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Prescription errors after the implementation of an electronic prescribing system

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Resumen

Objetivo: El objetivo de este estudio es detectar, cuantificar y comparar los errores de medicación producidos con un sistema de prescripción manual comparado con un sistema de prescripción electrónica asistida en las fases de prescripción y transcripción.

Método: Estudio prospectivo realizado en dos unidades clínicas de hospitalización (neumología y enfermedades infecciosas) de un hospital general. El estudio ha tenido dos fases (antes y después de la implantación de la prescripción electrónica asistida) y cada una tuvo una duración de un mes. Se han analizado y comparado los errores de medicación producidos en los procesos de prescripción médica, transcripción y registro de la administración por el personal de enfermería, así como en la transcripción/validación por el farmacéutico.

Resultados: Durante los dos periodos de estudio se detectaron un total de 3.908 errores referentes al tratamiento de los pacientes y 129 correspondientes a los datos identificativos de los mismos. Respecto a los errores cometidos en la identificación del paciente o la orden de tratamiento, con la prescripción manual se obtuvo una tasa de error del 14,4%, mientras que tras la implantación de la prescripción electrónica fue del 1,3%, siendo la reducción relativa del riesgo del 100 y del 85,44% en el servicio de infecciosas y neumología respectivamente (estadísticamente significativo). Se ha conseguido una reducción relativa del riesgo, de forma global en ambas unidades, que oscila entre el 78,91% y el 100% y una reducción absoluta del riesgo que oscila entre el 5,09 y el 30,45% respecto a los errores en los datos del medicamento, dosis, frecuencia/hora y vía/modo de administración, siendo estos resultados estadísticamente significativos.

Conclusiones: La utilización de la prescripción electrónica asistida ha disminuido los errores en la identificación, prescripción y trascripción del tratamiento farmacológico y por tanto ha contribuido a mejorar la calidad y la seguridad de la farmacoterapia aplicada a los pacientes.

Palabras clave: Prescripción electrónica asistida. Errores de medicación. Errores de prescripción. Seguridad. Eficiencia.

Summary

Objective: This study sets out to identify, compare and evaluate the medication errors of a manual prescribing system and an electronic prescribing system during the prescription and transcription phases.

Method: A prospective study of two clinical in-patient units (pneumology and infectious diseases) in one general hospital. Two phases were studied; before and after an electronic prescribing system was implemented. Each phase lasted one month. A comparative analysis was carried out of the medication errors in the medical prescription process, the transcription process and the administration recording process carried out by nursing staff as well as the pharmacist's transcriptions/validations.

Results: A total of 3,908 patient treatment errors and 129 patient identification errors were detected during both of the periods studied. The rate of errors in patient identification or treatment orders using the manual prescribing system was 14.4 against 1.3% after the electronic system was implemented. The relative risk reduction for infectious diseases and pneumology was 100 and 85.44%, respectively (statistically significant). In general, relative risk reduction was achieved in both units, oscillating between 78.91 and 100%. The absolute risk reduction oscillated between 5.09 and 30.45% for errors in drug data, doses, frequency/time and route of administration. These results were statistically significant.

Conclusions: The electronic prescribing system has reduced errors in the identification, prescription and transcription of pharmacological treatment and has consequently helped to improve the quality and safety of drug treatment received by patients.

Key words: Electronic prescribing system. Medication errors. Prescription errors. Safety. Efficiency.

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INTRODUCTION

Medication errors (MEs) are a major cause of serious damage to patients and a common cause of iatrogeny in hospitalised patients[1]. Both Leape et al. and Bates et al. have reported that MEs occur in 6.5 % of hospital admissions[2,3]. MEs most commonly occur in the prescription phase (56%) and the administration phase (34%). MEs are less common in the transcription (6%) and dispensing (4%) phases. MEs can be most easily intercepted in the first phases of the process; i.e. whilst being prescribed (48%). Twenty-nine percent of the errors made in the prescription phase occurred due to lack of drug knowledge and 18% due to lack of patient information and laboratory data. Errors were also caused by the erroneous calculation of doses, decimal errors, confusion over similar drug names, dose forms, the use of abbreviations, unusual routes of administration, uncommon dose regimes. Bates et al. also indicated that 28% of the negative side effects of drugs are linked to MEs and can therefore be prevented; 56% of these occur in the prescription process. The ME average is over 5% and approximately half of these errors occur in the prescription process. The main errors include the omission of doses, incorrect doses and errors in the frequency or route of administration. Other authors have reported that up to 78% of MEs resulting in negative side effects were caused by a fault in the prescribing-dispensing-administering cycle and could be improved by using computerised information systems[2-5].

