Project's proposal

AI Diagnosers

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1. Define and identify the problem: -

1.1. Sustainable development goals (SDGs) contribution:

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, provide a comprehensive framework for addressing the world's most pressing challenges. Among these, SDG 3 (Good Health and Well-Being) aims to ensure healthy lives and promote well-being for all at all ages. This goal is fundamental to social and economic development, as access to quality healthcare is essential for reducing poverty, increasing productivity, and improving overall quality of life (United Nations, 2015). Despite significant advancements in medical science and healthcare infrastructure, many regions continue to struggle with fundamental healthcare issues, including limited access to essential services, inadequate health financing, and workforce shortages.

One of the critical aspects of SDG 3 is strengthening global and national capacities for early warning, risk reduction, and management of health risks. Effective healthcare systems must be able to detect, assess, and respond to emerging health threats before they escalate into severe medical crises. However, many developing countries lack the necessary infrastructure, technological resources, and trained personnel to effectively monitor and mitigate health risks. This limitation often results in delayed or incorrect diagnoses, which can exacerbate the spread of diseases and lead to higher mortality rates (World Health Organization, 2020).

In many low-resource settings, the absence of reliable diagnostic tools further weakens the ability to provide timely medical interventions. Patients often experience long delays before receiving an accurate diagnosis, leading to disease progression and increased treatment costs. Misdiagnoses also contribute to unnecessary treatments, increased patient suffering, and greater economic

burdens on healthcare systems that are already struggling to provide adequate services.

Another major obstacle to achieving SDG 3 is the global shortage of healthcare professionals. The World Health Organization (WHO) estimates that by 2030, there will be a shortage of approximately 18 million healthcare workers, particularly in low- and middle-income countries (World Health Organization, 2020). This shortage significantly affects the quality of medical care, as overworked and under-resourced healthcare professionals face immense pressure to manage large patient loads with limited time for thorough diagnosis and treatment.

Health financing is another critical factor influencing the quality and accessibility of healthcare services. Many developing countries allocate insufficient resources to their healthcare systems, resulting in outdated medical equipment, shortages of essential medications, and inadequate training programs for medical professionals (United Nations, 2015). This financial strain makes it difficult for healthcare institutions to adopt modern diagnostic technologies, further increasing the risk of misdiagnosis and ineffective treatment plans.

Given these challenges, the need for accurate, efficient, and widely accessible diagnostic solutions has never been more pressing. Diagnostic errors not only threaten individual patient outcomes but also contribute to the inefficiencies and financial burdens that undermine healthcare systems, particularly in resource-limited settings. Addressing this issue is essential for advancing SDG 3 and ensuring that all individuals, regardless of their geographic or economic status, have access to reliable and timely medical care.

1.2. Defining the main problem to be solved:

Diagnostic errors are a serious issue in healthcare, affecting millions of patients worldwide. Figure (1) shows different types of diagnostic errors. When doctors miss or misinterpret critical medical information, it can lead to incorrect treatments, delayed care, or even life-threatening consequences. These mistakes happen for many reasons—sometimes due to overwhelming patient loads, gaps in medical training, or the lack of proper diagnostic tools. One major area of concern is medication-related errors, where patients receive the wrong drugs, incorrect dosages, or experience dangerous side effects. These errors not only harm individuals but also put extra strain on healthcare systems, increasing costs and hospital stays.

