

Dispensing errors in a Rio de Janeiro tertiary hospital: incidence, types, and causes

Erros de dispensação em hospital terciário do Rio de Janeiro: incidência, tipos e causas

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ABSTRACT

Objective: In this study, the drug dispensing system of a tertiary care center was analysed, with the purpose of identifying the occurrence of dispensing errors, their types, causes, and the role of double checking in prevention. The main factors that contribute for the errors and the recommendations to avoid them have been evaluated from the perspective

of the professionals involved in the dispensation process. Methods: 1,077 prescriptions were assessed in a 6-month period. The errors were recorded and corrected before the medication left the pharmacy. Each pharmaceutical unit dispensed was considered as a possibility of error. The results were analyzed through descriptive statistics (average, median, standard deviation, coefficient of variation, and frequencies). In the second step of the research, the opinion of the professionals directly involved with dispensing about causes and consequences of the errors was assessed through a questionnaire with open and closed questions to explore the factors and causes of errors. Results: A 4.5% rate of dispensing errors inside the pharmacy was observed, during the double-check process. The rate observed when the medicines arrived at the admission units was of 0.37%. The most frequent class of errors in dispensing was drug omission (62.9%), followed by dose added errors (11.7%); incorrect time (10.2%); incorrect drug (9.2%), and changed dosage form (6.4%). We found a direct relationship between the number of dispensed items during a shift and the number of dispensing errors ($p=0,844$). The schedule for team shifts influenced the error rate ($p=0,016$). Conclusion: Knowing the dispensing error profile is crucial for promoting behaviour changes and to define adequate error barriers.

Keywords: medication errors, dispensing errors, hospital pharmacy service; Brazil

RESUMO

Objetivo: Neste estudo, foi analisado o sistema de dispensação de medicamentos de um centro terciário de atenção, com o objetivo de identificar a ocorrência de erros de dispensação, seus tipos, causas e o papel da dupla checagem na prevenção. Os principais fatores que contribuem para os erros e as recomendações para evitá-los foram avaliados sob a ótica dos profissionais envolvidos no processo de dispensação. Métodos: 1.077 prescrições foram avaliadas em um período de 6 meses. Os erros foram registrados e corrigidos antes que o medicamento saísse da farmácia. Cada unidade farmacêutica dispensada foi considerada como possibilidade de erro. Os resultados foram analisados por meio de estatística descritiva (média, mediana, desvio padrão, coeficiente de variação e frequências). Na segunda etapa da pesquisa, a opinião dos profissionais diretamente envolvidos na dispensa sobre as causas e consequências dos erros foi avaliada por meio de um questionário com questões abertas e fechadas para explorar os fatores e as causas dos erros. Resultados: Observou-se uma taxa de 4,5% de erros de dispensação dentro da farmácia, durante o processo de dupla verificação. A taxa observada na chegada dos medicamentos às unidades de internação foi de 0,37%. A classe de erros mais frequente na dispensação foi omissão de medicamentos (62,9%), seguida de erros de adição de dose (11,7%); tempo incorreto (10,2%); medicamento incorreto (9,2%) e alteração da forma farmacêutica (6,4%). Encontramos uma relação direta entre o número de itens dispensados durante um turno e o número de erros de dispensação ($p = 0,844$). O cronograma de turnos de equipe influenciou na taxa de erro ($p = 0,016$). Conclusão: Conhecer o perfil do erro de dispensação é fundamental para promover mudanças de comportamento e definir barreiras de erro adequadas.

Palavras-chave: erros de medicação, erros de dispensação, serviço de farmácia hospitalar; Brasil

1 INTRODUCTION

The risks associated with the drug use in health care, chiefly those caused by errors or failures in the medication use system, have been subject for research all over the world.

Health services have increasingly prioritised the investigation and analysis of their occurrence, aiming to improve patient safety^{1,2}. However, the studies focus mainly on prescription and administering errors^{3,4}.

Medication errors take place in the prescription (39%), transcription (12%), dispensing (11%), and preparation/ administering (38%) processes⁵. Dispensing errors are defined as '*deviation from the prescriber's order, made by staff in the pharmacy when distributing medications to nursing units or to patients in an ambulatory pharmacy setting.*'⁶.

