

Prescribing errors in a Brazilian teaching hospital: causes and underlying factors from the perspective of junior doctors

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Abstract

AIM In university hospital settings most prescriptions are written by junior doctors, who are more likely to make mistakes than experienced doctors. Prescribing errors can cause serious harm to patients. In Brazil, few studies have investigated the causes of these errors. Our aim was to investigate the causes of prescribing errors from the perspective of junior doctors. **METHOD** Qualitative, descriptive and exploratory study that used a semi-structured individual interview with questions related to the planning and execution of prescriptions. It was conducted with 34 junior doctors who graduated from twelve different universities located in six Brazilian states. The data were analyzed according to the Reason's Accident Causation model. **RESULTS** Among a 105 errors reported, medication omission stood out. Most errors resulted from unsafe acts during execution, followed by mistakes in planning and rule violations. Many errors reached the patients, rule violations and slips accounted for the majority. Work overload and time pressure were the most frequently reported causes. Difficulties faced by the National Health System and organizational problems of the institution were identified as latent conditions. **CONCLUSION** The results reaffirm the multifactorial causes of the errors. Unlike other studies, the large number of violations may be related to the misuse of junior doctors to fill gaps in the health system combined with inadequacies in the prescription and training systems. We suggest conducting other local or multicenter studies to investigate cultural and contextual aspects that help to understand the causes of prescribing errors in Brazil and other low and middle-income countries.

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Conflict of Interest

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Ethical Approval

The study was approved without restrictions by the Human Research Ethics Committee of the Federal University of Uberlandia on 03/28/2018, under process number 2.570.103. All participants gave their consent before participating.

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STATEMENTS

What is already known about this subject:

- Drug harm differs among low, middle and high-income countries.
- Little has been studied regarding the causes of prescribing errors in low and middle-income countries.

Box 1: Reason's accident causation model [22]

Errors, i.e., non-voluntary active failures, are divided into two classes: those deriving from failure to execute a correct plan (execution errors) and those resulting from the correct execution of an inappropriate or incorrect plan (planning error). Failures to execute a correct plan are classified into *slips* and *lapses*. The correct execution of incorrect plans, called *mistakes*, are classified into knowledge-based mistakes (KBMs) and rule-based mistakes (RBMs) (REASON, 2000). Violations are voluntary or intentional active failures and consist of deliberately breaking codes of conducts and routines [22].

Slips are failures to recognize and select drugs with similar names in the electronic prescription system, for example;

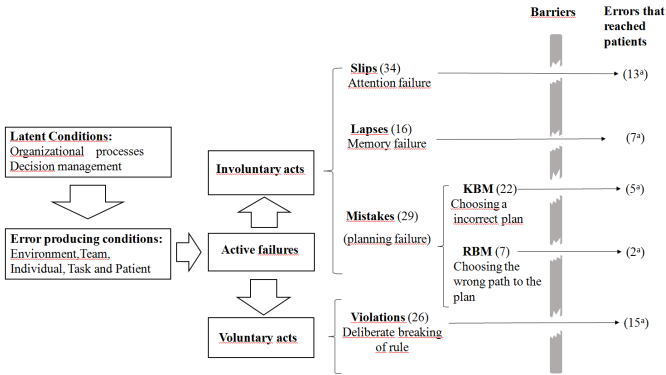
Lapses concern memory or attention faults, like planning the suspension of a medication and not prescribing it;

Knowledge-based mistakes (KBM) are likely to happen due to lack of knowledge or inexperience in medication prescription and refer to the incorrect choice of a plan, such as wrong medication prescription or dose due to lack of knowledge.

Rule-based mistakes (RBM), on the other hand, refer to the inappropriate choice of plan to achieve a goal. They are likely to happen due to the incorrect use of knowledge in the decision making context, for example, prescribing the dose for standard clinical conditions without considering adjustments for specific conditions such as renal function and patient age; cases where it is believed the decision at the moment is correct.