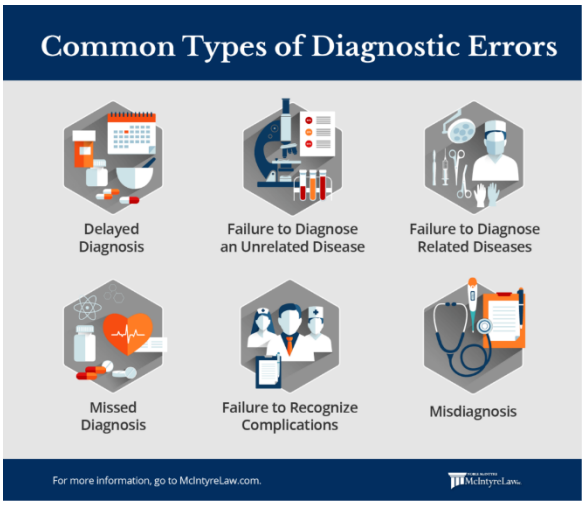
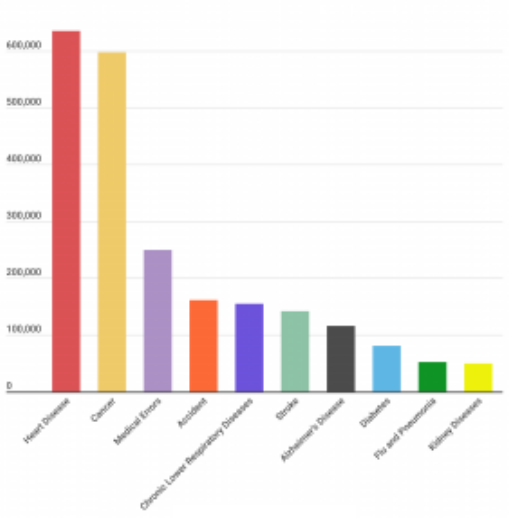


Fig (1)

The reality is that no country is immune to these challenges, but the impact varies depending on how well-equipped a healthcare system is. In some places, a lack of resources or outdated technology makes it even harder for doctors to make the right call. Medication errors are just one example of how diagnostic mistakes can snowball into bigger problems. If we want to improve patient safety and healthcare outcomes, we need better tools and smarter systems that help doctors make more accurate decisions—because every misdiagnosis can change a life forever. Graph (1) shows the top 10 deaths causes in the United States in 2016 and medical errors represent in the third



Graph (1)

place with more than 200,000 annual deaths! Table (1) shows a sample of medical errors in an Arab country (Egypt) in different time stamps.

Table (1)

Egypt					
Mostafa et al. (2020)	Prospective, pre- and post-intervention	N/A	1025 patients in pre phase 1024 patients in post phase	Patients with ME in pre phase: 351 (34.2%) Patients with ME in post phase: 157 (15.3%), p <0.001) No harmful errors recorded in both phases	Emergency department Intervention: improving nurses' drug knowledge and awareness of errors
Kenawy and Kett (2019)	Retrospective	10 months	4025 handwriting Rx 3799 e-Rx	Handwriting Rx with at least one error: 1666/4025 (41.4%) e-Rx with at least one error: 881/3799 (23.2%), p <0.05 Medications with dispensing error in handwriting Rx: 489/12,249 (4%) Medications with dispensing error in e-Rx: (330/11,808) (2.8%), p <0.05	Ambulatory care Severity index of errors was not evaluated
Ali Mas et al. (2018)	Prospective	6 months	1421 patients	Total patients with DRPs: 285 Total DRPs (Medication errors): 414, 3.2% of all medication orders Dosing error: 25.7% of all DRPs Temporary harmful DRPs: 24.64% Permanent harm DRPs: 3.14% DRPs causing death: 0.48%	Neurology ICU
Fawaz et al. (2017)	Prospective, pre- and post-intervention		936 Rx and 110 patients in pre phase 693 Rx and 112 patients in post phase	ME in pre phase: 312 (%) ME in post phase: 224 (%), p <0.001 Most common error type in both phases: prescribing error No harm resulted from Medication errors in both phases	Pediatric surgical patients Intervention: educational session to medical staff
Ali Mas et al. (2017b)	Prospective	12 months	1501 patients 5790 Rx	Rate of prescribing error: 523/5790 (9.03) The most frequent prescribing errors: dosing errors: 231 (42.2%), loading dose omission error 91 (16.6%), omission of essential drugs on 1st day 43 (7.9%), timing error 40 (7.3%)	Coronary care unit patients
El-Shazly et al. (2017)	Prospective and chart review	9 months	148 patients	Total ME: 403/3819 medical errors Most common Medication errors: dispensing 167 (41.4%), administration 124 (30.7%), prescribing 81 (20.1%)	NICU Errors severity index was not specified for Medication errors