Failures in dispensation mean a rupture of one of the last links in medication use safety. Even considering that a large part of them do not cause severe damage to patients, dispensing errors represent a fragility on drug use systems and point at, in an indirect relation, a greater risk for the occurrence of Adverse Events (AE)⁷⁻⁸.

Pharmacists are responsible for the precise distribution of drugs and have to develop and follow standard operating procedures that prevent errors and that ensure that the drugs are safely distributed to the patients. Some steps have been recommended by authors and institutions that work with patient safety to prevent dispensing errors⁹⁻¹⁰, including checking all dispensing prescriptions; reduce distractions and design safe environments for dispensation; , pay attention to the identification and differentiation of the drugs during storage;

- ,keep the prescription and the drugs dispensed together throughout the entire process and assure a final check
- . The use of automation resources such as bar codes can be effective in this stage. In dispensaries without automated resources the check should be done manually¹⁰⁻¹¹.

The double checking done by pharmacists and dispensary assistants and then by the nursing staff during the receipt and prior to administering allows the identification of errors¹¹⁻¹². A study showed that a person may find around 95% of the errors made by someone else during the checking process. If the error rate in dispensing is 5% and a double check is done prior to the delivery of the medicaments, the actual likelihood of an error to get to a patient will be 5% of 5%, i.e., 0.25%¹³.

Revision studies point to sizeable variations in the rate of on dispensing errors occurrence (between 0 and 45%), the largest rates being observed in direct observation, an in by comparing the dispensed items and the prescription¹⁴⁻¹⁵. According to the authors, such large variation is related to different medication dispensing systems used in

hospitals and from the different methodologies, terminologies and ratings adopted in the surveys¹⁵⁻¹⁶. The types of errors in dispensation include especially the drugs omission, supplying the wrong drug, wrong dosages, and wrong pharmaceuticals type. Excessive work, interruptions and inadequate lighting of the environment were considered factors that contribute to errors.^{3,8,16}

Dispensing errors analysis has been on the rise in recent years in Brazil, showing a range of 1.7% to 34% errors. The distribution systems studied were individualised or mixed distribution systems.^{17,18,19,20,21,22}

The goal of this study was to determine the frequency and type of the errors in dispensing process identified by the double pharmaceutical checking both inside and outside the dispensary. Beside that, causes and consequences of dispensing errors on the perspective of the professionals involved in the process were evaluated, to support recommendations to improve the process.

2 METHODS

The study was carried out in a large tertiary hospital in the city of Rio de Janeiro. The service dispenses some 400 prescriptions/day, through individualised dose system. The total number of pharmaceutical units dispensed ranged from 7,000 to 8,000 units per day.

The hospital uses an *on-line* system for the prescriptions that mandatorily includes all the data required by the Brazilian legislation for a drug prescription. The use of generic name is mandatory. Each prescription is assigned a sequential number and a bar code that is used to record the issuance of the prescription and the automatic removal of stock of medicaments. All the prescriptions go through a triage process, done by pharmacists, prior to being dispensed.

The first part of this study focused on the measure of frequency and classification of the dispensation errors. For that, 1,077 prescriptions were assessed during a 6-month period. The errors were recorded and corrected before the medication left the pharmacy. Each pharmaceutical unit dispensed was considered as a possibility of error. Descriptive statistic (average, median, standard deviation, coefficient of variation, and frequencies distribution) was applied in the results analysis. . The dispensing errors were rated according to the criteria used bellow, adapted from Beso and collaborators (2005)³(Table I).

TABLE I - Types of dispensation errors

Types of content errors	
Omission of item	Failure to dispense a prescribed item
Dose added	Dispense a larger quantity of medication to that prescribed
Incorrect dosage form	Dispensing a medication prescribed with a pharmaceutical type other than the one prescribed
Incorrect drug	Dispensing a drug that is different to that prescribed.
Incorret time	Medication dispensed at the wrong time

Source: Adapted from Beso *et al.* (2005)

Risk factors were investigated through a comparison of the error rates found amongst fixed, rotation and student shift members; error rate and time worked at the Pharmacy Department, rate of errors and work shift, rate of errors and number of items in the prescription. For that, a Kruskal-Wallis and Mann-Whitney tests were applied.

To monitor the dispensing process the indicator elements shown in Table II were used.

