Review

Medical Errors: An Analysis of Their Definition and Impact

Jose Daniel Sanchez * and Alejandra Corvalan

Posted Date: 28 April 2025

doi: 10.20944/preprints202501.1990.v2

Keywords: medical errors; definition; impact; types; contributing factors; diagnostic error; causes; consequences; prevention strategies; ethical considerations; legal liability; communication; training; technology; patient safety; multidisciplinary approach; patient safety culture; ethics committees

 doi:10.20944/preprints202501.1990.v2

Review

Medical Errors: An Analysis of Their Definition and Impact

José Daniel Sánchez Redrobán [1] and Hanny Corvalán Reinthaller [2].

1. Universidad Tecnológica Indomaerica, Facultad de Ciencias de la Salud y Bienestar Humano, 170301, Quito – Ecuador
2. Independent researcher. Durham – North Carolina

* Correspondence: danielsanchez@uti.edu.ec

Abstract: Medical errors are acts or omissions committed by healthcare professionals that can lead to adverse events, which are defined as injuries or conditions caused by medical treatments rather than the disease itself, they have been one of the leading causes of death in the United States and constitute a serious and complex problem affecting the healthcare system, leading to devastating health consequences for patients and economic loss for healthcare facilities. (to err is human), This paper aims to explore medical errors, their types, causes, consequences as well as strategies to prevent them, such as patient – provider communication, continuous training and the implementation of new technology tools and reporting systems, focusing in a multidisciplinary approach to create a safe environment where healthcare providers feel comfortable reporting errors and not threatened; it highlights the need to foster a patient safety based culture, and the importance of the ethics committees when navigating a medical error. This document also delves into diagnostic error, its causes and consequences, as well as strategies to prevent it; ethical considerations, legal liability, and the crucial role that communication, training, and technology play in improving patient safety are discussed, highlighting the need to foster a culture of patient safety and the fundamental role of ethics committees in the management of medical errors.

Introduction

Despite the advances in medicine and the noble purpose of preserving life and helping those in need, it is not infallible, and it is not exempt from healthcare professionals making mistakes even if the intentions are good; human error is always a factor that has to be considered, especially with the challenges of the healthcare environment as sleep deprivation, high patient load, and a fast paced workflow; when all of these happen at the same time, it's only natural for mistakes to happen, but it doesn't mean that strategies to prevent said mistakes can't be implemented to reduce their frequency and severity, as well as the impact they have in the healthcare system, including patients, providers, facilities and national healthcare institutions. (1)

Definition and Scope of the Problem

A medical error can be defined as any act or omission committed by a healthcare professional during patient care that causes or has the potential to cause harm to the patient rather than the disease itself. These errors can occur at any stage of the care process, from admission and diagnosis to treatment and follow-up. According to recent studies, the extent of this problem is extraordinarily concerning, given that medical errors are still a leading cause of death, disability and illness worldwide. The World Health Organization estimates that each year millions of patients suffer the consequences of medical errors that were preventable, resulting in considerable economic cost to healthcare systems and a considerable burden on patients and their families (3) Medical errors can occur at any point in the patient care process, the most common types include:

1. **Diagnostic errors:** They include incorrect, delayed or missed diagnoses, as well as overdiagnosis, which can lead to unnecessary and potentially harmful treatments.

 doi:10.20944/preprints202501.1990.v2

2. **Treatment errors:** They cover errors in prescribing, administering and monitoring medications, as well as errors in surgical procedures and other medical treatments.
3. **Prevention errors:** They refer to the failure to implement preventive measures, such as vaccination or disease screening, which can increase the risk of complications and diseases.
4. **Communication errors:** They include failures in communication between healthcare professionals and patients, as well as communicating with other professionals, which can lead to misunderstandings and incorrect clinical decisions.

It is important to recognize that medical errors are not always the result of negligence or incompetence of healthcare professionals; they are often the result of a complex interaction of many factors, including healthcare system limitations, lack of resources, personnel fatigue, care pressure and biases (4).

Impact of Medical Errors on Public Health and the Economy

Medical errors have a significant impact in public health matters, not only they are one of the leading causes of death in patients of all ages in the United States, but they can also lead to long term disease and disability, this translates in an increase of the length of hospital stays and additional treatments, which further increases the risk for many other conditions, making it a complex situation to solve. From the economic point of view, medical errors can have a profound impact on the perceived efficacy of the healthcare system, reducing patient trust and therefore decreasing the likelihood of seeking medical help when needed; they can also cause an irreparable damage to the reputation of healthcare professionals and facilities, who are left to face the costs associated with the treatments and legal compensations, and furthermore, they have to face the indirect costs such as decreased productivity and personnel burnout. (5) Medical errors are a complex problem which affect all the participants of the healthcare systems around the world. Despite the efforts to minimize their impact and occurrence in the last years, they're still present on the day-to-day practice, much remains to be done in order to ensure all patients receive high quality care.

From an economic point of view, medical errors represent a considerable burden on health systems; direct costs include expenses associated with the treatment of complications and adverse events, as well as compensation for medical negligence. Indirect costs, such as lost productivity and social costs, are also relevant.(6) Medical errors are a complex and multifactorial problem that affects patients, healthcare professionals and healthcare systems around the world. Its impact on public health and the economy is considerable, revealing the urgent need to address this problem effectively.

