AI-Driven Platforms for Enhancing Chronic Disease Management: Utilizing Machine Learning to Improve Disease Tracking, Patient Education, and Care Coordination

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1. Introduction

Chronic diseases, which represent long-term and slow-progressing illnesses such as diabetes and hypertension, are rapidly emerging as a significant public health issue. Ultimately, it is estimated that the prevalence of chronic diseases is set to increase, reaching 57% by 2020. Subsequently, this increase in illness will lead to a considerable burden on health systems, particularly with chronic diseases currently accounting for the majority of health care expenditure, totaling $241 billion in the United States alone. Traditional approaches to slowing the progression of chronic diseases are limited in their capacity to foster patient engagement and are inefficacious for reducing costs related to chronic care complications. Thus, in the digital era of health care, innovative solutions are needed to enhance patient-centered chronic disease management. Machine learning is now entering the health care space, touted as the panacea for low predictive powers, the second opinion for rare diseases, and even a cure-all for diagnostic errors. There is great potential for the application of AI-driven platforms in precision medicine tailored to the unique characteristics of several chronic diseases.

As healthcare digitization and modernization significantly alter the landscape of patient care, AI holds the potential to transform healthcare as we know it. Advances in AI offer the means to improve the efficiency of several aspects of patient care, including disease tracking, patient education, and care coordination. Therefore, AI and its derivative advances in machine learning function as a vehicle for change to improve aspects of focus for chronic disease management. This review will synthesize recent research in novel AI-driven methods for patient care innovation, concentrating on chronic disease management. Research describing the acceleration of chronic diseases, the patient's role in care delivery, and the potential for

AI-driven platforms to transform care models will be outlined. The following review will define the current chronic disease crisis and plausible sources of temporary relief. Given our dense population, reduction in processed foods is critical for the control of the dramatic increase in chronic illnesses.

1.1. Background and Significance

Chronic diseases have become a significant aspect of today's healthcare landscape, with 60% of US adults experiencing at least one chronic condition and more than 40% suffering from multiple chronic conditions. Chronic diseases are complex and long-term, requiring healthcare providers, patients, and other stakeholders to engage in long-term management efforts. The management of chronic diseases has extensive consequences, directly affecting the quality of life of all involved stakeholders. In the United States, it is estimated that nearly 70% of all deaths and 86% of all healthcare-related costs are due to chronic diseases. Traditionally, the chronic disease management process has been largely left to the patient, following the directions and advice provided by their healthcare providers. Periodic appointments with healthcare providers contribute to the disease management process but are not focused on coordinating the efforts of all involved stakeholders. Furthermore, the care coordination processes required to integrate the needs of patients, families, and healthcare professionals across healthcare systems are usually less efficient, resulting in varying quality and overutilization of healthcare resources. Despite information about various chronic disease management interventions, there remains relatively little judicious use of personalized interventions and tools tailored to the specific management needs of patients with chronic diseases. The emerging field of artificial intelligence is now enabling a variety of predictive, prescriptive, and personalized tools to assist in effective chronic disease management efforts. In healthcare, AI is, for the most part, being used to improve patient outcomes, but to a lesser extent, systems are utilizing AI to improve care efficiency through automation. The use of AI systems for healthcare-related activities is expected to grow in the coming years. The use of such systems is projected to reduce the costs of care while improving both healthcare service delivery and public health safety.

2. Fundamentals of Chronic Disease Management

Chronic diseases are characterized by their prolonged duration. These conditions are often incurable and result in long-term mental, physical, and social effects. The management of

chronic diseases is essential for the holistic healthcare of an individual, and health systems worldwide are increasingly referred to as chronic care systems. Chronic diseases often necessitate the deployment of long-term treatment and disease management plans that are personalized for the patient. A multitude of chronic diseases exist today; the most common include diabetes, heart disease, certain cancers, respiratory conditions, and mental health conditions. Chronic diseases are often the cause of the increasing pressure on health systems, primarily due to their prevalence and their ability to be the primary cause of morbidity and mortality.

Chronic disease management refers to the comprehensive healthcare strategies devised for the holistic care of a patient. It differs from acute disease treatment protocols, as these tend to be one-time interventions of an urgent nature. Chronic disease management is considered to be a continuum of care and can involve the collaboration of the patient, healthcare professionals, caregivers, and community engagement programs. Some of the leading causes of death today are chronic diseases, and their prevalence is increasing globally, particularly in developed countries. Holistic and continuous improvements can be achieved by intensively managing these chronic diseases and the complications that may result from them.