In the second stage of the research, the opinion of the professionals directly involved with dispensing was assessed through a questionnaire with open and closed questions. The questions in the questionnaires took into account the recommendations of the NCC MERP to improve the accuracy in drug dispensation, as well as the causes and factors that are associated with dispensing errors, adapted from the work of Otero-López and collaborators (2002), and Rissato (2012)^{22,23,24}. The questionnaire was applied in a manner to assure confidentiality. The questionnaires were analysed through a content analysis. The study was approved by the hospital's ethics committee (opinion number 455811).

Table II- Indicator elements used in the study

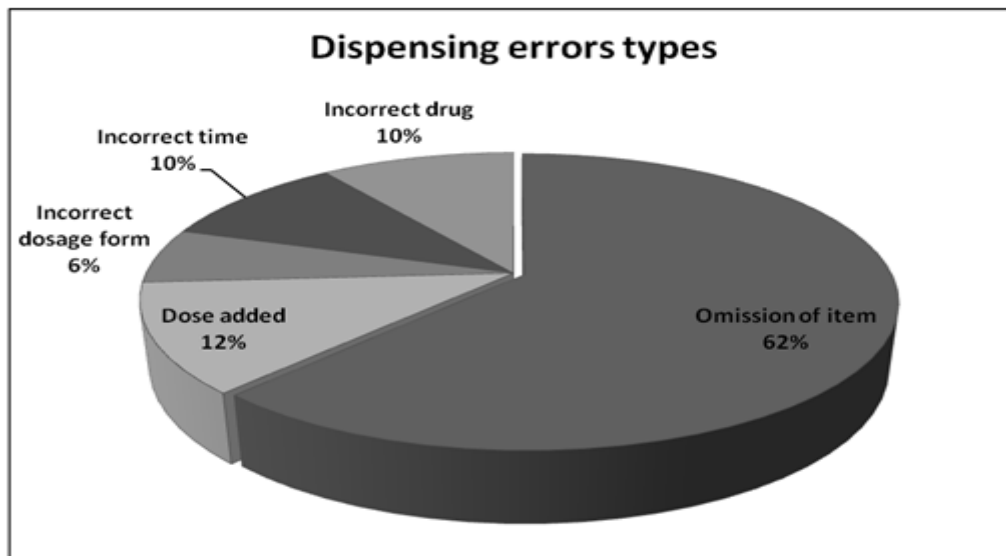
<i>Indicator</i>	<i>Calculation</i>
Percentage of processes with inadequate identification	Number of prescriptions and/or identification labels that were wrongly placed / total number of processes assessed x 100
Error rate in triage as done by pharmacists	Error rate in triage / total number of medicaments filtered x 100
Error rate in dispensation as avoided by double checking	Error rate in dispensation as detected by pharmaceutical double checking units/ total number of pharmaceutical units dispensed x 100
Error rate in dispensation as detected by the nursing team	Error rate in dispensation as detected by nursing team checking (pharmaceutical units) / total number of pharmaceutical units dispensed x 100
Error rate in dispensation done, per type	Number of dispensation errors done by type / total errors made x 100
Percentage of triage errors that led to dispensing errors	Number of errors made due to triage errors / Total number of triage errors x 100
Percentage of out-of-stock medications	Number of pharmaceutical units not dispensed due to out-of-stock cause / total number of pharmaceutical units dispensed x 100

Source: own production

3 RESULTS

A 4.5% dispensation errors rate was observed inside the pharmacy, along with a 0.37% rate for errors after leaving the pharmacy. The double-checking prior to the medication delivery to hospital admission units seemed to be an efficient method to prevent dispensation errors, as it reduced the number of errors after leaving the dispensary in more than ten fold. The types of dispensation errors found are shown in Figure 1.