Historical Perspective of Patient Safety

Although medical errors have existed since the beginning of the medical practice, it was just in the 20th century that they were addressed as a healthcare problem that can be prevented; in 1999, the United Stated Institute of Medicine published a report called "*To Err is Human: Building a Safer Health System*" which opened the discussion about medical errors, highlighted the magnitude of the problem, and made a call for action for the healthcare system to get involved and improve the patient safety conditions. Since that publication, many other authors have addressed the issue, and a lot of initiatives have been tested and implemented to reduce medical errors, including the development of reporting systems as well as continuous training, and the implementation of new technologies to improve safety in healthcare, but even with all the efforts, medical errors still occur. (7) The healthcare system is extraordinarily complex, and despite its advances help to preserve the patients' health, they also add more layers of complexity to the providers, as they have to continuously study to remain updated, and still manage high patient loads, fast paced environments and chronic exhaustion. (1) Health system complexity, human variability, and resource limitations continue to pose significant

 doi:10.20944/preprints202501.1990.v2

challenges to patient safety. It is essential to continue investigating the causes of medical errors and develop effective strategies to prevent them and mitigate their consequences. (8)

Classification of Medical Errors according to their Seriousness and Consequences

A medical error is the act or omission made by a healthcare provider that can lead to negative consequences for the patient, when a medical error is made, it is very important to establish the severity of the consequences that it caused, and what was the gap in the system that allowed for it to happen; an adverse event is defined as an injury caused by the medical treatment rather than the disease, so in definition, adverse events can be viewed as consequences of errors, (9) according to the cause of the adverse event, they are classified into:

- **Preventable adverse events:** due to an error choosing or applying an accepted strategy.
- **Ameliorable adverse events:** An event that was not preventable but could have been less harmful if the strategy was different.
- **Adverse events due to negligence:** occurred due to inadequate or below standard care. (patient safety network)

Medical errors can have a wide range of consequences, from minor and temporary to serious and permanent; according to their severity, medical errors can be classified as follows:

1. **Mild adverse events:** These are errors that cause minimal or temporary harm to the patient, such as a mild allergic reaction to a medication or a small infection at the site of an injection.
2. **Moderate adverse events:** They are errors that cause significant but reversible harm to the patient, such as a bone fracture during a fall in the hospital or an adverse reaction to a medication that requires hospitalization.
3. **Severe adverse events:** These are errors that cause permanent or life-threatening harm to the patient, such as a brain injury during surgery or a severe allergic reaction that causes anaphylactic shock.
4. **Fatal adverse events:** These are errors that result in the death of the patient, such as a fatal medication error or a serious nosocomial infection.
5. **Near miss:** an adverse event that occurred due to an error, but didn't cause any harm.

Contributing Factors to Medical Errors: A Multidimensional Analysis

During the last decades the healthcare system worldwide has tried to reduce medical errors as much as possible, but despite the immense efforts, they remain as part of the day to day healthcare process, and in order to keep getting better in preventing them, it is crucial to understand the reasons that can lead to a medical error and adverse events; after years of research, the causes can now be identified and grouped in 3 different categories, human, system, and patient related. All these categories involve components that interact with each other and between the groups in complex and intricated ways, generating a susceptible environment, allowing for medical errors to occur at any step of the process of caring for a patient. (10) To develop effective prevention and mitigation strategies, it is crucial to understand the factors that lead to medical errors. Research in the fields of medicine and law has identified a wide range of elements that can increase the likelihood of these errors occurring.

 doi:10.20944/preprints202501.1990.v2

Human Factors: Healthcare Professionals

Almost worldwide healthcare is seen as a noble and reputable field to work in, but the increasing costs of tuition, long years of training, lack of acknowledgement, non-competitive salaries and poor work-life balance have decreased the number of interested candidates to get into the healthcare route, even in countries where the lack of personnel is not a problem, institutions tend to offer the lower possible payments and keep the shortest amount of staff, making it hard to acquire and keep healthcare workers; (https://pmc.ncbi.nlm.nih.gov/articles/PMC9086817/pdf/CroatMedJ_63_0107.pdf), the lack of personnel for all of the reasons mentioned only leads to the personnel to be overworked, this issue becomes chronic, and the consequences start to affect the system:

Health professionals, despite their training and experience, are human beings susceptible to errors. Fatigue, stress, lack of effective communication, and cognitive biases are some of the human factors that can compromise patient safety.(9)

- **Fatigue and Stress:** Excessive workload, long shifts, and lack of adequate rest can negatively affect the cognitive and physical performance of healthcare professionals, increasing the risk of errors. Fatigue can decrease attention, concentration, memory, and decision-making ability, while chronic stress can lead to emotional exhaustion and depersonalization, which can affect response time, judgement and the quality of care provided.
- **Lack of Communication:** Effective communication between members of the healthcare team is essential to ensure patient safety. Lack of clarity in the transmission of information at the shift change, poorly written indications, ambiguous verbal orders, lack of coordination between different professionals involved in patient care, and linguistic or cultural barriers can lead to misunderstandings and errors.
- **Cognitive Biases:** Cognitive biases are systematic thinking patterns that can lead to erroneous judgments and precipitated decisions. In the medical context, these biases can influence the way professionals collect, interpret and process clinical information, which can lead to diagnostic and treatment errors. Some common cognitive biases in medical practice include confirmation bias (the tendency to seek information that confirms pre-existing beliefs), anchoring bias (the tendency to rely too much on the first information received), and availability bias (the tendency to overestimate the probability of events that are easily remembered).

