



Review

Diagnostic errors in emergency departments[☆]Pere Tudela^{a,*}, Anna Carreres^a, Mònica Ballester^b^a Unidad de Corta Estancia, Servicio de Urgencias, Hospital Universitario Germans Trias i Pujol, Badalona, Barcelona, Spain^b Dirección de Calidad, Hospital Universitario Germans Trias i Pujol, Badalona, Barcelona, Spain

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ABSTRACT

Diagnostic errors have to be recognized as a possible adverse event inherent to clinical activity and incorporate them as another quality indicator. Different sources of information report their frequency, although they may still be underestimated. Contrary to what one could expect, in most cases, it does not occur in infrequent diseases. Causes can be complex and multifactorial, with individual cognitive aspects, as well as the health system. These errors can have an important clinical and socioeconomic impact. It is necessary to learn from diagnostic errors in order to develop an accurate and reliable system with a high standard of quality.

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El error diagnóstico en urgencias

RESUMEN

Debemos reconocer el error diagnóstico como un episodio adverso posible e inherente al acto clínico, e incorporarlo con normalidad al resto de los indicadores de calidad asistencial. Por diferentes fuentes de información podemos conocer su frecuencia, aunque probablemente todavía está subestimada. En contra de lo que se podría suponer, en la mayoría de los casos no acontece en enfermedades infrecuentes. Sus causas suelen ser complejas y multifactoriales, con aspectos tanto cognitivos individuales como del sistema. Estos errores pueden tener un gran impacto clínico y socioeconómico. Es necesario aprender de los errores diagnósticos para desarrollar un sistema seguro, propio de una cultura de calidad.

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The diagnostic approach of patients is the factor that determines the need for complementary tests and hospital admission, as well as specific treatment and prognosis. It is therefore of great importance in any area of care, but especially in the hospital emergency services (HES), that the approach to diagnosis is performed correctly and as precisely as possible. The possibility of diagnostic errors (DEs), initially considered as rare occurrences, has been progressively recognized and documented in the last 2 decades. And while it is generally accepted that the overall incidence of DEs can affect 5–15% of patients, to date they have been poorly considered in healthcare quality programs, usually focused on patient care and therapeutic processes.^{1–4}

Frequency of diagnostic errors

From the initial study by Leape et al.,⁵ which estimated the frequency of DEs in 14% of the adverse events (AE) in hospitalized patients, the results from different studies conducted since have been varied, mostly between 6 and 17%.^{2,6} In our healthcare environment, a recent study reports 11.8% of the total AE.⁷

However, these data should be interpreted with caution, since we only have partial information. The limited provision in the healthcare environment regarding AE reporting, as well as the fact that some reporting systems do not allow to specify whether a DE was involved, often make records inaccurate and probably underestimated. For these reasons, some indirect approaches have been tried, such as the analysis of DEs detected at autopsies, simulation studies, second reviews (at central services such as Radiology or Pathology), laboratory audits, surveys among physicians and patients, or complaints and claims.⁸ Table 1 table lists some aspects of these different sources of information, which, together with their advantages and limitations, may have some complementary value.

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Table 1
Sources of information to estimate diagnostic error incidence.

Source	Incidence	Comments
Autopsies	10–20%	Probably underestimated
Simulation studies	13–15%	
Second review studies (radiology or pathological anatomy)	2–5%	
Laboratory audits	2–4%	
Surveys	35% doctors 42% patients	DE affected family/friend Perceive a high risk of harm
Claims and complaints	29%	DEs are the costliest
Case review ^a		They are not rare diseases
Voluntary reporting	0.5%	Probably underestimated

DE: diagnostic error.

^a Includes: stroke, asthma, subarachnoid hemorrhage, neoplasms, pulmonary embolism, aortic dissection, diabetes, appendicitis.

Adapted from Graber.⁸

This reality does not look very different for HES. In a current study, DEs account for 19% of the AEs detected,⁹ similar to the 22% in a previous study by Fordyce et al.,¹⁰ but lower than the 53% in a more recent work.¹¹ Among patients who return before 7 days, DEs account for 28% of AEs.¹² Thanks to the EVADUR study, a reference work in terms of AEs in HES, we know that, in our healthcare environment, diagnostic errors or delays represented the third cause of AE, with 18% of cases.¹³ Thus, although we do not have a reference in terms of an acceptable DE index at present, and considering the important methodological differences, all this indicates that the frequency of DEs is, at least, significant.