Violations are voluntary actions in which rules are deliberately ignored, for example, prescribing without a proper assessment of the patient's current clinical conditions.

Figure 1: Active failures, error-producing and latent conditions (adapted from the Reason's Accident Causation model [22]).



Numbers = number of errors
^a = number of errors reaching patients
Note: the gaps in the barriers represent failures in the system
Source: the researcher

Box 2 Examples of accounts of active faults resulting from involuntary acts.

SLIP:

"The drugs had similar names, nitroglycerin and nitroprusside, vasodilators, I know the names have to be in alphabetical order, but this led me to making this mistake". Interviewee C

"Yesterday I prescribed Promethazine IM, but when I selected it for the prescription, I pressed the arrow and IV came out, without me realizing." Interviewee Y

Interviewee S forgot to suspend the thrombosis prophylaxis in the preoperative state and the surgery had to be canceled.

"I've done it twice, and it makes me upset. Once we had to cancel the surgery and the other time we managed to revert the situation to allow time to operate". Interviewed S

"Medications that the patient takes, and you omit in the first postoperative prescription because the patient can't take it. Then because you don't add the medications the first time, sometimes when you add them some are left out. This happens a lot, and sometimes you lose the continuity of some medications". Interviewee S

KBM:

Due to lack of knowledge, Interviewee N had to redo the prescription of magnesium sulfate for a patient with pre-eclampsia.

"When I started here we didn't know much about dosage, so there were times when I had to make more than one prescription for a medication due to the dilution, the saline solution, the administration, especially when it's magnesium sulfate, because of pre-eclampsia at GO [Gynecology and Obstetrics]. We're a little inexperienced when it comes to dilution". Interviewee N

"Lack of instructions for using some medications. We don't have a lot of knowledge on this and I don't know if it's something that was standardized here, for example, sometimes you prescribe a certain antibiotic without knowing if you should put it in the prescription [...] I don't know if it is something we should put in the prescription ". Interviewee U

Due to lack of knowledge, one interviewee prescribed a contraindicated drug during pregnancy.

"Once I was prescribing for a pregnant lady, and I prescribed Fluconazole, which has proven risk to pregnancy ". Interviewee R

RBM:

Out of habit of prescribing scopolamine associated with dipyrone to all pregnant women, one of the interviewees, unconsciously and automatically prescribed it to a pregnant patient who was allergic to dipyrone.

"I was in a rush... Seeing many patients... You go to the pregnant patient..., recommend scopolamine associated with dipyrone to everyone, without knowing why and then... it was almost administrated." L

"Sometimes there are two medications, IV and IM, and we end up quickly prescribing an IV medication as IM, out of habit... you rarely get an IV medication, but this is a hospital, so there are intravenous medications here where there isn't elsewhere." Interviewee S