System Related Factors: The Context of Health Care

The healthcare system is referred to as all the organization, rules, resources (software and hardware) present in a facility that is involved in the healthcare process, all these components can facilitate the medical error occurrence. (11)

- **Organization of the Health System:** The way the healthcare system is organized and managed can influence patient safety. Lack of clear protocols, fragmentation of care, lack of continuity of care, and lack of adequate supervision can increase the risk of errors. Additionally, pressure to reduce costs and increase efficiency can lead to work overload and staff reduction, which can compromise the quality of care.

 doi:10.20944/preprints202501.1990.v2

- **Lack of Resources:** Lack of human, material and financial resources can limit the ability of healthcare professionals to provide safe, quality care. Staff shortages can lead to work overload and burnout, while a lack of adequate medical equipment and supplies can lead to errors during diagnosis and treatment.
- **Inadequate Technology:** Medical technology, while it can improve efficiency and accuracy of care, can also be a source of errors if not used appropriately, specifically the lack of training in the use of new technologies, poor interoperability between different information systems and technical failures can contribute to medical errors.

Patient-Related Factors: The Importance of Active Participation

Despite the common believe that patients leave their health in the hands of healthcare professionals, they actually play an active role in their care process, in fact, if the patients do not engage, every attempt to help them will be futile; from the description of their symptoms, to the adherence to the treatment, patients have to be involved and work towards their goals side by side with the providers in order to prevent medical errors. (12)

- **Lack of Adherence to Treatment:** Treatment adherence refers to the degree to which patients follow medical recommendations. Non-adherence can be due to a variety of factors, such as lack of understanding of instructions, medication side effects, financial barriers, or lack of social support. It is the provider's responsibility to ensure that patients completely understand instructions and try to work around the patient needs and barriers; non-adherence can lead to complications and the need for additional treatments, increasing the risk of errors.
- **Poor Communication:** Effective communication between patients and healthcare professionals is essential to ensure safe and quality care. Patients should feel comfortable asking questions, expressing concerns, and sharing relevant information about their medical history and symptoms. Lack of communication can lead to misunderstandings, misdiagnoses, and inappropriate treatments.
- **Lack of Understanding:** Patients may have difficulty understanding complex medical information, which may impact on their ability to make informed decisions about their health and follow treatment recommendations. Lack of understanding can be due to a variety of factors, such as the use of medical jargon, lack of appropriate educational materials, or language or cultural barriers; providers must ensure proper communication, trying to explain medical situations the easiest way possible, being open to questions and negotiating with the patients to elaborate feasible care plans.

Diagnostic Error: Definition and Types

Diagnostic error (DE) is a complex and multifaced problem that affects medical practice at all levels of care, although medicine has advanced significantly in recent decades, the possibility of delayed, wrong or misdiagnosis remains a worrying reality. The Institute of Medicine (IOM), now known as the National Academy of Medicine (NAM), defines ED as *"the failure to establish an accurate and timely explanation of the patient's health problem or problems, or to communicate that explanation to the*

 doi:10.20944/preprints202501.1990.v2

patient". (https://pubmed.ncbi.nlm.nih.gov/25077248/). This patient-centered definition emphasizes the importance of not only establishing a correct diagnosis but also doing it in a timely manner, especially those diagnoses that can be life threatening. The Society for Improving Diagnosis in Medicine (SIDM) proposes a classification of EDs into three main categories:

1. **Missed or missing diagnosis:** When no explanation is found for the patient's symptoms, despite the diagnostic tests performed.
2. **Incorrect diagnosis:** When the initial diagnosis turns out to be incorrect and the true cause of the symptoms is discovered later.
3. **Delayed diagnosis:** When the correct diagnosis is established, but with a significant delay that may have negatively affected the patient's prognosis or treatment.

It is important to note that these categories are not mutually exclusive and that, in many cases, a diagnostic error may involve a combination of them.(11)

Factors Influencing Diagnostic Errors in Medicine

Medical diagnosis is the first goal in the care plan, to actually treat a patient, the first step is learning what is the condition affecting them, it is a complex process to come to a diagnosis, involving both patient and provider working together with the information they have available, experience, knowledge and diagnostic tools; even when medicine has made incredible advances towards diagnostic procedures, diagnostic errors are still occurring, and they can have serious consequences, from delayed treatments to patient death. Diagnostic error causes are multifactorial, and they can be attributed to a combination of cognitive, system and patient related factors.(8)

I. Cognitive Factors: Providers

Cognitive factors are defined as the mental processes that clinicians use to gather, interpret and evaluate clinical information to be able to make decisions; even with years of training and experience, healthcare providers are susceptible to bias and are affected by other limitations that can influence their judgement and lead to diagnostic errors. (13)

- Cognitive Biases

Cognitive biases are systematic patterns of thinking that can lead to deviations from rational judgment, in the context of medical diagnosis some of the most common biases include:

- **Confirmation bias:** The tendency to search and interpret information that confirms a preconceived hypothesis e, ignoring or minimizing information that contradicts them.
- **Anchor bias:** The tendency to excessively fixate on the first information received from the patient, even if it is incomplete or inaccurate, and to incorrectly adjust the diagnosis to the one that information pointed towards, even as new information becomes available.
- **Availability bias:** The tendency to overestimate the probability of diseases that are easier to remember or have been encountered recently, which can lead to missing fewer common diagnoses, perpetuating the false belief that the most common diagnosis is always the answer.
- **Overconfidence bias:** The tendency to overestimate one's own diagnostic capacity and underestimate the possibility of error.