2. Defining the solution: -

2.1. Prior solutions have already been tried:

1. Traditional Clinical Decision Support Systems (CDSS)

- **Overview:**
  CDSS are software tools integrated into electronic health records (EHR) that provide healthcare professionals with real-time alerts, recommendations, and reminders to improve diagnostic accuracy.
- **Pros:**
  - Enhance physician decision-making with data-driven insights.
  - Reduce medication errors through automated checks.
  - Integrate with hospital systems for workflow efficiency.
- **Cons:**

- High implementation and maintenance costs.
- Can lead to "alert fatigue," where clinicians dismiss frequent notifications.
- Limited adaptability to complex, rare, or evolving conditions.

2. Telemedicine and Remote Consultations

- **Overview:**
  Telemedicine allows patients to consult healthcare providers remotely, facilitating early diagnosis and second opinions through digital communication.
- **Pros:**
  - Expands access to medical expertise, especially in remote areas.
  - Reduces waiting times and improves patient convenience.
  - Enables quick follow-ups and monitoring of chronic conditions.
- **Cons:**
  - Limited diagnostic capabilities for conditions requiring physical examination.
  - Reliant on internet access and digital literacy.
  - Potential for miscommunication due to lack of in-person interaction.

3. Standardized Diagnostic Protocols & Checklists

- **Overview:**
  Protocols and checklists help guide healthcare providers through standardized diagnostic processes to minimize human errors.
- **Pros:**
  - Ensures consistency in medical assessments.

    - Reduces cognitive biases in diagnosis.
    - Provides a simple, low-cost solution for improving diagnostic accuracy.
- **Cons:**
    - Not always adaptable to individual patient variations.
    - Relies heavily on clinician compliance.
    - May slow down decision-making in emergency cases.

These prior solutions have contributed to improving diagnostic accuracy, but they also highlight the need for a more advanced, adaptable, and integrated approach to reducing errors in medical diagnosis.

2.2. Solution overview:

Our solution is designed to enhance diagnostic accuracy and efficiency within healthcare systems. By integrating advanced data-driven methodologies, it aims to reduce human errors, improve patient outcomes, and support medical professionals in making more informed decisions. This solution aligns with global efforts to strengthen healthcare delivery, particularly in regions where misdiagnosis and resource limitations pose significant challenges.

Best Value Proposition for Users and Customers:

- **For Healthcare Providers:** It enhances diagnostic precision, reduces workload, and minimizes misdiagnoses.
- **For Hospitals & Clinics:** It optimizes operational efficiency, lowers costs related to diagnostic errors, and improves patient safety.

- **For Health Authorities & Policymakers:** It contributes to better health data analytics, supports evidence-based policy decisions, and helps improve overall healthcare standards.

2.3. Solution features:

Solution Features

- **Reliable Diagnostic Support** – Provides accurate insights to assist healthcare professionals in making informed decisions.
- **Seamless Integration** – Easily integrates with existing hospital systems and workflows.
- **User-Friendly Interface** – Designed for healthcare professionals with an intuitive and efficient experience.
- **Real-Time Insights** – Delivers quick and actionable diagnostic support to improve patient care.
- **Continuous Learning** – Improves over time by adapting to new medical data and trends.
- **Security & Compliance** – Ensures patient data confidentiality and aligns with healthcare regulations.

3. Competition & Market Landscape: -

3.1. Competitor Analysis

Feature	IBM Watson for Oncology	Aidoc	Zebra Medical Vision	Our Solution
Focus Area	Oncology treatment recommendations	Medical image analysis	Medical imaging for multiple conditions	Broad diagnostic support across specialties
Integration with Hospital Systems	Requires structured data input and integration with EHRs	Seamless integration with radiology workflows	Cloud-based integration, requiring imaging data	Designed for easy implementation with existing workflows
Regulatory Approvals	Limited FDA approvals	FDA-approved for multiple imaging diagnostics	Approved for several imaging applications	Compliance with key healthcare regulations
Strengths	Extensive medical literature database; personalized recommendations	Real-time AI-powered image analysis; fast and accurate detection	Broad range of diagnostic capabilities; scalable cloud-based platform	Multi-specialty diagnostic support; enhances clinical decision-making
Weaknesses	Expensive; requires high-quality data	Focused only on imaging-based diagnostics	Integration challenges with diverse hospital systems	Addresses both structured and unstructured medical data; designed for seamless adoption

Competitive Advantage

While IBM Watson for Oncology, Aidoc, and Zebra Medical Vision offer specialized AI-driven diagnostic solutions, they are often limited in scope, focusing on either a single specialty (oncology) or specific diagnostic methods (imaging).