The electronic prescribing systems (EPS) may prevent or reduce *prescription errors* in medical treatment when used along with databases containing clinical information, patient analyses and drug information and provide warnings about allergies and clinically significant drug interactions, etc. Bates et al.[2] documented that the expert systems are particularly useful for preventing MEs. They discovered that when using an EPS providing very little prescription support, the negative side effects of drugs that potentially would not have been intercepted dropped by 84% and the negative side effects of those that could have been prevented dropped by 17%. Bates et al. also carried out a prospective analysis to evaluate the impact of an expert EPS system (electronic prescribing without clinical decision support) on reducing the number of MEs. They discovered that dosage errors for prescriptions that were not sent out dropped by 81% and serious MEs for prescriptions that were not intercepted dropped by 86%[5]. In a review of various publications, Hunt et al. concluded that, for both inpatients and outpatients, ESPs help to improve clinical dose management, preventive care and other aspects of medical care. The impact on the patient, however, remains uncertain[6]. Kaushal et al. and Kuperman et al. systematically revised the various publications on the impact of the EPS on reducing MEs; these authors found that MEs were indeed reduced[7,8]. Leape et al. reported that improving computer systems for the purpose of prescribing may help to prevent 78% of the errors that may cause a drug to have negative side effects[2].

Indeed, strategies for improving prescription procedures (educative, informative, prescription revision by medical practitioner) have a positive effect both on the quality of medical care and pharmaceutical costs[9]. However, authors and scientific societies[9-12] now consider the EPS to be the most suitable means of improving the quality of prescriptions and to reduce MEs[9,10] and pharmaceutical costs as it is a safer and more efficient means of prescribing drugs[13-22]. Therefore, health organisations should consider the EPS as an effective means of reducing drug iatrogeny and improving the efficiency of the health care processes in the pharmacological treatment of patients.

This study sets out to identify, compare and evaluate the medication errors of a manual prescribing system and an electronic prescribing system during the prescription and transcription phases.

METHOD

A prospective, open study carried out in two sequential phases (before and after implementing the electronic prescribing system –EPS–). The prescriptions of patients receiving drug treatment in two clinical units of one general hospital will be analysed: the pneumology department (27 beds) and the infectious diseases department (26 beds). The average hospital stay during the study period is 11.02 and 10.03, respectively. These two departments were chosen because they had already introduced the unit dose dispensing system and a manual prescribing system in 2002 and were both implementing electronic prescribing in the same period of time.

The first phase or the manual prescription phase (MP) recorded the MEs of the medical prescription, transcription and the administration recording process carried out by nursing staff. The errors were recorded again in the second phase of EPS, after waiting a one month post-EPS implementation adaptation period. Each phase lasted one month. The difference between these phases was that in the first MP phase, the doctor would use a pre-printed form for prescribing the medical treatment. A copy of this form would be sent to the pharmacy department and used by the pharmacist to be entered into the Hospiwin® computer programme. The nursing staff would also transcribe the medical treatment on another form. In the second EPS phase, the doctor would enter the treatment into the aforementioned computer programme, print it out and sign the administration form ready for the nursing staff to then administer the drugs, thus eliminating the pharmacist

and nurse's transcriptions.

To avoid any bias, the doctors and nursing staff were not informed of the study. During the study period, there were no staff changeovers or any other changes that may have affected the results. Every day, two pharmacists would be responsible for revising the treatment orders or the electronic prescription. If they had any doubts when analysing errors, they would consult another pharmacist. For the purpose of this study, the daily transcription and validation of the treatment orders would be carried out by a different pharmacist to the ones who revised the treatment. The following errors were obtained in both phases:

Medical prescription errors:

—*Patient identification errors:* errors for omission of the date, time and signature, patient name or history number, omission of details regarding drug allergies or incorrect bed.