- Heuristics

Heuristics are mental shortcuts that allow doctors to make quick decisions in situations of uncertainty. Although they can be useful in clinical practice, they can also lead to errors if applied inappropriately, some examples of heuristics include:

 doi:10.20944/preprints202501.1990.v2

- **Representativeness heuristic:** The tendency to diagnose a disease based on the similarity of the patient's symptoms to a typical case of certain disease, without actively considering other possibilities.
- **Availability heuristic:** The tendency to diagnose diseases that are more common or have been found recently, without adequately considering the actual prevalence of the disease in the population.

- Limitations of Human Reasoning

In addition to biases and heuristics, human reasoning has inherent limitations that can contribute to diagnostic errors, these limitations include:

- **Limited information processing capacity:** Clinicians must process large amounts of clinical information in a short period of time, which can lead to errors due to cognitive overload.
- **Fatigue and stress:** Fatigue and stress can affect attention span, memory, and judgment, increasing the likelihood of errors.
- **Lack of knowledge or experience:** Doctors can make diagnostic errors if they do not have the knowledge or experience necessary to recognize a particular disease.

II. System Related Factors

System related factors are the characteristics of the work environment and the organization of the health system that may contribute to diagnostic errors.(14)

- **Time constraints:** The constant pressure and short time slots that healthcare professionals se submitted to during medical consultations are important factors that can lead to diagnostic errors. Providers often take care of a large number of patients in a limited time, which can make it difficult to take a complete history and physical examination, as well as consider all possible diagnostic hypotheses.
- **Environmental pressure:** The constant pressure of caring for high volumes of patients, especially in departments with a constant fast paced environment is very demanding for providers, accompanied by lots of stimuli occurring at the same time, and chronic fatigue can affect their diagnostic ability. Furthermore, the need to make quick decisions in emergency situations can lead to errors due to lack of proper reflection and analysis.
- **Poor Communication and use of electronic tools:** Poor communication between different health professionals caring for the same patient can be an important cause of diagnostic errors. Failure to share relevant information, misinterpretation of test results, or lack of coordination in patient follow-up can lead to delays in diagnosis or misdiagnoses. Also, the misuse of the electronic medical records to keep on track of the patient’s latest updates or failing to upload recent changes can lead to errors.

III. Patient Related Factors

Patient-related factors may also influence the likelihood of diagnostic errors, not just by not communicating or the lack of engagement, there are some cases with rare presentations or uncommon diseases that can lead to medical errors.(15)

- **Complexity of the Cases:** Some patients present with complex or atypical clinical symptoms, which can make diagnosis difficult. Rare diseases, unusual presentations of common

 doi:10.20944/preprints202501.1990.v2

diseases, or the presence of comorbidities can increase diagnostic uncertainty and the probability of error.

- **Communication:** The patient-provider relationship is a complex interaction, patients need to build trust to openly share personal details with providers about their medical history, if they don't feel comfortable enough, they might not mention crucial information needed to make an accurate diagnosis, delaying the process or leading the provider to move on to other probable causes.

Overdiagnosis, Diagnostic and Therapeutic Cascades

Overdiagnosis is an increasingly recognized phenomenon in modern medicine and refers to the diagnosis of a medical condition that, if undetected, would never have caused symptoms or affected the patient's health. Overdiagnosis can occur due to several factors, including overuse of screening tests, lowering thresholds to define diseases, and pressure to find explanations for the patient's symptoms. Another negative outcome that comes from overuse of screening texts is diagnostic and therapeutic cascades, these are a series of events triggered by an incidental finding in a diagnostic test or by a side effect of a treatment.(10)

The implications of both overdiagnosis and cascades are significant; mainly because it can lead to unnecessary treatment, which can be expensive, cause side effects and cause anxiety to the patient; they can also lead to divert healthcare system resources that could be used to treat patients with real and potentially serious illnesses and finally, they can create a false sense of security in the patient, leading them to ignore important symptoms of other diseases, believing that they're already being treated and in the process of getting better. (16)

Diagnostic Error in Primary Care

Primary care providers are the first point of contact that most of the patients will see, and they are also the ones who will continue the care after patients have been treated by a specific specialist, so they are the ones who will provide the long term care for a wide variety of patients, with different levels of complexity; this is what makes primary care providers especially susceptible to diagnostic errors. Being the ones making the referrals, diagnostic errors made by primary care providers can have serious consequences, delaying proper diagnosis and treatment, or submitting the patients to unnecessary tests and therapies that carry their own risks. Given the importance of primary care, it shouldn't be ignored when applying the strategies needed to prevent medical errors, even when primary care does not face life or death decision making, it is the foundation of the healthcare system, and therefore the efforts to prevent medical errors should also be directed to them. (16)

Consequences for the Patient's Health

Patients are the ones who directly suffer the consequences of diagnostic errors, they can be mild or severe and in some cases irreversible, they also carry a mental and emotional component that many patients can never fully recover from, and it permanently changes their perception of the healthcare system and providers, (11) the consequences can be divided into the following categories:

- **Increased morbidity:** Morbidity refers to the presence of a disease or medical condition. Diagnostic errors can increase morbidity by delaying the beginning of appropriate treatment, giving the wrong treatment, or simply not giving treatment at all, which can lead to long-term complications and sequelae.

 doi:10.20944/preprints202501.1990.v2

- **Increased mortality:** In severe cases, diagnostic errors can have fatal consequences. A study published in the British Medical Journal estimated that medical errors, including diagnostic errors, are the third leading cause of death in the United States.
- **Decreased quality of life:** Even when not fatal, diagnostic errors can significantly affect a patient's quality of life. Chronic pain, disability, anxiety and depression are just some of the possible long-term consequences of a misdiagnosis or delayed diagnosis.
- **Mental and emotional:** for some, just going to the doctor is already an stressful experience, getting a diagnosis can be relieving, but when it is a life impacting illness it can cause lots of emotional pain, and going through tests and treatments just increases said stress; it is simply devastating when said diagnosis was wrong and the patient underwent unnecessary tests and treatments, and even worse when they did not receive life saving measures, it can lead to long term depression, anxiety, and permanently impact the patients perception of the healthcare system, as well as create conflicts within the patient support system.

Economic Impact

Diagnostic errors also have a significant economic impact, both for patients and the healthcare system. (5) These costs may include:

- **For the patient:**
- **Additional medical expenses:** Misdiagnosis or late diagnosis can lead to unnecessary tests and treatments, increasing medical expenses for the patient and the healthcare system.
- **Loss of productivity:** Undiagnosed or misdiagnosed illnesses can lead to decreased work productivity, resulting in loss of income for the patient and their family.
- **For the healthcare system:**
- **Litigation costs:** In some cases, diagnostic errors can lead to medical negligence claims, resulting in legal and compensation costs for healthcare professionals and healthcare institutions.
- **Burden on the health system:** Diagnostic errors can cause misuse of the resources in healthcare facilities, they also generate mistrust amongst the population, which can lead to significant losses for the facility and providers involved.

Table 1. : Impact of Medical Errors.

Consequence	Description
Patient harm	It can manifest as physical harm, such as injuries or health complications, or as psychological harm, such as anxiety, depression, or loss of trust in the health system.
Delay or avoidance of appropriate treatment	A wrong or late diagnosis can lead to the patient not receiving the necessary treatment in time, which can aggravate their condition and decrease their chances of recovery.

 doi:10.20944/preprints202501.1990.v2

Unnecessary or dangerous treatment	An incorrect diagnosis can result in the administration of treatments that the patient does not need, which may be ineffective or even harmful to their health.
Psychological repercussions	A diagnostic error, especially a serious one, can have a significant emotional impact on the patient and their families, including anxiety, depression, post-traumatic stress, and loss of trust in health professionals.
Financial implications	Medical errors can result in additional expenses for the patient and their family, such as additional treatment costs, loss of income due to inability to work, and legal expenses in the event of malpractice lawsuits.
Malpractice Lawsuits	Patients affected by medical errors can file legal claims against the healthcare professionals or institutions involved, seeking compensation for damages suffered.
Impact on the reputation of the professional and the institution	Medical errors, especially if made public, can damage the reputation of the healthcare professional and the institution where the error occurred, which can affect the trust of patients and the community at large.

Addressing Contributing Factors: Steps Towards Safer Health Care

Preventing medical errors requires a multidimensional approach that addresses human, systemic, and patient-related factors.(17) Some key strategies include:

- **Improving Communication:** Encourage open and effective communication between members of the healthcare team, promoting a healthy work environment focused on patient safety. Implement open communication pathways between professionals and patients, this includes using clear and understandable language, actively listening, open ended questions, empathy and validation, continuously checking if the patient is understanding, and encouraging patient participation in decision-making.
- **Continuous Training:** Provide ongoing training to healthcare professionals on patient safety, effective communication, teamwork and error management. Training in clinical reasoning and decision-making skills can also help reduce cognitive biases and improve diagnostic accuracy. It is also important to keep training professionals in the electronic healthcare tools, so they are aware of the updates and modifications.
- **Healthcare System Support:** Improve the organization and management of the healthcare system, ensuring the availability of adequate resources, the implementation of clear protocols and continuity of care. Foster a culture of safety in which mistakes are seen as opportunities for learning and improvement, rather than cause for blame or punishment.
- **Technology Implementation:** Use technology effectively to improve patient safety, such as electronic medical records, early warning systems, and decision support tools as well as

 doi:10.20944/preprints202501.1990.v2

mandatory double checks for decision making, with the advances in medicine and medical technology it is easier to catch errors before they turn into adverse events.

- **Patient Empowerment:** Encourage the active participation of the patient in their care, providing clear and understandable information about their disease and its treatment, and promoting adherence to treatment.

