	0	6	9
maxillofacial surgery	78	0	4	74	
Rheumatology	54	3	2	49	
Endocrinology	53	0	6	47	16
Allergy	4	0	1	3	
Nephrology	105	4	8	93	
Total	12,778	447	1,000	11,331	854

To evaluate the most frequent prescription errors on the discharge report we used the ISMP list of error-prone abbreviations, symbols, and dose designations<sup>[16]</sup>. The data were retrieved from a clinical-administrative database of the hospital.

To calculate the mean cost per prescribed medication we consulted our Hospital's Pharmacotherapeutic Guide<sup>[17]</sup> (actualized with con Nomenclator Digitalis 2007) or Vademécum 2007<sup>[18]</sup>. The reference price corresponds to the average cost of the three cheaper generic specialties. When the size of the packaging was not specified, we systematically chose the smaller.

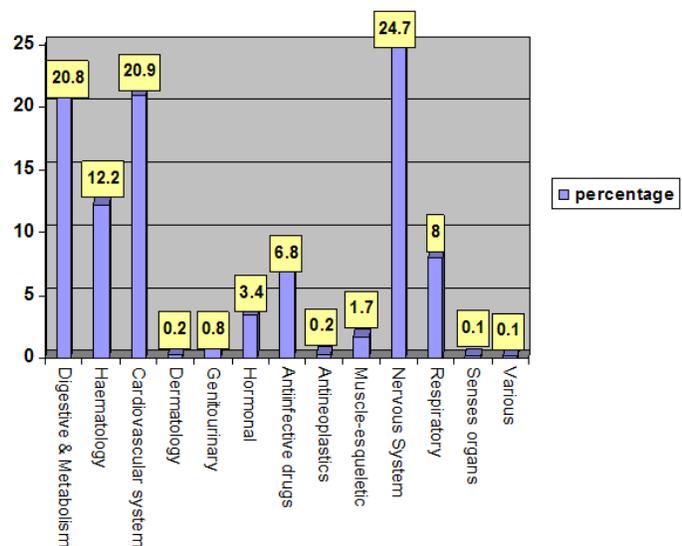
Descriptive statistical analysis has been carried out calculating the frequencies and the percentages for the qualitative variables (gender, type of non-recommended expression, drug's therapeutic group according to the Anatomical Therapeutic Chemical [ATC] Classification System, prescribed drugs for which generics are available, prescribed C-group drugs, route of administration, LTU and NDITV drugs, the service and doctor who prescribe) and the means, standard or typical deviation, maximum and minimum values for quantitative measures. Ninety five percent confidence intervals were calculated for means as well as proportions. Inferential statistical tests were carried out for comparing variables using bivariate analysis and all the results were considered statistically significant at  $p$  levels of  $< .05$ .

The current study has been carried out with a commitment to fulfill the ethical research rules and the legal requirements following current legislation guaranteeing confidentiality of data of a personal nature and its automated treatment according to current legislation about data protection of a personal nature (Organic Law 15/99, of the 13th December, of the Protection of Data of a Personal Nature, Royal Decree 994/1999, of the 11th June).

### 3 Results

A total of 854 discharge reports contained a total of 4,055 medical prescriptions. The mean age of the patients of the discharge reports was 58.6 years ( $SD = 21$ ) and 54% of these were males. Reports that did not contain medical prescriptions were eliminated from the sample (3%) and substituted by others taken from the preview oversample in the study design. Only 2.3% of the reports were carried out by trainee physicians and two thirds of the hospital discharge reports belonged to a medical and clinical specialty. The mean number of prescribed medications in each hospital discharge report was 4.7 ( $SD = 3.6$ ).

The service with the highest mean number of prescribed pharmaceutical drugs was Internal Medicine – with a mean of nearly 8 medical prescriptions ( $7.9 SD = 4.2$ ) per discharge report and Neumology, Cardiology and Infectious diseases – with a mean of around seven prescribed pharmaceutical drugs per discharge report. According to the Anatomical Therapeutic Chemical Classification System (ATCCS), overall, the most prescribed drugs have been grouped into those of the Nervous System (24%), followed by those of the Digestive Apparatus and for Metabolism, and those for the Cardiovascular system (both were 20.8% of the total number of prescriptions). The least prescribed drugs were those in the group for organs of the senses (0.1%) and the antineoplastic and dermatological drugs, with a frequency of 0.2% each (see the Figure).