Table 1: Prescribing errors reported by junior doctors

Prescribing errors	N	Illustrations of the types of errors reported
Medication Omission	25	Omission of prescription of medication the patient was using at home due to lack of attention and work overload.
Unnecessary medication	16	Unnecessary prescription of enoxaparin for thrombosis prophylaxis due to failure to check the changes in the prescription from the previous day.
Wrong dose	11	Prescribing the wrong dose of antimicrobials due to lack of knowledge on the electronic prescription system.
Wrong route of administration	9	Prescribing the wrong route of administration due to lack of knowledge on the different presentations of heparin.
Therapeutic duplicity	8	Duplicate prescribing of drug due to failure to check changes in the electronic prescription system and patient's record.
Lack of instructions for use ^a	8	Omission of instructions about medication dilution due to confidence in the knowledge of the Nursing team.
Wrong medication ^b	7	Selection of the wrong medication in the electronic system due to similarities in the drugs' names.
Wrong patient	5	Drug prescription to the wrong patient due to the junior doctor being interrupted during the prescription activity.
Wrong dilution ^a	4	Prescribing the wrong dilution of magnesium sulfate to a patient with pre-eclampsia due to lack of knowledge on the institution's protocols.
Previous history of allergy	3	Prescribing Dipyrone to allergic patients out of habit of prescribing it to most patients.
Wrong time and frequency of administration	3	Prescribing wrong frequency of administration due to inability of junior doctor to copy the prescription from the previous day in time.
Contraindicated medication	2	Prescribing Fluconazole, an antimicrobial with proven risks to pregnancy, due to lack of knowledge about the teratogenic adverse effects of the medication.
Drug interaction ^c	2	Concomitant prescription of Fluconazole and Ondansetron, which cause adverse events, due to lack of knowledge.
Absence of doctor's signature ^b	1	Junior doctor forgot to sign the prescription due to work overload.
Wrong treatment duration	1	The antimicrobial treatment had already been concluded and the suspension was already decided upon by the medical team, but due to lack of attention and failure to check the medical record, the antimicrobial continued to be prescribed.
Total	105	

^a Other types of errors according to Otero-López *et al.* (2008) [30]

^b Wrong medication refers to inappropriate medication to treat the diagnosis and/or inappropriate medication for the age, clinical situation, etc., of the patient.

^c Drug interaction refers to drug-drug and drug-food interaction.

Source: elaborated by the researcher based on the taxonomy by Otero-López *et al.* (2008) [30].

Box 3 Examples of accounts of errors resulting from voluntary acts

Violations

"... when the emergency room is full and we have to write, I don't know, thirty prescriptions until eleven in the morning... we end up having to copy the prescription and hand it without seeing the patient. The nursing staff keeps saying 'you have to release the prescription, the patient has no prescription...' and sometimes, there is no time because, if something serious comes in the emergency room, we leave to deal with the more stable patient in the infirmary when it is possible..." (Interviewee L)

"The patient used AAS® and Clopidogrel® and did not receive them for 48 hours, because [the prescription] was copied and pasted, from Friday to Saturday and then again from Saturday to Sunday, and so there were no such medications in the system, and nobody noticed it. On Monday I copied and pasted it again, without these drugs, and when reviewing it, I saw the drugs were absent the previous weekend". (Interviewee P)

"Antibiotic that is suspended in a clinical round, but next day the person doesn't see it was suspended by hand the day before, and ends up just copying the prescription and prescribing it that day". Interviewee G

"... an erythropoietin that had been prescribed, and then the Nursing team was 'oh god, how is it administered?'. I had already left, they asked the on-duty doctor, the on-duty doctor had no idea how it was used, 'let's read the drug leaflet.' Then it wasn't administered. The next day they asked me: 'how do you use it?', so they did not do it. One day missed because of that. (Interviewee P)

Table 2: Classification of error-producing conditions reported by junior doctors

Error-producing conditions	N
Environment	
Work overload	21
Time pressure	16
Physical Environment	4
Interruptions	2
Medical Complication	1
Team	
Absent or inadequate tutoring	9
Communication failure	4
Trust in the Nursing team	3
Individual	
Lack of knowledge	13
Tiredness, sleepiness, hunger	5
Inexperience	2
Task	
Electronic prescription system	29
Handwritten prescription	13
Failure to check prescriptions	9
Inadequate Protocol	3
Unavailable or inappropriate medical records	3
Patient	
Complex patient or patient unfamiliar to doctor	5
Polypharmacy	2

n = number of times the condition was mentioned by interviewees.
Source: The researcher

Box 4 Reports exemplifying error-producing conditions

"Now, what most leads you to make mistakes is, by far, the amount of work and the amount of patients". (Interviewee F)

"Being in a hurry, many patients to see, critical patients, very long prescriptions with many items, running against time to prescribe until 11 am". (Interviewee C).