2.1. Definition and Types of Chronic Diseases

Chronic diseases are defined as health conditions or diseases that are persistent in duration, meaning that they have one or more of the following characteristics: they are permanent, leaving residual disability, are caused by non-reversible pathological alteration, require special training of the patient for rehabilitation, or may be expected to require a long period of supervision, observation, or care. This is different from acute diseases, like the flu, for example, which people recover from within a matter of days or weeks. The term also excludes many conditions traditionally considered to be non-communicable, such as various musculoskeletal, infectious, or skin diseases. Chronic diseases are unique because they generally need long-term management through proper medication, awareness, and certain changes in the lifestyle of the patient. There are different types of chronic diseases, some of which include conditions like asthma, arthritis, diabetes, and cancer, to name a few. Each chronic disease has specific characteristics associated with it, which is why the management, medication, and method of keeping these diseases in check vary vastly across them. A chronic condition is a human health condition or disease that has repeat or persistent symptoms of

long duration and generally is rarely cured completely. Some chronic diseases may be long-lasting but might never have effects that can cause the disease or symptoms to come back. Chronic conditions are usually defined as those less amenable to treatment, resulting in a limit in activities of daily living and infrequent clinical visits. They can be a burden to patients, affecting quality of life due to the practical support for medication and long-term follow-up to an unusual degree, having a potentially high cost to the healthcare system. It can be further categorized into communicable chronic diseases and non-communicable chronic diseases. Chronic diseases can also affect a person's ability to carry out daily activities, including living independently, sleeping, and involving themselves in exercise and leisure activities. Chronic illnesses affect 6 out of 10 people in the United States. Globally, about 71% of deaths are due to non-communicable diseases. The four main types of chronic diseases that are the biggest burden to developed countries are cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes. There are a number of reasons as to why chronic diseases are difficult to manage, including the length of time the disease has been present, complications and/or co-morbidities associated with the particular disease, lack of self-management education and support in caring for the condition, lack of involvement in the management of the particular disease, the amount of medical records that need to be read, and the time and planning required to try and improve the management and outcomes for a person with a chronic disease.

3. Role of AI in Healthcare

For decades, artificial intelligence (AI) and machine learning have been described as revolutionary technologies with the potential to reshape many industries, including healthcare. With the rise of AI, accepted limitations in healthcare data have decreased, enabling new applications in chronic disease monitoring and management that could not have been achieved through the analysis of highly curated data alone. As part of these developments, machine learning, as it is currently practiced due to available computational resources, is seeing a dramatic shift in its technologies with the rise of deep learning. This technology, in combination with improved natural language processing, has enabled new forms of documentation and input for healthcare. Workflows, such as patient interviews and diagnostic processes, have also been empowered by AI through the integration of wearable and in-home sensor data, which is collected passively, and through a convergence of

technologies can now also be labeled based on patient and long-term outcomes, allowing for regular updates and improvements of these integrated diagnostic processes.

AI has the ability to mine through vast amounts of connected data from disparate sources in healthcare and deliver real-time personalized insights and support that can prevent adverse health outcomes and minimize overall patient risk. AI has been demonstrated to improve diagnosis through data fusion, track chronic disease throughout changes in the patient over time, predict patient outcomes, and stratify cohorts to personalize care. Moreover, AI has the ability to reduce provider administrative burden, improve the flows within the clinic and overall healthcare system, and serve as a provider of education and a liaison between patient and specialist, thereby improving care coordination. Lastly, there are many aspects that AI aids in, but the partnership between the healthcare professional and AI is essential to delivering on the promise of the future of patient care.

3.1. Overview of AI Technologies

Machine learning (ML), a branch of artificial intelligence (AI) that focuses on the development of algorithms that enable computers to change with new data. In health care, algorithms developed through ML have been used to improve techniques such as image analysis and interpretation (amplifying clinicians' diagnostic capacities or supplementing the shortcomings of non-expert clinicians). Deep learning (DL) is a subfield of ML that has developed to enable computing models to represent complex data through the use of artificial neural networks that can be trained with large quantities of labeled data. A range of DL approaches and architectures, including artificial neural networks, convolutional neural networks, recurrent neural networks, and long short-term memory, have been implemented to process structured and unstructured health data with the goal of improving care processes and patient treatment and outcomes.