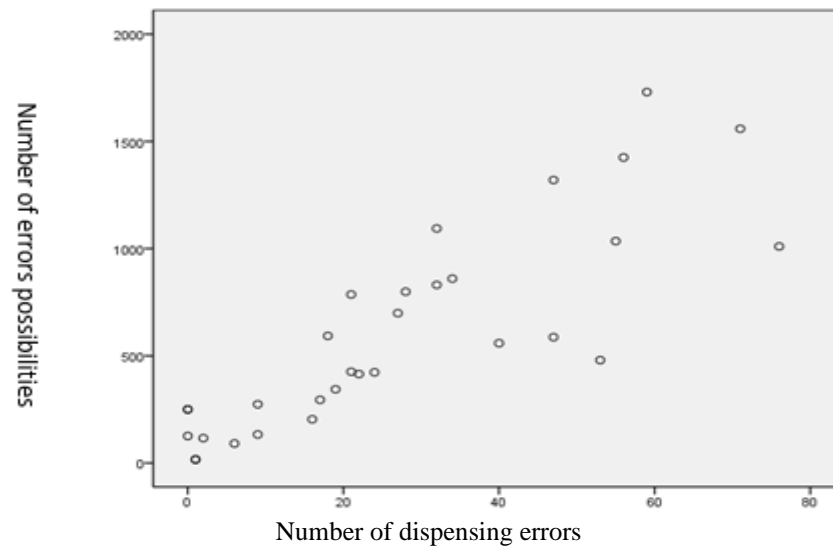
FIGURE 1 - Types of dispensing errors found in pharmaceutical double checking, N= 848, Rio de Janeiro, 2013.



Errors in pharmaceutical triage were observed in 1.3% of the total items analysed, and only 16.0% of them were observed and corrected by the dispensing agent. That is, 84.0% of the triage process made by the pharmacist led to prevent dispensing errors at pharmacy.

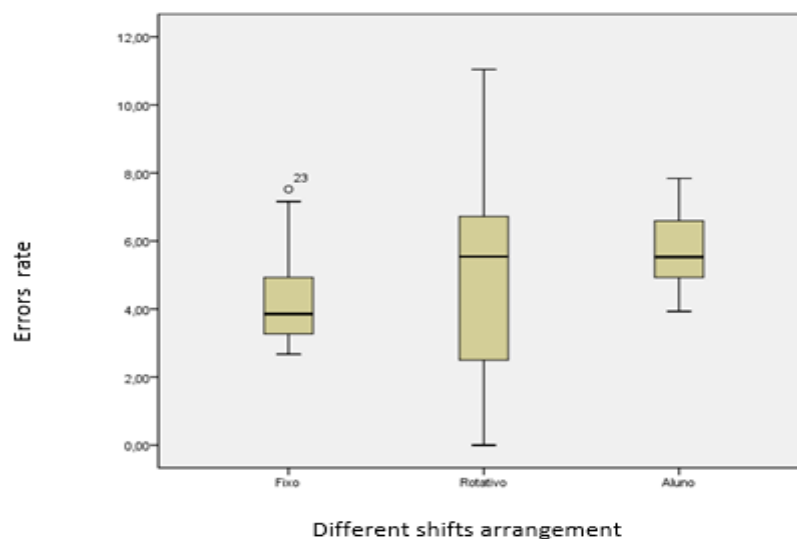
It was possible to establish a positive correlation between the number of units dispensed for a given prescription and the number of dispensing errors ($\rho= 0.844$) as shown in Figure 2. This correlation was also described in other studies⁹.

FIGURE 2 - Dispersion graph for number of error possibilities in a prescription and number of dispensing errors.



It was possible to observe that the dispensing agents that are fixed in this activity have a lower rate of errors, followed by the rotation workers and the students (Figure 3). The influence of one's time at work was not as significant ($p\text{-value} = 0.686$) in terms of accuracy in dispensing as the shift schedule of the dispensing agents. The error rates in dispensing in the morning and afternoon periods were quite similar and no significant statistical difference was found between the dispensing shifts ($p\text{-value} = 0.653421$).

FIGURE 3 - Error rate box-plot for dispensing agent in a shift arrangement



Fifty-three professionals were interviewed: 23 checking staff (21 pharmacists, 1 pharmacy degree student working as an intern, and 1 nursing technician), and 30 dispensing agents (17 nursing technicians, 8 nursing assistants, 2 hospital management technicians, and 3 clinical pathology technicians).

Most of the respondents agreed that the environment (100%); individual human failure (through tiredness) (86.7%); lack of communication (77.8%); problems related to medication packaging/repackaging (73.3%); lack of supervision / poor supervision (57.8%), and a lack of information about the medications (53.3%) contribute for the occurrence of dispensing errors.

Table III shows a summary of respondents' opinion on the factors that contribute for the occurrence of errors.

TABLE III - Opinions of professionals interviewed on the factors that contribute to error, Rio de Janeiro, 2013.