**Figure.** Bar diagram showing percentages of the most prescribed drugs grouped according to the Anatomical Therapeutic Chemical Classification System (ATCCS).

Mean hospital stay of the patients with discharge reports who were the object of the study was 9.2 days ( $SD = 12.8$ ).

Near 39% of the medical prescriptions for the discharge report contained abbreviations and symbols in the expression of the dose. The most frequently used abbreviation for expressing dose was “*comp*” used in reference to “*comprimido*” (tablet) and was present in one in three prescriptions. Apart from “*cap*” – for “*capsula*” (capsule) – which appeared in 2.7% of recommendations by physicians, the use of the remaining symbols and abbreviations was almost unnoticeable. Only 0.7% of all prescriptions had non-recommended expressions of decimals and zeros in the prescribed medication dose. None of the 4,055 medical prescriptions contained abbreviations and initials of chemical formulas and drugs or medication, proposed as an indicator of error in medical prescriptions.

The drug dose was not specified in 7.9% of the prescriptions described in the discharge notes. The way of administration was not specified in 32.9% of cases. Two percent did not mention the frequency of administration and 31.6% did not mention the length of treatment. In nearly one out of every two prescribed medications a mistake was made in the prescription (Mean = 0.4;  $SD = 0.5$ ), whether for the use of abbreviations and symbols to depict the dose, or because of non-recommended expressions to depict decimals and zeros in the dose. The indicators proposed by the Ministry of Health for estimating the quality of medication prescription were calculated (indicators of good clinical practice):

Percentage of prescriptions without abbreviations, symbols or non-recommended dose expressions, number of medical prescriptions without mistakes/number of revised prescriptions  $\times 100\%$ :  $2,467/4,055 \times 100\% = 60.8\%$ .

Pro-mean of abbreviations, symbols or prohibited dose expressions that have been used, number of erroneous expressions/number of prescriptions revised:  $1,588/4,055 = 0.4$ . Mean type of composed indicator.

The use of these expressions in each service or section was not homogeneous. In the Gynecological service these prescription errors occurred in 98% of treatments whereas, in the psychiatric service they only appeared in 13% of prescriptions.

The prescription of NDTV reached 2.8% of all prescriptions analyzed. The prescription of pharmaceutical specialties of LTU in hospital discharge reports occurred in 2.1% of cases.

No prescription was recorded as a GPS. Therefore this was replaced by a prescription under low principle (International Common Denomination).

Only 13.8% of the prescriptions were carried out under the Official Spanish denomination of Medication. Next an analysis was made of the proportion of prescriptions carried out considering all the generic specialties available on the market. It was found in the sample that out of a total of 2,048 generic specialties available, only 563 specialties were prescribed as an active ingredient (Spanish Official Denomination), in other words, of all the drugs which had a generic version on the market and that could be prescribed as a generic pharmaceutical specialty, only 27.5% were prescribed.

The mean cost of the 4,055 medical prescriptions was 17.3 Euros ( $SD = 31.3$ ) and half of the prescriptions cost less than 5.17 Euros. There was a difference of 825.5 Euros between the most and least expensive drug prescribed.

## 4 Discussion

The results of the present study, provides relevant information about the variables of quality and appropriateness of medical prescriptions, as well as errors committed in writing prescriptions which is closely related to patient safety. In this study it has been found that the level of quality in medical prescriptions in the hospital discharge report is similar to the reported by other authors <sup>[19-21]</sup>.

It is also true that there is some use of abbreviations and non-recommended symbols related to medication errors in the prescriptions of the discharge report.

Prescription errors have been identified as the most frequent cases of adverse effects due to medication, which are in turn the most frequent of the adverse events in most published epidemiological studies <sup>[22, 23]</sup>.