Natural language processing (NLP), a branch of AI that has been developed to enable systems to understand, interpret, and respond to human language, including its spoken and written forms. NLP systems have been employed in various application areas spanning health care, such as in the identification of medical concepts and entities in clinical or biomedical documents, and in disease management and prediction, treatment recommendation, and adverse drug event detection. Data mining originated from natural science and aims to evaluate meaningful patterns from big data, usually collaboratively involving different

researchers to generate the highest results. Data mining methods have been extensively used in health care areas, especially in chronic disease management. Research in the application of these methods, such as classification, clustering, and association rules, is increasing in chronic disease research and is making important inroads in disease treatment. Machine learning is especially useful in the assessment and prediction of clinical dissertation indexes.

Data-driven technologies could replicate the success of advancements. Chronic disease management has bottlenecked due to the lack of patient disease monitoring and assessment, the misunderstanding of patient disease education, and the lack of care management plans for hospital follow-up services. In fact, the core of disease management is both sophisticated follow-up services for different levels of patients and the utilization of current cutting-edge technologies, such as artificial intelligence, the Internet of Things, and big data. The follow-up services are based on the deep-level data-driven chronic disease management system. Through the analysis of large amounts of unstructured information and structured data, the system identifies key patterns to predict patient disease outcomes, then provides corresponding education for patients and tailors their care plan based on the patient health data. Objective assessments can be undertaken to provide data-driven support for disease management in the final stage of chronic disease. AI and deep learning are well-constructed tools based on a sequential pattern and can be used in image recognition, human speech understanding, playing games, running robotic vehicles, medical imaging, diagnosis, prognosis, drug discovery, and genomics.

4. AI Applications in Chronic Disease Management

To date, studies have been published to utilize AI for improving chronic disease management as practical applications of AI solutions. Several reports discuss the use of AI or predictive analytics in the application of HAT, mental conditions, kidney disease, diabetes, asthma, heart disease, and cancer. AI-based programs have triggered implications across industrial operations, reimagining the essence of healthcare delivery and approaching disease diagnosis and management more holistically than ever. The core value of AI in chronic disease management surfaces across various features. It can enable robust disease tracking and monitoring, offering access to real-time data, including early symptoms or vitals, to the treating physician. In chronic disease management, predictive analytics can anticipatorily determine incremental disease complications and related patient burdens. This additional

insight into patient health-related risks will, in turn, assist in tailoring patient interventions. On the micro level, scattered and episodic patient data offer reduced utility to the physician for the best clinical judgment. Meanwhile, currently available AI algorithms can assimilate complex patient-clinical trial-level data for the development of personalized medication plans, accommodating individual health patterns. AI-driven personalized medication plans offer efficacy and critical side effect risk assessment, which is essential in chronic diseases to accomplish clinical care and thus minimize disease remission. AI-driven remote patient monitoring can also increase patient engagement and therapy adherence, having a substantial impact in chronic healthcare scenarios. AI can aid custom patient paneling based on clinical preferences, thereby improving the communication ecosystem between the patient and the physician. Moreover, AI-embedded virtual assistants can create patient and caregiver portals tailored for breed-related hallmarks and pan-indication care mapping, the core foundation for caregiver satisfaction and patient engagement. Adaptation and proliferation of AI-driven virtual assistants is evident in care management. Until now, AI-embedded virtual assistants have been effectively utilized for chronic patient disease management. To aid real-time disease management, they are equipped with diagnostic competence and population-level insights, providing therapeutic recommendations based on clinical symptoms, examination findings, laboratory results, and advanced diagnostic modalities produced in real time. AI-based telehealth systems have also been shown to enhance remote diagnosis and offer long-term condition care and prevention. A collaborative approach integrating global data has utilized AI to identify coronary heart disease subtypes informed by their shared genetics and efforts on identifying potential therapeutic targets. AI has also effectively been utilized to draw out hospitalizations pertinent to heart failure by analyzing clinical reports using electronic health record data. AI-embedded remote patient monitoring can facilitate personalized interventions beyond the differential diagnosis, thus fulfilling treatment objectives in chronic diseases such as asthma and chronic kidney disease. Success of such interventions has been reported in both clinical trials and real-world studies.