Concept of diagnostic error

DE could be extremely complex and difficult to define. But, from a practical perspective, it has been defined as the diagnosis which is not made, is made late (when sufficient information was available at the beginning) or it is wrong.¹⁴ Other authors have defined it as failure to establish an accurate and timely explanation of the patient's health problems.^{2,15} It is not easy to determine the concept of DE, and it is often difficult to agree on whether the error existed. There is a deep open debate, since there are different and complex issues that hinder the consensus in the evaluation and interpretation of a DE. On the one hand, the influence of the time factor and the progressive nature of clinical processes, different manifestations at different times of the clinical course. Likewise, it is necessary to consider the need to maintain a balance between underdiagnoses and an excessively intensive search. Furthermore, we need to consider the influence that aspects such as probability and severity related to the different diagnostic options may have on a DE.¹⁶ Fig. 1 may be illustrative of all of this. Perhaps a possible solution to these considerations, and a more modern approach, would be trying to measure the DE through a scale, rather than in a dichotomous way.

The experience

Among the different DE studies, Schiff et al.¹⁷ can be considered as reference, with the analysis of 583 errors. The most frequently missed diagnoses were pulmonary embolism, drug reactions, lung cancer, colon cancer, and acute coronary syndrome. The stage in the diagnostic procedure that was crucial to generate the error was: a) failure to request a diagnostic test (laboratory or radiology) in 44% of the cases; b) clinical assessment (consideration of a diagnosis, prioritization, recognition of complications) in 32%, and c) an error in the medical records (10%) or in the physical examination (10%). It should be accepted that the mechanisms of error often involve

complexity as a certain degree of overlap exists between the two main categories.

A particular view is the one provided by autopsy studies, which show a lack of correlation between the clinical and the autopsy diagnosis of 7–18%.^{18–20} HES accumulate predominantly acute disease, mainly myocardial infarction, pulmonary embolism, aortic dissection, digestive hemorrhage, subarachnoid hemorrhage, pancreatitis and mesenteric ischemia accumulate. Among the elderly, a recent study shows the existence of over- or under-diagnosis in more than 10% of cases, including entities such as chronic obstructive pulmonary disease, heart failure, dementia, stroke, myocardial infarction or Parkinson's.²¹ This leads to the conclusion that older people are likely to be especially vulnerable to DE, perhaps because some symptoms may be underestimated, attributed to aging, or because some of the diagnostic criteria, while useful to younger people, may not be applicable in the elderly.

As for HES, some initial studies focused on the diagnostic difficulties of specific diseases (myocardial infarction, appendicitis, subarachnoid hemorrhage), without being able to obtain more general conclusions. Subsequently, the analysis of patients admitted compared to the diagnoses made in the HES and at discharge, showed a variable DE incidence of between 0.6 and 12%, although with a limited number of cases.^{22,23} In our experience, it was 6% (42 cases) of patients admitted, and among the reasons for consultation, fever was the one with the highest frequency of errors.²⁴ Further studies on series of claims have been an important source of information and have contributed to a new era in the study of DE.^{25,26} Table 2 shows the most remarkable aspects of all these studies.

From these clinical and autopsy works, we can highlight some observations. On the one hand, the evidence that most cases involve relatively common conditions. Some entities, such as infectious diseases, myocardial infarction, pulmonary embolism and aortic dissection, stand out. Fever as a reason for consultation, especially when it starts without any other accompanying symptoms, can be difficult to diagnose and is the form of presentation of numerous and varied infectious diseases.^{27–29} The diagnostic difficulty sometimes associated with acute coronary syndrome is a well-known fact and has been the reason behind different studies.³⁰ Regarding pulmonary embolism, our group had previously analyzed unsuspected cases, which reached 25%, being confused with heart failure and pneumonia.³¹ Subsequently, other authors have estimated that this figure can reach up to 43% of patients.³² The case of aortic rupture is especially discouraging; the meta-analysis of Azhar et al.,³³ which collects data from 9 studies and 1109 patients, shows that the incidence of undiagnosed aortic rupture reaches 42% of the cases, usually confused with renal colic or myocardial infarction. However, there is a significant dispersion in the diagnoses; in the study by Okafor et al.,²⁶ the first 5 diagnoses do not reach 40% of the total. This fact makes it difficult to formulate specific improvement strategies. A particular aspect relates to patients with poorly defined reasons for consultation in HES, which in the elderly can account for up to 20% of cases, and in which the DE index stands at 37%.³⁴ It should also be noted that almost all of these studies focus primarily on DE analysis in hospitalized patients, which implies that we largely ignore the possible errors in those discharged from HES.

Mechanisms and types of error

DEs have not only been difficult to detect, but also to understand. From the point of view of the psychology involved in the diagnostic reasoning mechanism, it has been estimated that an error can occur in 10–15% of cases.⁸ This may be justified, at least in part, if we consider the high number of clinical processes that must be

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