The use of abbreviations, symbols and non-recommended dose expressions affects 40% of medical prescriptions of the discharge reports evaluated. No publications have been found in the bibliography consulted analyzing the frequency of the utilization of these erroneous expressions in the discharge reports. As demonstrated in the present study, the use of these qualified expressions by the scientific community is a frequent occurrence in hospital discharge forms. The reason for this

could be the lack of knowledge of pharmacists about the relationship between this action and its possible adverse effects due to medication. There is probably no awareness about the severity of the problem. Added to this is the fact that the chemist is subjected to a heavy workload when hospital discharge reports are written. Daily activity affected by healthcare pressure, means that discharge reports are elaborated in a very rushed way on occasions. According to the recommendations of the ISMP and other organizations, it would be useful for each institution to study these errors and to establish a list of dose abbreviations, symbols and expressions which are prohibited in the center. It is important, therefore, for all pharmacists who prescribe medication to be aware of this potential problem.

Spanish healthcare authorities have proposed minimizing the proportion of innovative drug prescriptions of these types of drugs as an objective for improving the quality of prescriptions. The current policy for the rational use of medication promotes the use of more effective and/or efficient medication<sup>[24]</sup>. Therefore, every year the lists of these specialties are updated, in order to spread information among prescribing pharmacists.

NDITV in medical prescriptions account for 2.8% of all the reports analyzed. Although this overall figure is an acceptable value, and is similar to the figures reported in the literature<sup>[21, 25]</sup>, if each section or service is analyzed it can be seen that those services grouped under Other Medical Services (Nephrology, Allergy, Rheumatology and Endocrinology) prescribe these specialties in more than 12% of cases, with significant differences compared to the mean of the other services. This discrepancy is marked by the prescription of new insulin by the Endocrinology section and by new antihistamines which do not provide a therapeutic improvement compared to previous ones, by the Allergy section. The lack of information provided to specialist pharmacists about these specialties could explain this fact. The physicians could be influenced by unilateral information coming from the pharmaceutical company about these new drugs.

In 2004, Matoses *et al.*<sup>[21]</sup> carried out a retrospective study developed in a general hospital with 450 beds and 11 different services, analyzing 778 medical prescriptions in 195 discharge reports. Of these prescriptions, 1.1% corresponded to NDITV. In the referred study the Cardiology and Emergency services were identified as the services which most prescribed these types of drugs (both with a 2.5% prescription rate).

The quality of the pharmacological prescription has been evaluated using the study of prescribed medication of a low therapeutic contribution<sup>[21, 26]</sup>. In the present study 2.1% was prescribed of this therapeutic group. This result is considered to be acceptable by most authors<sup>[21, 26, 27]</sup>. In the Cardiology service and the Digestive Apparatus service, there are a higher percentage of these prescriptions than in the rest, with statistically significant differences. In the Cardiology service the prescription of these drugs is at the expense of capillary stabilizers (although there is no evidence about its efficiency, at present there is not an effective pharmacological alternative). In the Digestive Apparatus section these prescriptions are based on capillary stabilizers and on laxatives and their therapeutic efficiency is currently controversial.

In the aforementioned study by Matoses<sup>[21]</sup>, up to 1.3% of the prescribed medication in the reviewed hospital discharge reports were classified as medication of LTU. As in the present study, mainly capillary stabilizers were notable in the group of bioflavonoids, at 50% above the total, prescribed by the Digestive service and mucolytics, at a level of approximately 30% of the discharge reports from the Emergency services.

Although the prescription of specialties of high therapeutic utility does not mean that this medication is indicated in the place where it is used, it is clear that a high prescription of the medication with LTU is not recommendable. However, the problems occur in drugs which have been on the market for many years in our country and are used in situations in which there are currently no efficient alternative drug or in medication with questionable effectiveness such as mucolytics or AINEs administered in a topical way. Similarly, it would be necessary to consider the other factors affecting the decision about the prescription of these drugs of LTU in clinical practice as shown by the prescriptive routine, the prescription included by the patient, the excess information provided by pharmaceutical campaigns, etc. without underestimating the placebo effect which actually improves the condition of some patients using medications of LTU.

Controlling pharmaceutical costs is a concern for all healthcare authorities. Measures have been established in many European countries which range from including certain drugs on negative lists, agreeing with the pharmaceutical industry about the control of company profits, and managing to persuade the physicians to not prescribe above fixed limits.