Preventing medical errors is an ongoing endeavor that requires the involvement of every participant of the care process, once we understand the causes, we can make collective efforts to improve the healthcare system and take a patient-based approach in all decisions, having in mind that patient safety is not a destination, but an everyday journey for providers. (18)

Diagnostic errors represent a significant challenge in healthcare, negatively impacting patients' health and generating considerable costs for healthcare systems. Preventing these errors is an ethical and public health imperative that requires a multifaceted approach. In this article, we explore various strategies aimed at minimizing the occurrence of diagnostic errors, focusing on improving doctor-patient communication, training and training in clinical reasoning and decision making, the use of diagnostic support tools, the implementation of error notification and learning systems, and the active participation of the patient in the diagnostic process.(3)

Clinical Importance: Providers Perspective

Despite decades of effort, medical errors are still a very common cause or morbidity and mortality in the United States and the rest of the world. As part as the ethical rules of practicing medicine the main goal for healthcare providers should be “cause no harm”, but medical errors happen even when providers have the best intentions. Most of the errors are not the fault of one provider or group of providers, instead, they are the result of failures in the healthcare system that affect the care process, such as similarly spelled medications stored together, unstandardized dosing writing, absence of pharmacist supervision or an unbalanced workload.

Errors can be prevented with all the strategies previously mentioned, but even then, the very first step to learn the root cause of an error is reporting it, and currently, reporting an error is greatly avoided by healthcare professionals, especially if the consequences were mild or a near miss, due to the fact that reporting can be severely sanctioned and permanently affect the providers career, so one of the main efforts should be made towards embracing a system improving culture, instead of individual punishment; providers that are involved in medical errors should be held accountable, but they should also have open pathways to talk about the problem and what do they think was the root cause of the errors, so modifications can be implemented, preventing future adverse events. (19) When the focus of correcting medical errors shifts from individual or group sanctions to foundational system modifications, we can actually prevent the same mistake from happening again, because all the steps on the chain of care are double checked; this perspective also allows providers to feel secure in their work environment, prompting them to report more instead of minimizing problems that can perpetuate the adverse event cycle. (12) Hosting a safe work environment is essential to break the barriers that prevent the underlaying problems with healthcare organization from getting fixed, it is crucial to understand that retaliating against healthcare professionals won’t make the system work better, it will just delay changes that have to be made sooner or later to embrace a patient safety centered healthcare model. (19)

Implementation of Error Notification and Learning Systems

Implementing error reporting systems is essential to learn from previous mistakes and improve patient safety, these systems must be confidential and non-punitive, promoting safety culture and organizational learning. Errors must be analyzed systematically to identify root causes and develop effective prevention strategies. Patient safety training should be an integral part of the education and

 doi:10.20944/preprints202501.1990.v2

training of health professionals. Students and residents must learn to identify, report and analyze errors, and to actively participate in improving patient safety.(1)

Patient Participation in the Diagnostic Process

Active participation of the patient in their own care process is crucial to improve diagnostic accuracy and error reduction, the patients need feel safe sharing their concerns and should be encouraged to share details about their medical history, symptoms and anything that they feel is related to their current situation; once the diagnosis is made, providers should always communicate in a timely and sensitive manner, explaining the findings in a way that is easy for the patient to understand, inform about treatment options, risks and benefits, always giving the chance for them to ask questions and express their preferences. The use of electronic tools like electronic medical records systems and the patient interface that patients can access anytime is a great way to empower them to participate in their care process, they have available information, explanations and ways to communicate with providers, it can even help patients to provide information that they don't feel comfortable sharing face to face, improving the provider-patient relationship, lowering the chance of missing or mistaking a diagnosis. (15).

Ethical Considerations in the Management of Medical Errors

As was mentioned previously, despite the best efforts and intentions from medical providers the practice of medicine is not exempt from errors and the consequences that come with them, healthcare providers should take every step possible to prevent the occurrence of medical errors, but once they were already made, ethical considerations must prevail when making the decisions about the management of the adverse events.(13)

The Importance of Transparency and Open Communication with the Patient

When an adverse event occurs, the most important step to take is transparent communication with the patient, showing respect and consideration, as these are the foundations of the provider-patient relationship; all the errors must be communicated with all honesty and in a timely manner, allowing the patient to make decisions for the next steps required to recover their health.(20) Healthcare providers always have the duty to inform, it is understandable that in a highly competitive environment like medicine, recognizing that we make mistakes is incredibly hard, not only it gives the feeling of being insufficient, but it represents a failure to the perceived self, with all this in mind, what must prevail is the patient safety, therefore healthcare professionals have the duty to inform, regardless of personal conflicts, hoping that the adverse events can be treated as soon as possible.(19) Despite the difficulty of communicating an error to the patient, it comes with some benefits for both sides, they can be summarized as presented:

For the patient, open communication can:

- **Reduce anxiety and uncertainty:** Knowing what happened and why can help the patient better understand their situation and feel more in control.
- **Facilitate informed decision making:** Knowing the consequences of the error and the available treatment options allows the patient to make informed decisions about their care.
- **Strengthening the provider-patient relationship:** Honesty and transparency can foster trust and mutual respect, which is essential for an effective therapeutic relationship.

For the health professional, open communication can:

- **Relieve emotional burden:** Admitting a mistake and apologizing can help a doctor deal with guilt and prevent burnout.

 doi:10.20944/preprints202501.1990.v2

- **Encourage learning and improvement:** Recognizing errors and analyzing their causes can help doctors learn from them and take steps to prevent future errors.
- **Improve reputation:** Honesty and transparency can strengthen patients' trust in the doctor and the health institution once they have taken the steps to correct the error.