"[When you are] on duty, especially in the Emergency Room, where there are lots of patients to see and patients arriving, you end up not being able to check the [patient's] history since they were admitted, and not seeing that an important medication is missing, like a prophylaxis or medication that they already used at home". (Interviewee U)

"The most common mistake I made during my training was getting the drug dilution wrong, especially when the patient is sedated or uses vasoactive drugs. Sometimes we get the dilution wrong!" How many ampoules should you dilute it in, how much the drip should run and for how long." This has already happened a couple of times". Interviewee R

"Protocols are being established now, but if a boss is from one segment and the other from another, or if the shift changes, all practices change. I'm having a lot of difficulty with this at GO [Gynecology and Obstetrics]". (Interviewee N)

Box 5 Reports exemplifying latent conditions

"I understand that there is a reason for the copy of the prescriptions to expire, but depending on the sector where we are, due to the amount of things we have to do, we are not always able to discuss the patient before prescription time and we copy it. We copy it quickly, to have time to take it for discussion, to save it, and then, after copying it every day before discussion, a lot of little things are left out." (Interviewee K)

"We're used to it because the nursing team is very well trained, they know how to dilute and all. So sometimes this error happens because of that." (Interviewee H)

"... the surgical environment is stressful, the intraoperative, the preoperative. Residency in general surgery is one of the [specialties] that demand the most from junior doctors. With a [high] workload, sometimes out of choice, [because] we know that two years is a short time, - orthopedics and other surgical specialties depend on you doing it, books don't teach you how to operate, you learn by doing -, sometimes even if you are the most dedicated [junior doctor], you miss something" (Interviewee S)

"The more academic part itself. We, as a junior doctors, having more tutors, having to be less in charge of the work and have more discussions, I think that would be the way". (Interviewee F)

"Do you think we have an office to see the patient in the Emergency Room? There is no office! The patient is seen in his seat, if you are lucky to have a stretcher, they are seen on the stretcher, if not, the exam is in the seat, there is no way to touch the abdomen, you ask embarrassing questions in front of everyone in the room... This is very serious, we have no structure to prescribe, nor to diagnose, nor anything. We know that SUS is chaotic, that SUS has difficulties, there is no money, but [I'll tell you] one thing... this had to be shut down, because this is a crime, the patient being treated like that." (Interviewee P)*

"... now when you need to look for, run after a boss to communicate a case, you have to go to the operating room... [...] and even if you say that the case is serious, this and that, depending on the boss, they won't go..." (Interviewee N)

"... recent graduates don't know how to prescribe at all, they are students, at the very beginning. It's difficult ... [...] it is not safe due to lack of tutorship, our tutorship here is very bad". (Interviewee P)

"Dilutions, for example, is something we really don't learn in a systematic way. This is something that is really missing ... I know what I have [to prescribe], but how to prepare it I don't" (Interviewee H)

"I think that pharmacology, for example, is a discipline that we study a lot in the beginning [of the course] when it is a long way away from the reality of prescribing something. Then, today we need to prescribe, and no longer remember those concepts, what was taught at the time and somethings are even outdated, you know." (Interviewee V)

The discipline Pharmacology was really outdated. The basis I had as an undergraduate student was very bad for my professional life. So, it's not just my problem. Several people have the same problem." (Interviewee Z)

"... you get to work and, sometimes the boss turns around and says "copy the prescription, I'm going to stamp it", and that's not writing a prescription. I think we should have a course just to learn how to prescribe, because at least here at the internship, it's like this: the intern doesn't write it, someone dictates it to the intern without us knowing what it's for, how it works, how to prescribe it. Is this the dose used, is it just for this patient? So, if you want to learn, it's a matter of chasing them and keeping asking." (Interviewee J)

"You'll get there and see the two bosses sitting. They don't get up to look at the patient's face, and are extremely grudging when you ask for help to prescribe something." (Interviewee P)

** SUS Acronym for Sistema Único de Saúde (Unified Health System), the national health system in force in Brazil.*