—*Drug errors:* unsuitable drugs given the patient's history of allergies or previous ADRs, unsuitable drugs for the patient's age, hepatic or renal insufficiency or underlying pathology. The pharmacist would, therefore, revise the patient analyses and the medical report containing the diagnosis and indicate any unsuitable drugs or proprietary drugs (outlining any other existing drugs or proprietary drugs in accordance with the guidelines in terms of administering the drugs, e.g. pills instead of liquid requested for nasogastric tube or e.g. inhaler and not liquid requested for administering bennet, or e.g. requesting amoxicillin-clavulanate in a 2 g vial when only 1 g needs to be administered and 1 g vials exist, selecting ampoules for oral administering when specific oral administering already exists), unsuitable choice of drugs (when a drug that is not included in the hospital's drug guidelines when an equivalent exists), contraindicated medication due to contraindicated interaction, unnecessary medication, duplicate therapeutics (same unjustified active principal or two equivalent active principles), omitted drugs, illegible or confusing drugs, incorrect, illegible or omission of pharmaceutical form.

—*Dose errors:* prescribing a dose that is too high or low, omission of dose or illegible, ambiguous or confusing doses.

—*Frequency errors/administration time errors:* excessive or insufficient frequency, omission of frequency, ambiguous or confusing frequency, incorrect administration time, omission of administration time for those drugs administered once a day and whether at morning or night.

—*Route of administration errors:* incorrect or omission of route of administration (when the route of administration is omitted or the directions indicated are incorrect, e.g. drug administration directions that are not possible and for which there are no other proprietary drugs to be administered by an alternative route).

—*Treatment duration errors:* excessive or insufficient duration (according to the technical specifications of the chosen proprietary drug), or erroneous calculation of administering dates.

—The pharmacological interactions have been revised, taking into account those of clinical relevance but which can be administered at the same time provided that the doses are adjusted accordingly and/or the patient is monitored.

Nursing administration form errors: errors due to contradictory or confusing orders, omissions on the medication transcription, omission in the administration transcription, unsuitable route of administration, transcription omission and error, dose error, route of administration error, frequency error or drug withdrawal error, therapeutic duplication on the transcription and illegible transcriptions.

The number of patients, forms revised and treatment lines were counted. Each treatment line counted corresponded to the new prescription for a drug or the modification of a prescription for drugs previously prescribed. For patient treatment errors, the total possible number of errors was the total number of treatment lines revised. For patient identification errors, the total possible number of errors was the total number of forms revised. The errors for both clinical departments were measured and totalled in order to establish whether there were any differences between the departments.

The electronic prescribing programme used was Hospiwin® 2000 (Baxter). This programme provides the doctor with an EPS for treatment orders as well as prescription support in real time. By using the drug database included in the hospital's drug-related guidelines, it provides information on the most common doses, maximum and minimum doses, and warnings on therapeutic duplications or medication interactions. Once the electronic prescription is issued, the doctor prints out the patient's treatment to be sent to nursing staff to record that the drugs have been administered. The transcription process in this latter phase has been eliminated. The pharmacist validates the medical orders on the computer whilst connected to the inpatient unit network. The programme allows the pharmacist and the doctor to communicate directly with each other by messaging.

For statistical calculations, the "treatment assessment" programme (version 1.0.1) was used. This programme was developed by the Biostatistic Clinic Unit of the Ramón y Cajal Hospital (http://www.hrc.es/investigacion/bioest/otras_calculadoras.html). This programme is used to calculate the error rate, the relative risk reduction (RRR) and absolute risk reduction (ARR).

Errors have been categorised in accordance with the Otero et al.[23] model and were modified in some aspects after reviewing literature[24,25] and based on own experience: the patient's identification details and the medical order are gathered together, including any omissions and incorrect data. Errors are broken down per

Table I. Characteristics of the treatments analysed in both phases studied

	Manual prescription	*Electronic prescription*	*Total*
Total			
Total patients	172	138	310
Total number of forms revised	839	610	1,449
Total number of treatment lines	2,848	1,966	4,814
Pneumology			
Number of patients	89	81	170
Number of forms revised	412	249	661
Total number of treatment lines	1,255	699	1,954
Infectious diseases			
Number of patients	83	57	140
Number of forms revised	427	361	788
Total number of treatment lines	1,593	1,267	2,860

omission and nursing transcription errors are included under the variable analysed (medication, doses, frequency, means).

RESULTS

The data on the number of patients, the number of forms and the number of treatment lines revised are presented in table I. Table II presents the patient treatment errors detected; the overall errors are shown as well as a breakdown of the errors specific to each department. A total of 3,908 patient treatment errors (Table II) and 129 patient identification errors (Table III) were detected throughout both of the periods studied and for both departments studied.

Table II contains the seven groups of errors analysed in the two study periods. The distribution of errors according to the type of variable analysed is shown in table IV.