Improve Healthcare Team Outcomes

All the healthcare personnel are part of the same team and their goal is the same, get the patient back to health, one of the biggest barriers in the medical field is the lack of communication between providers, not just doctors, nurse practitioners or physician assistants, but medical assistants, pharmacologist, lab technicians and every professional that has direct or indirect contact with the patient, they all need to be aware of the updates and communicate effectively with one another to ensure patient safety.(19) Implementing tools like checklists, double check for prescriptions, EMR notes and medication charts that all the team can have access can reduce medical errors drastically, avoiding double medication administration, medication interactions, unnecessary testing and confirmation of progress, it can also allow to confirm verbal orders, which can always be prone to misunderstandings. All the healthcare team must continuously train and remain up to date with electronic systems and tools updates and use them in the best interest of the patient.(1) Additionally, accreditation agencies and training programs should continually focus on improving patient safety and teaching ways to reduce common medical errors. A collaborative interprofessional team of these agencies, clinicians, and administrators can identify inherent system and process deficiencies and develop corrective measures to reduce the incidence of medical errors in the healthcare industry.

The Role of Ethics Committees in the Management of Medical Errors

Ethics committees play a crucial role in the management of medical errors, providing guidance and support to both patients and healthcare professionals. These committees are composed of experts in ethics, medicine, law, and other relevant disciplines, and their primary function is to promote ethical, quality healthcare, and provide unbiased analysis and resolution of ethical conflicts. Ethics committees can help analyze and resolve ethical conflicts that arise in relation to medical errors, these conflicts may involve difficult decisions about treatment, disclosure of information, or allocation of resources. The ethics committee can provide an objective perspective and help the parties involved reach a fair and ethical solution. Ethics committees can also contribute to the development of policies and procedures to prevent and manage medical errors; these policies may include protocols for reporting errors, communicating with patients, and implementing corrective measures. The ethics committee can help ensure that these policies are respectful of patients' rights. Ethics committees play a crucial role in the management of medical errors, acting as safeguards that promote integrity and accountability in healthcare. Below are relevant examples from literature that highlight its importance.

Functions of the Ethics Committees

1. **Protection of Human Rights:** Ethics committees are essential to protect the rights of patients and ensure that medical practices are carried out ethically. Its creation is justified by the need to navigate the use of human organs and critical end-of-life decisions, which highlights its role in preventing abuse of power and errors in medical care.
2. **Evaluation of Research Projects:** Health research ethics committees are responsible for evaluating projects to ensure the protection of participants and scientific integrity. This

 doi:10.20944/preprints202501.1990.v2

includes reviewing research protocols with participation of patients, ensuring that ethical practices are followed and that risks to patients are minimized.

3. **Confidence Building**: These committees not only address ethics in research but also foster trust between healthcare professionals and patients. By establishing a framework for ethical discussion, committees help resolve conflicts and make consistent decisions, which are essential for the management of medical errors.
4. **Independence and Autonomy:** The independence of ethics committees is crucial to their effectiveness. They must operate without outside influences to fairly evaluate cases of medical errors and ensure that decisions are made based on sound ethical principles.

Ethics committees are essential in the management of medical errors, as they protect the rights of patients, evaluate ethics in research, and foster trust in the health system. Their independence and ability to address ethical dilemmas are critical to improving the quality of healthcare and preventing future errors. Preventing and managing medical errors is a complex challenge that requires a multifaceted approach. Ethics plays a crucial role in this process, guiding actions and decisions toward protecting patients and promoting safe, quality healthcare. Transparency, open communication, the duty to inform and the role of ethics committees are key elements to address medical errors in an ethical and responsible manner, promoting a culture of safety and learning in the field of health.(12)

Legal Liability for Diagnostic Errors: A Legal Analysis

The medical process, particularly diagnosis, is subject to the uncertainty inherent to human knowledge and the variability of biological responses. This reality opens the door to the possibility of errors, which, in certain circumstances, can generate legal liability for the healthcare professional. The doctor-patient relationship is configured as a service leasing contract, in which the doctor undertakes to provide their professional services with due diligence. Jurisprudence has established that this obligation is one of the means, not results, that is, the doctor does not guarantee the patient's cure but rather undertakes to put at his disposal all the means at his disposal to achieve that goal. In the event of failure to comply with this obligation, whether by action or omission, the doctor may incur civil liability. Diagnostic error, as we will see below, can be one of the manifestations of this non-compliance. In cases of medical liability due to diagnostic error, the burden of proof falls on the patient or their family members, meaning they are the ones who must demonstrate that the doctor acted negligently or recklessly, that damage occurred and that there is a causal relationship between the medical action and the damage suffered. Proving medical negligence or recklessness can be complex, since it requires proving that the doctor deviated from the "lex artis ad hoc", that is, the body of knowledge and practices accepted by the medical community at the time of the action. To do this, medical experts are usually required to evaluate the professional's performance considering the standards of the profession.(14)

Concepts of Guilt, Negligence and Recklessness

Fault, in the field of medical civil liability, refers to the lack of diligence or care in professional performance. It manifests itself in two forms:

- **Negligence:** Omission of due diligence. That is, the doctor does not do what they should do according to the standards of the profession. For example, not performing the necessary diagnostic tests for the patient's symptoms.
- **Imprudence:** Hasty or reckless action, without taking due precautions. For example, performing a medical procedure without having the necessary training or experience.

 doi:10.20944/preprints202501.1990.v2

For civil liability to exist, the fault must be serious, a simple diagnostic error, without negligence or recklessness, is not sufficient to generate liability. Jurisprudence has recognized the difficulty inherent in medical diagnosis and has established that error, by itself, does not constitute liability. Legal liability for diagnostic errors is a complex and delicate issue, the doctor has the obligation to act with due diligence, in accordance with the "lex artis ad hoc", but a guaranteed result cannot be required. The burden of proof falls on the patient, who must demonstrate medical negligence or recklessness, the damage suffered and the causal relationship between the two. It is important to note that not every diagnostic error generates civil liability.