Our solution stands out by offering a multi-specialty, AI-powered diagnostic support system that integrates structured (EHR data) and unstructured data (doctor notes, prescriptions, lab tests) to provide comprehensive clinical

decision support. Unlike competitors that require high-quality imaging data or extensive IT infrastructure, our solution is designed for seamless adoption within diverse healthcare settings, ensuring accessibility and ease of use for healthcare professionals.

3.2. How does our solution stand out:

Our solution stands out by offering a clinician-focused, AI-powered diagnostic support system that seamlessly integrates into existing hospital workflows. Unlike competitors that primarily serve as patient-facing applications or require extensive system overhauls, our solution prioritizes ease of adoption, accuracy, and real-time insights for healthcare professionals.

4. Progress Status: -

Our solution is currently in the data cleaning and preprocessing phase. We have acquired a comprehensive dataset containing approximately 400,000 records, including medical history, lab results, prescriptions, diagnoses, and doctor notes. To ensure high accuracy and reliability, we are systematically cleaning and structuring this data, addressing inconsistencies, missing values, and potential biases. This step is crucial for building a robust foundation for the next phase: training and validating the AI model to enhance diagnostic accuracy and support healthcare professionals effectively.

5. Future plans: -

Next Steps for Development

1. **Prototype Refinement**
    - Optimize AI algorithms for cardiovascular disease detection (HF)
    - Improve integration with hospital EHR systems
    - Enhance user interface for emergency department workflows
2. **Clinical Validation**
    - Conduct controlled trials in partner hospitals
    - Compare AI diagnoses with traditional methods
    - Gather clinician feedback for iterative improvements
3. **IoT Implementation**
    - Integrate wearable device data (ECG, heart rate, blood pressure)
    - Develop ambulances to ED real time vital sign streaming
    - Implement smart hospital bed sensors for continuous monitoring
4. **System Expansion**
    - Add multi-language support for global deployment
    - Incorporate environmental data (air quality, weather) for risk analysis
    - Develop mobile companion app for patient clinician communication

Clear Vision

"To revolutionize emergency cardiovascular care through intelligent, instantaneous diagnosis - where every second counts and no patient falls through the cracks."

Core Principles:

- **Accuracy**: Reduce diagnostic errors by >50%
- **Speed**: Deliver preliminary diagnoses in <2 minutes

- **Accessibility**: Function in both high-tech and low-resource settings
- **Ethics**: Maintain transparent, bias-free AI decision making

Implementation Pathway:

1. Complete prototype testing → 2. Secure regulatory approvals → 3. Hospital pilot programs → 4. Full-scale deployment

6. The Team: -

1. The first member:

Name: Begad Wael Mostafa

Hobbies and Experts: Highschool student who is inspired with biology and medicine. His dream college is the faculty of medicine He is a crazy technician who seeks for perfectionism. He has experience in AI Modeling, circuit design, robotics and embedded systems. In addition, he has extracurricular hobbies such as playing piano and oud.

Photo:

2. The second member:

Name: Abdelrahman Waleed Farouk

Hobbies and Experts: A high school student who is inspired by Engineering and especially medical engineering. Some of interests also are robotics and product engineering. He has enough experience in business and entrepreneurship. He has extracurricular activities such as playing football.

Photo:

3. The third member:

Name: Omar Mohamed Radwan

Hobbies and Experts: Highschool student who is inspired by arts and design. He has experience in graphic designing, data analysis, and robotics design. He loves mathematics a lot. He has some extracurricular activities such as playing football and going to the gym.

Photo:

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