In Spain there has been a development in the prescription of generic medication and active ingredients (or common international denomination, CID) as an important measure for controlling pharmaceutical costs. As mentioned in the results section, there were no prescriptions by generic specialties, but there were some by active ingredient (CID). The handling of drugs by their name is very important for the appropriate use of medication: It improves knowledge about the drugs; it increases safety of their use and ensures maximum efficiency in pharmaceutical presentation.

The number of prescriptions by CID in the hospital under investigation is insufficient. Only 13.8% of the medical prescriptions of the discharge reports use the Common International Denomination. In the remaining 86.2% the commercial or brand name is used for the prescribed drug.

Although the percentages reported in the bibliography are similar<sup>[21,28]</sup>, they shouldn't be considered as optimal. There are generic drugs available for quite a considerable proportion of the drugs prescribed. In the present study, of the 4,055 medical prescriptions that were collected, 2,048 were available as generic specialties, that is to say, 50.5% of all the prescriptions. However, they were only prescribed in 13.8% of cases.

Tornero *et al.*<sup>[29]</sup> studied the prescription habits of generic drugs in hospital care and the impact of two intervention improvement strategies. The study was developed in January 2002, in a district hospital in Valencia (Spain) with 250 beds. Using base data, 42% of the prescribed medication could have been prescribed as generic, but it was only prescribed as such in 10% (21% in the Internal Medicine Service). The study concluded that the use of promotion campaigns for the use of GPS is limited and transitory.

Rausell *et al.*<sup>[30]</sup> estimated the percentage of generic drugs prescribed before intervention for improving a prescription. The basic prescription of generic drug specialties was 2.1%. After an intervention period of four to six months this percentage increased to 3.3% and at the end of a year it was up to 5.1% and these differences were statistically significant.

GPS are not commonly used by hospital pharmacists. In Spain, the main problem for the extensive implementation of generic drugs is that traditionally they have not been used, mainly due to the limited information available to healthcare professionals and the absence of official lists of widely available generic medication<sup>[28]</sup>. It has been shown that the level of information held by physicians and the controversy about the therapeutic equivalence between generic medication and those of reference could be some of the crucial factors causing a lack of implementation of generic specialties. It is necessary to encourage prescriptions and the use of generic medication in hospitals. As well as improving information about the availability and effectiveness of the generic specialties, the involvement of the prescribing physician should also be considered, not only in primary care, but also in specialized care.

Pharmaceutical costs have been increasing considerably in recent years. The rational use of medication is a priority and implies the use of strategies and tools to achieve this. The mean cost of each prescription in the present study was 17.3 Euros.

In a study published by Muñoz *et al.*<sup>[31]</sup>, 256 hospital discharge reports were analyzed which were collected randomly in eight departments in the months of June and July 2000, at a university hospital. Out of the 1,233 prescriptions, in 220 there was a possibility of using a GPS (18%). However, it was only prescribed in 2.2% of the generic specialties. The cost of the medication was 707,521 pesetas (4,252.3 Euros). If all the possible generics had been prescribed the cost would have been 505,672 pesetas (3,039.15 Euros). The authors concluded that the prescription of generic medication is not common practice in hospital physicians.

A policy for the relational use of medication should include training programs directed at hospital pharmacists about the possibilities and progresses that could bring about an improvement in medical prescriptions.

## 5 Conclusions

The overall quality of medical prescriptions issued in hospital discharge reports is not at a satisfactory level. The prescription of medication as generic specialties is inexistent. Similarly, the prescription as an active ingredient is insufficient.

However, errors in making prescriptions is a frequent occurrence, almost one in every two prescribed medications is carried out incorrectly. Evaluation using these indicators forms the basis for prioritizing improvement strategies.

An overall indicator of the quality of prescriptions is the proportion of new drugs which have little or no therapeutic relevance in the discharge notes. In our study the prescription is relatively low, although doctors should stick more closely to hospital pharmaco-therapeutic guides. Anyway prescribing, especially in higher age patients, becomes very individualized as the therapeutic objectives are changing. This is especially true for the end life patients and thus a judgment just based on a "standard" has significant limitations.

It is necessary to implement programs for raising awareness and increasing sensitivity about the importance of quality and appropriateness in medical prescriptions, as well as to for introducing information to physicians on more efficient preparations and good practices for writing discharge reports thus improving patient safety.

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