Conclusion

As a human-related science, medicine will always be prone to errors, if humans are involved, the risk is inevitable; that doesn't mean that healthcare organizations, institutions and professionals shouldn't use every resource available to prevent them from occurring. The goal in medicine should always be the best outcome for the patient, therefore preventing medical errors is still a great endeavor for all the participants in the care process, and to make it happen the first step is recognizing what are the gaps in the system allowing errors to occur, in order to correct the issue and prevent it from happening again; to be able to achieve this, the whole healthcare system should aim to transition from a punitive to a learning approach, taking error reports as an opportunity to be better and provide high quality care without taking the security of a positive work environment from healthcare providers; medicine with a patient centered approach is always the goal when it comes to error prevention.

References

1. Engel KG, Engel KG, Rosenthal MM, Engel KG, Sutcliffe KM, Rosenthal MM, et al. Residents' responses to medical error: coping, learning, and change. Acad Med. 2006;
2. Grober E, Bohnen JD, Grober ED, Grober ED, Bohnen JMA. Defining medical error. Can J Surg. 2005;
3. Wu AW, Wu AW. Medical error: the second victim: The doctor who makes the mistake needs help too. BMJ. 2000;
4. Gallagher TH, Waterman AD, Gallagher TH, Ebers AG, Waterman AD, Fraser VJ, et al. Patients' and physicians' attitudes regarding the disclosure of medical errors. JAMA. 2003;
5. Andel C, Davidow SL, Andel C, Davidow SL, Hollander M, Moreno DA, et al. The Economics of Health Care Quality and Medical Errors. J Health Care Finance. 2012;
6. Bos JVD, Bos JVD, Rustagi K, Rustagi K, Gray T, Halford M, et al. The $17.1 Billion Problem: The Annual Cost Of Measurable Medical Errors. Health Aff (Millwood). 2011;
7. Bates DW, Boyle DL, Bates DW, Vliet MBV, Boyle D, Schneider JR, et al. Relationship between medication errors and adverse drug events. J Gen Intern Med. 1995;
8. Tang FY, Sheu SJ, Tang FI, Yu S, Sheu SJ, Yu S, et al. Nurses relate the contributing factors involved in medication errors. J Clin Nurs. 2007;
9. Hobgood C, Hobgood C, Hevia A, Tamayo-Sarver JH, Hevia A, Tamayo-Sarver JH, et al. The influence of the causes and contexts of medical errors on emergency medicine residents' responses to their errors: an exploration. Acad Med. 2005;
10. Weingart SN, Callanan LD, Weingart SN, Ship AN, Callanan LD, Ship AN, et al. A physician-based voluntary reporting system for adverse events and Medical errors. J Gen Intern Med. 2001;
11. Kaldjian LC, Jones EW, Kaldjian LC, Wu BJ, Jones EW, Wu BJ, et al. Reporting medical errors to improve patient safety: A survey of physicians in teaching hospitals. JAMA Intern Med. 2008;
12. Makary MA, Makary MA, Daniel M, Daniel M. Medical error—the third leading cause of death in the US. BMJ. 2016;
13. Rothschild JM, Landrigan CP, Rothschild JM, Landrigan CP, Cronin J, Kaushal R, et al. The Critical Care Safety Study: The incidence and nature of adverse events and serious medical errors in intensive care. Crit Care Med. 2005;

 doi:10.20944/preprints202501.1990.v2

14. Hayashino Y, Hayashino Y, Ozaki M, Feldman MD, Utsugi-Ozaki M, Feldman MD, et al. Hope modified the association between distress and incidence of self-perceived medical errors among practicing physicians: prospective cohort study. PLOS ONE. 2012;
15. Garbutt J, Garbutt J, Brownstein D, Brownstein D, Klein EJ, Klein EJ, et al. Reporting and disclosing medical errors: pediatricians' attitudes and behaviors. JAMA Pediatr. 2007;
16. Spitzer RL, Williams JBW, Kroenke K, Linzer M, deGruy FV, Hahn SR, et al. Utility of a New Procedure for Diagnosing Mental Disorders in Primary Care: The PRIME-MD 1000 Study. JAMA. 1994;
17. Kohn LT, Kohn LT, Kohn LT, Corrigan JM, Corrigan JM, Donaldson MS, et al. To Err Is Human Building a Safer Health System. null. 2000;
18. Mc N, Mc N. The emotional impact of mistakes on family physicians. Arch Fam Med. 1996;
19. Mizrahi T, Mizrahi T, Mizrahi T. Managing medical mistakes: ideology, insularity and accountability among internists-in-training. Soc Sci Med. 1984;
20. Hall L, Johnson JA, Hall L, Johnson J, Watt I, Johnson J, et al. Healthcare Staff Wellbeing, Burnout, and Patient Safety: A Systematic Review. PLOS ONE. 2016;