DISCUSSION

The number of errors has been considerably reduced by implementing the EPS in two inpatient units; error reductions obtained range from 38.7% (treatment duration) to 98.5% (route of administration). It is difficult to make a general comparison between the results we obtained and those already documented due to the fact that each author measures the data differently. However, other authors also obtained a reduction in MEs of between 55% and 86% after implementing the EPA[3,5,8]. In Spain, some (though very few) studies have been carried out to measure the impact of implementing EPS programmes on reducing MEs: Hidalgo et al. obtained a significant reduction in errors[17] and Delgado et al.

Table II. Error distribution

Type of error	*Manual prescription*	*Electronic prescription*	*ARR*	*Confidence interval*	*RRR*	*Confidence interval*	*p*
Total							
Medication data	1,099/2,848 (38%)	160/1,966 (8%)	30.45%	28.29 to 32.60%	78.91%	73.32 to 84.50%	< 0.05
Dose	831/2,848 (29%)	47/1,966 (2%)	26.79%	24.99 to 28.59%	91.81%	85.63 to 97.98%	< 0.05
Administration frequency/time	174/2,848 (6%)	20/1,966 (1%)	5.09%	4.11 to 6.08%	83.35%	67.22 to 99.47%	< 0.05
Route of administration	490/2,848 (17%)	5/1,966 (0%)	16.95%	15.55 to 18.35%	98.52%	90.36 to 106.68%	< 0.05
Nurse transcription	512/2,848 (18%)	414/1,966 (21%)	-3.08%	-5.37 to -0.79%	-17.14%	-29.86 to -4.41%	< 0.05
Drug interaction	63/2,848 (2%)	56/1,966 (3%)	-0.64%	-1.55 to 0.28%	-28.77%	-70.01 to 12.48%	NS
Treatment duration	26/2,848 (1%)	11/1,966 (1%)	0.35%	-0.13 to 0.83%	38.71%	-13.90 to 91.33%	NS
Total errors	*3,195*	*713*					
Pneumology							
Medication data	672/1,255 (54%)	151/699 (22%)	31.94%	27.83 to 36.06%	59.66%	51.97 to 67.34%	< 0.05
Dose	475/1,255 (38%)	34/699 (5%)	32.98%	29.86 to 36.11%	87.15%	78.90 to 95.40%	< 0.05
Administration frequency/time	111/1,255 (9%)	11/699 (2%)	7.27%	5.45 to 9.09%	82.21%	61.61 to 102.81%	< 0.05
Route of administration	173/1,255 (14%)	4/699 (1%)	13.21%	11.22 to 15.20%	95.85%	81.43 to 110.27%	< 0.05
Nurse transcription	317/1,255 (25%)	108/699 (4%)	9.81%	6.21 to 13.41%	38.83%	24.58 to 53.08%	< 0.05
Drug interaction	47/1,255 (4%)	33/699 (5%)	-0.98%	-2.87 to 0.91%	-26.06%	-76.55 to 24.43%	NS
Treatment duration	9/1,255 (1%)	11/699 (2%)	-0.86%	-1.89 to 0.18%	-119.44%	-263.63 to 24.75%	NS
Total errors	*1,804*	*352*					
Infectious diseases							
Medication data	427/1,593 (26%)	9/1,267 (0%)	26.09%	23.87 to 28.31%	97.35%	89.05 to 105.65%	< 0.05
Dose	356/1,593 (22%)	13/1,267 (1%)	21.32%	19.20 to 23.44%	95.41%	85.92 to 104.89%	< 0.05
Administration frequency/time	63/1,593 (4%)	9/1,267 (1%)	3.24%	2.18 to 4.31%	82.04%	55.16 to 108.92%	< 0.05
Route of administration	317/1,593 (20%)	1/1,267 (0%)	19.82%	17.85 to 21.79%	99.60%	89.7 to 109.49%	< 0.05
Nurse transcription	195/1,593 (12%)	306/1,267 (24%)	-11.91%	-14.76 to -9.06%	-97.30%	-120.61 to -73.99%	< 0.05
Drug interaction	16/1,593 (1%)	23/1,267 (2%)	-0.81%	-1.69 to 0.07%	- 80.74%	-168.68 to 7.21%	NS
Treatment duration	17/1,593 (1%)	0/1,267 (0%)	1.07%	0.56 to 1.57%	100%	52.72 to 147.28%	< 0.05
Total errors	*1,391*	*361*					