Accounts of respondents on the contributing factors for the occurrence of errors.	
<i>Communication failures</i>	<ol style="list-style-type: none"> 1) 'changes in routine that are not advised' C8, "changes of routine with no training provided" C9 2) 'medical team no familiarised with the dosage' C14 3) 'lack of communication amongst teams' C23 4) 'triage errors' C18
<i>Problems related to drugs packaging / repackaging</i>	<ol style="list-style-type: none"> 5) 'label comes off the blister package' C6 6) 'returned medications are stored wrongly due to packaging similarities' C13 7) 'labels stuck together' C28 8) 'medication with no identification or damaged' D7 9) 'similarity, especially of vials' C18 10) 'lack of inputs to individualise oral liquids' C23 11) 'packaging violated, torn, or defective (package empty)' C8
<i>Working environment / place and working conditions</i>	<ol style="list-style-type: none"> 12) 'Unwillingness to fetch medication from stock and in distant bins' C13 13) 'Too many prescriptions, depending on the size of the team on a given day' C8 14) 'Carry out other duties such as counter or telephone work' D10, 'extra chores' D13 15) 'fixed duties, leading to inexperienced people in some positions' D18 16) 'under-staffing' C28
<i>Information on the medicaments</i>	<ul style="list-style-type: none"> • 'Lack of advice to doctors on the correct way to prescribe non-standardised items and use of the obs mode' D28 • 'lack of knowledge of prescribing professionals on the computerised system' C7
<i>Lack of supervision / poor supervision</i>	<ul style="list-style-type: none"> • 'lack of service standardisation' C8, 'lack of routine standardisation' D16 • 'supervision is eventually done at the checking stage and it is not feasible for a professional to oversee the dispensing agent all the time' C18 • 'lack of supervision some times' D28
<i>Individual human failures</i>	<ul style="list-style-type: none"> • 'the flaw can be rectified in the checking stage' C13 • 'many flaws do not harm the dispensing agent at all. One's work remains the same' • "absence of a study on the number of prescriptions that can be dispensed by a professional without going over the human limit" D10 • 'lack of attention' D7 • 'all are prone to error, on an every day basis' D17 • 'many demands, little motivation' D28

C - Checking Agent; D - Dispensing Agent

The content analysis for the opinions of the respondents on 'how to avoid dispensing errors' allowed the division of the opinions into 5 themes: People Management (42.1%), Process Restructuring (Reorganisation) (23.7%), Individual Attitudes (19.3%),

Ergonomics (7.9%), and Others (7.0%). The distribution of these opinions is show in Table IV.

TABLE IV - Opinion of professionals interviewed on the best way to avoid dispensing errors, N = 114, Rio de Janeiro, 2013.

People Management (n = 48) 42.1%	
•	Solving labour issues / work overload: 15
•	Continuous education / team training: 10
•	Stimulating / Encouraging the team: 5
•	Limit noise / chat excesses and distractions amongst dispensing agents: 5
•	Improvements in task assignment: 4
•	Direct supervision: 3
•	Avoiding interruptions: 2
•	Promoting a rotation of duties: 2
•	Allowing rest time: 1
•	Improving well-being: 1
Process Restructuring (and reorganisation) (n = 27) 23.7%	
•	Written routines / protocols: 8
•	Improving communication amongst the teams / keeping data on absences up-to-date, on the exchange of data between pharmacists and dispensing agents: 8
•	Improve the computer system: 7
•	Rectify incorrect procedures: 2
•	Checking after sealing: 1
•	Create different packages for the medications: 1
Individual attitudes (n = 22) 19.3%	
•	Maintain attention throughout the dispensing: 11
•	Boost commitment / interest / dedication: 6
•	Improve awareness / concentration: 5
Ergonomics (n = 9) 7.9%	
•	Improve ergonomics at work: 6
•	Improve the arrangement / layout of medications in dispensation: 3
Others (n = 8) 7.0%	
•	Correct pharmaceutical triage: 3
•	Advise doctors to use the computer system correctly: 2
•	Don't know / there is no better way: 2
•	'There is no high number of errors in dispensing': 1

4 DISCUSSION

The double-checking work done prior to the medication being delivered to hospital admission units seemed to be an efficient method to prevent dispensation errors, as it reduced the number of errors after leaving the dispensary in more than tenfold. Beso and colleagues³ observed a reduction from 2.1% to 0.02% through doucle checking and Cina and colleagues⁷ found a reduction from 3.6% to 0.75%. However, the literature review by Alsulami and colleagues (2012) concluded that the evidence is insufficient to state that double-checking reduces the risk of medication errors.