4.1. Disease Tracking and Monitoring

One way in which AI and related technologies have improved the management of chronic diseases is through more advanced disease tracking and monitoring systems. For most chronic conditions, patients are managed by visiting a primary care provider on routine occasions and, depending on their particular condition, monitor and record important health

parameters themselves, which are shared with their care provider as part of their routine check-up. However, it is increasingly possible to track certain health parameters in real time for various diseases through the use of new health monitoring technologies.

Continuous monitoring technologies refer to devices and platforms that monitor patients by collecting longitudinal data over time, using this data to predict future health events and provide alerts to care providers who can intervene as necessary. AI is typically used in real-time data system learning and personalizing differential health status based on the data currently available. Most often, these are embedded in "wearable" technologies such as watches, rings, or even clothing. Many mobile phone applications designed to support chronic disease management integrate wearable sensor technologies, and an increase in patient-based data collection is expected.

The collection of real-time data provides a number of benefits, foremost of which is the opportunity for timely intervention. Currently, real-time patient data are typically only collected in the case of inpatient hospital and critical care settings, especially in light of the pandemic. Access to accurate patient trend data is also essential for providing proactive care as it allows for the early detection of changes in patient health. Finally, the digitization and analysis of health data can allow organizations to predict trends and respond to epidemics and disasters by understanding what data normally looks like and reacting to spikes or falls in data that could suggest an unusual incidence rate or event. Decreasing disease complications and early interventions aid in improving patient outcomes, decreasing healthcare service usage, and healthcare-related costs. A case study of an AI-driven platform that collects continuous data for severe asthmatic patients and identifies trends in their health data to adapt their medication regimens over time is provided. The technology has been effectively monitoring patient health trends and providing medication adjustments for actively monitored patients and has received positive feedback about patient interest in contributing to further development.

5. AI-Driven Patient Education

In addition to tracking chronic disease and other health-related data, AI technology is useful for enhancing the educational component of chronic disease management. By analyzing patient data for word choice, sentence structure, and paragraph structure based on individual reading comprehension levels, AI can identify existing knowledge of the patient and where

potential knowledge gaps occur. This allows the AI platform to efficiently assimilate correct healthcare-related knowledge to the patient. Several healthcare data platforms incorporate AI for patient engagement and education.

Patient engagement and education are facilitated by interactive and easy-to-use applications developed by healthcare researchers or AI developers. AI-guided learning materials, chatbots, and comprehensive patient educational applications for smartphones and web-based platforms are available to patients or caregivers in multiple formats as a result of substantial research and development by learning specialists, physicians, and software developers. Concurrent with AI-driven platform development, numerous research studies demonstrate the favorable acceptance and efficacy of computer-, web-, and app-aided healthcare education for patients or caregivers. Improved patient and caregiver understanding of chronic disease conditions and wellness support is associated with: a) higher persistent practice of beneficial health and wellness behaviors; and b) higher willingness to adhere to disease exacerbation intervention protocols. As a result, online, app, and AI educational programs that enhance patient electronic synchronized health data collection are being expanded.

5.1. Customized Educational Content

AI's ability is not just providing broad educational materials, but also translating the data learned from individual patients and making recommendations based on their preferences, needs, and learning styles. Having educational training from AI tailored to the individual helped patients remain engaged and learn about their care to a greater extent. This concept has been discussed in a series of publications through a continuous feedback loop, as the system would make a recommendation, see how well that recommendation worked, and then make a new suggestion the next time around. Pilot technologies such as this are fielded throughout the industry across various disease spaces, including multiple industry players and startups, and are being used in health systems with success. Thus, the desire for greater personal health digitally is evident, and tools are still advancing to meet that need. Ultimately, an educated patient should have increased health literacy, resulting in more significant shared decision-making conversations with their provider, and ultimately increased patient satisfaction.

The development of AI algorithms tailored toward patient communication and understanding has been impeded primarily by a lack of standardized inputs that can be used

as a form of outcome to teach the algorithm. Other barriers to education in this space include the regulation of speech through the Health Insurance Portability and Accountability Act and the need to be cognizant of patients' comprehension and disease state in developing context, as some examples, and finally, ensuring ease of access for patients in the educational process. Later generation natural language processing toward developing standardized patient educational tools is taking off. Tools are being utilized in EMRs as Electronic Health Records to put information in a simplified, non-medicalized way that the patient would understand, thus educating them prior to receiving their results. AI in the form of chatbots or help functions to answer technical questions or standard FAQ queries about disease areas has been released. AI continues to revolutionize patient access to the health care system, making it that much easier for patients to learn more about their health and take action.