Table III. Patient identification or treatment form error distribution

	Manual prescription	*Electronic prescription*	*ARR*	*Confidence interval*	*RRR*	*Confidence interval*	*p*
Total	121/839 (14%)	8/610 (1.3%)	13.11%	10.57 to 15.65%	90.91%	73.27 to 108.54%	< 0.05
Pneumology	56/412 (14%)	0/249 (0%)	13.59%	10.28 to 16.90%	100%	75.65 to 124.35%	< 0.05
Infectious diseases	65/427 (15%)	8/361 (2%)	13.01%	9.28 to 16.74%	85.44%	60.94 to 109.95%	< 0.05

Table IV. Error distribution by variable

	Manual prescription in pneumology	*Electronic prescription in pneumology*	*Manual prescription in infectious diseases*	*Electronic prescription in infectious diseases*
1. *Patient/medical order identification data*	*56*	*0*	*65*	*8*
1.1 Omission of date, time, signature	14	0	3	0
1.2 Omission of patient details: name, clin. hist. no, bed	10	0	40	0
1.3 Omission of alergy details	32	0	21	8
1.4 Incorrect patient	0	0	1	0
2. *Drugs data*	*672*	*151*	*427*	*9*
2.1 Unsuitable drugs: alergy or previous ADR	0	0	0	0
2.2 Unsuitable drugs: age, RS, HI, pathology	54	63	3	6
2.3 Unsuitable choice of proprietary	0	28	0	0
2.4 Unsuitable choice of drugs	26	29	13	3
2.5 Unnecessary drugs	3	4	0	0
2.6 Therapeutic duplication	1	0	1	0
2.7 Omission of treatment transcription	5	23	0	0
2.8 Illegible or confusing drugs	28	1	11	0
2.9 Incorrect pharmaceutical form	31	3	15	0
2.10 Illegible or omission of pharmaceutical	524	0	384	0
3. *Dose*	*475*	*34*	*356*	*13*
3.1 Dose too high	46	16	10	12
3.2 Dose too low	2	7	1	0
3.3 Extra dose	43	0	0	0
3.4 Dose omitted or illegible	359	7	335	1
3.5 Ambiguous or confusing dose	25	4	10	0
4. *Administration frequency/time*	*111*	*11*	*63*	*9*
4.1 Excessive frequency	1	6	0	0
4.2 Insufficient frequency	0	2	0	0
4.3 Omission frequency	23	1	6	6
4.4 Ambiguous or confusing frequency	54	1	49	3
4.5 Incorrect administration time	0	1	0	0
4.6 Omission of administration time	33	0	8	0
5. *Route of administration*	*173*	*4*	*317*	*1*
5.1 Incorrect route of administration	2	1	0	1
5.2 Omission of route of administrtion	171	3	317	0
6. *Treatment duration*	*9*	*11*	*17*	*0*
6.1 Excesive treatment duration	9	10	17	0
6.2 Insufficient treatment duration	0	0	0	0
6.3 Incorrect calculation of administration dates	0	1	0	0
7. *Drugs interaction*	*47*	*33*	*16*	*23*
8. *Nurse transcription*	*317*	*108*	*195*	*306*
8.1 Contradictory (or confusing) transcription	41	2	38	0
8.2 Omission of medication transcription	47	0	12	0
8.3 Omission of administration transcription	123	98	63	306
8.4 Unsuitable route of administration	0	0	3	0
8.5 Transcription omission/error: dose, route, frequency, cancelled	106	8	78	0
8.6 Therapeutic duplication on transcription	0	0	1	0

also obtained a great reduction in errors with a global RRR of 48% after implementing an EPS[21].

Manually prescribing treatment is the cause of the majority of the MEs detected and the cause of errors on the pharmacist and the nursing staff transcription and in the dispensing and administering phases. This has already been documented by other authors[13,26]. Some errors are almost completely eliminated by using the EPS; e.g. patient identification errors, date, time, the prescribing doctor's signature and errors due to illegible or confusing drugs, omission of pharmaceutical form or omission of the treatment transcription. This information, by default, must be entered into the computer system and thus reduces possible errors[17]. In our study, the percentage for errors caused by illegible or confusing drugs was reduced to 0.6% in when using the EPS; illegible, confusing or omissions in doses dropped from 87.7% in MP dose errors to 27.6% using the EPS. The illegible, confusing or omitted frequencies caused 75.6% of frequency errors in MP systems and 55% in EPS systems. In this respect, Meyer found that 10% of treatment orders prescribed manually are illegible and Bobb et al. reported that two thirds of the errors made in the manual process can be avoided by using EPSs[25,27]. In a study carried out by Lesar et al. with treatment orders written manually and later transcribed by the pharmacist, it was found that the average medication errors was 3.99 per 1,000 prescriptions; 13.4% of the errors made were due to confusions regarding the name, dose or drug abbreviation and 10.8% were due to incorrect frequencies[26].