The comparison between studies of medication errors should be made with caution since they present a great variation in the occurrence rates of errors and significant differences in their definition and classification. In addition, one must consider the differences in the types of drug distribution systems adopted and also the characteristics of each hospital studied. This difficulty was also mentioned by Cheung and co-workers, in 2009, and in the work of James and co-workers in the same year. Both reviewed dispensing errors, finding error rates ranging from 0 to 45%, and 0.008 and 18%, respectively. Studies using the observational method were more sensitive than those using the anonymous notification method, incident reporting, critical incident technique, and medical record review^{9,13,14,25}.

Omission was also the type of error more frequently found by Rissato²² (23%), Anacleto¹⁸ (44.5%), Oliveira¹⁷ (52%), and Albuquerque²⁰ (35.93%).

The high amount of 'omission' errors could be linked to lack of drug supply issues and/or to communication problems in both the dispensation process as in the arrival or end of product stock. However, only some 6% of the drugs were not dispensed due to supply issues in the hospital.

This study identified a positive correlation between the number of units dispensed for a given prescription and the number of dispensing errors. Rissato²² also identified a direct relation between errors and the numbers of drugs per prescription. A 3.2 times higher risk was found in prescriptions that had more than 10 medications²². Anacleto and colleagues observed, in 2007, an error rate of 92.3% in prescriptions that had 9 or more medications, a risk 4 times higher than that observed in prescriptions with less than 9 medications¹⁸.

The fixation of the professionals on the dispensing function favored the reduction of dispensing errors (p-value = 0.016). There was no significant statistical difference between dispensing shifts (morning and afternoon).

A lack of a standard training routine, as much as on written routines and of permanent instruction was observed. In assessing the perception of errors by the professionals interviewed, there was a trend amongst checking professionals to believe that there are more errors than the reality shows. As for the dispensing professionals, they believe they make less mistakes than they actually do.

In general, the opinions of professionals interviewed about the factors that contribute to dispensing errors tend to reflect the individual difficulties on each study scenario, being compatible with those discussed in the literature^{10,25}.

The influence of the "local environment and working conditions" on the errors seems to be clear to the interviewees, since all (100%) respondents agreed that this factor influences dispensing errors. Within this theme, "interruptions and distractions" (extra care, conversation, telephone, radio) were considered as more important, closely followed by "work overload." The degree of importance was also reflected in the reports of interviewees, who provided more suggestions for improvement the environment and working conditions when compared to other topics.

Although an electronic prescription system is used, there are still flaws that lead professionals to confuse themselves when interpreting prescription. Among the "problems related to the packaging and repackaging of medicines", both groups attributed greater importance to the similarity between labels and packaging, a topic widely discussed in the literature¹⁰.

In "individual human failures" both groups agree that "fatigue" is the factor that most influences the occurrence of dispensing errors. This factor also appears in the work of Beso and colleagues³ that observed that the main causes of errors cited were: being occupied (21%), lack of personnel (12%), short time (11%) (fatigue), interruptions (9.4%) and medicines with similar names (8.5%).³

According to the interviewees' opinion, assuring sufficient human resources and continuing education, besides restructuring processes (having written routines, improving team communication and improving the computerized system) are the main measures needed to reduce dispensing errors.

5 CONCLUSION

Dispensing plays an important role in the intricate process of drug using in a hospital. It permeates and connects many of the actions carried out in different sectors. Physical, human and technological resource structure, pursuant to 'reference standards' are essential to prevent and reduce medication errors.

The professionals involved in each of the processes should grasp the notion that, as they are a part of a system, their actions can affect the behaviour of the whole. For that reason, any action of a party can affect the actions of the others and consequently the care provided to patients.

The methodology used allowed acquiring knowledge on the main errors committed, to help determine the main factors that produce the failures. Such a knowledge is fundamental for promoting a change of attitude, as well as define preventive measures.

However, the involvement of one single hospital unit is the main limitation of the work, which suggests caution to extrapolate its results to other scenarios.

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