When the MP errors were analysed, it was found that the highest error rate was for the drug's prescription details (38%) and for dose (29%). Therefore, for Dean et al. 54% of the errors were caused by to the dose and 58% resulted from the drug selection process and 61% of errors were made as a result of MP[28]. Teich et al. reported that there was an improvement in five aspects of the prescription relating to dose, frequencies and the prescription of recommended drugs by implementing the EPS. Cherton et al. reported that errors in doses and unsuitable frequencies dropped by 13 and 24%, respectively. Overhage et al. obtained a 25% improvement in prescriptions[13,29,30]. Hidalgo et al. reported a significant reduction in errors due to the omission of the route of administration, doses or dose type, administration frequency errors and proprietary drug details[17]. For Delgado et al. there was a decrease in transcription/validation errors, errors made on the nursing staff's transcription and dispensing errors[21].

However, using an EPS does not completely eliminate errors, as our study revealed (error rate oscillated between 1.3 and 8%). Such errors may be due to the prescriber's lack of training and inability to correctly use the computer system. These results concur with those of other authors (2.4-6.2%)[5,21,25,31]. By surveying doctors, Koppel et al. identified two groups of medication errors from using the EPS: the first includes information errors due to faults occurring when combining the information systems and the prescription information programmes; the second is due to the users' lack of training or inability to correctly use the prescribing programmes[32].

By using an EPS, a third of treatment duration errors were reduced and we noticed a 1% increase in interactions. Presumably, this was due to the information programme's warning system and prescription support which provides information on the maximum recommended duration or specific treatments, medication interactions and warning of clinically significant interactions. Indeed, this helps the prescriber issue safer medication. However, no contraindicated interactions were detected. Nightingale et al. analysed the warnings generated after the EPS was introduced and they found that 57% of prescriptions have a great number of warnings. They also observed that 0.07% of prescriptions are cancelled because the warnings generated indicate they may trigger a serious health problem[9].

Those errors that are not intercepted and reach the patient are essentially caused when transcribing the medical treatment on the nursing staff administration forms. When the EPS is used, this transcription process is eliminated as the doctor prints out the treatment administration form directly from the computer system. This print out is used by the nursing staff and the transcription is no longer required. It is expected that these types of errors would therefore be considerably reduced. The error rate in the pneumology department was reduced from 25 to 4%. However, in the infectious diseases department this rate increased slightly from 12% with the MP to 24% using the EPS. This may be due to the fact that some nursing staff did not know how to use the new EPS and continued to transcribe the medical prescription manually. It is interesting to note the different reactions between the nursing staff from both clinical departments; the new EPS was much better accepted in the pneumology department than it was in the infectious diseases department. Delgado et al. reported that the RRR for nursing staff's transcriptions in the transition from the manual prescription phase to the EPS was 68%[21].

However, one of the limitations to this study is that the treatment prescriptions received outside working hours were not analysed. The errors made at these times may differ from those within the working hours.

Another limitation is that only the nursing staff's prescription and transcription errors were evaluated. A further study must be carried out to investigate whether the use of EPS reduces dispensing and administration errors in this area. Due to the fact that during prescription process is when more errors are made[10,25,28], this study sets out to analyse and measure the prescription process in particular and the impact of the EPS. Furthermore, the study can be considered more reliable given that similar results

have been obtained for the reduction of these errors in both medical departments analysed.

The one month period between implementing and analysing the EPS may be too short. This period may not have been sufficient for allowing the learning curve to level off or, on the contrary, intensive monitoring may have affected the results. Nevertheless, because the short-term effects of implementing the EPS were being investigated, other works published also used this same pre-analysis length of time[13,21]. Waiting only a month means that it is less likely that there will be any great changes in medical staff and patients between observations.

The pneumology and infectious diseases departments were chosen as they were the first to implement the new system. The results of this specific study cannot be extrapolated to other hospital departments or units.

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