6. Improving Care Coordination with AI

It is important to encourage close alignment among all care team members engaged in chronic disease management. Wide variation and lack of a completely integrated system are currently the main challenges. Patients receive care from more than one healthcare practitioner, and this requires effective care coordination among the people involved. Communication among practitioners is highly fragmented in most traditional care settings. To ensure the necessary and timely information sharing, a range of barriers and activities must be addressed: (1) mechanisms for capturing health information, (2) accessibility of patient information from disparate systems, (3) communication tools for professionals who do not share the same information technology systems, and (4) the requirements of using these tools for intersecting communication as part of the day-to-day routine. With an AI-driven platform in place, patients can receive whole-person care in an integrated health system rather than a series of fragmented programs focused on changing disease dimensions.

Healthcare providers employ a multi-dimensional approach, considering biological, psychosocial, and environmental determinants that contribute to personal health. AI has created a multi-dimensional care plan; the care team must support efforts to encourage the free-flow of data. The referring provider's encounter note often must schedule an appointment, further detailing specific conditions and patient care desired. Furthermore, patients should also know how they have progressed with this disease and whether they should continue taking the same drugs as prescribed by the subspecialist or if they could stop

them. Both the referring provider and the patients need timely information for decision-making. AI has enabled an interdisciplinary team to manage and track overall health, make informed decisions, and refine the care plan for management, chronic idling, and pediatrics. Nephrology efforts have also demonstrated their efficacy in helping chronic kidney disease patients avoid the need for dialysis. A partnership with a tech company has fostered collaboration and energetic care coordination. A patient with elevated creatinine is diagnosed by the nephrology clinic's AI application. She then sends a note and a prescription to the patient's nurses to call the patient and schedule dialysis.

6.1. Interdisciplinary Communication

Chronic disease management often involves various healthcare professionals collaborating to design and implement a cohesive patient treatment plan. Some disciplines that may be involved in managing chronic disease include general practitioners, dietitians, social workers, physiotherapists, and psychologists. An example of where interdisciplinary collaboration is crucial is in diabetes management, where a person's treatment plan may require consultation with numerous specialists, including endocrinologists, ophthalmologists, podiatrists, diabetes educators, and exercise physiologists. One way that AI can assist is through the facilitation of interdisciplinary communication, helping various healthcare professionals work together to provide patients with the greatest possible care.

AI-driven technologies have the potential to break down the traditional silos of patient information, making it more readily accessible across multiple healthcare professionals. This practice can potentially enhance the treatment plan generation process through improved information gathering. Communication is an indirect patient-centered attribute where solving silo issues is a prime opportunity for patient health information system developers. Therefore, patient health information can foster improved relations between health professional colleagues, resulting in the patient's total health picture being attended to, thereby enhancing collaboration and teamwork. Furthermore, patient care can be enhanced through the implementation of patient health information solutions that can extract meaning across accumulated knowledge between health practitioners in multiple, otherwise dispersed, healthcare environments. Combining knowledge of providers in chronic patient care can lead to enhanced care coordination solutions. Additionally, AI might be used to suggest suitable locations to retire possessions or assist in understanding the significance of specialists' reports.

It could be used to aid in counseling individuals and family members using advanced techniques in psychology, ranging from interpreting emotional tone in natural language to actual cross-space counseling. In healthcare, advances in artificial intelligence can facilitate the counseling, learning, and communication of individuals representing the medical model in relationships with individuals representing the psychological role. These advances could include shared modes of sensible communication, as well as enhanced ways of assisting the adoption of ideas from two different psychological models. This may be particularly effective for families with a shared member with chronic disease or managing chronic diseases that have comorbidity on the psychological health of the individual involved. AI techniques may also be useful to plan and conduct interdisciplinary communication and interventions within multidisciplinary teams to align other team members with members from one discipline. These activities may also involve the medical family therapy team. Additionally, an AI-driven platform can drive collaboration between technology institutions focused on technological innovation and healthcare institutions focused primarily on the delivery of medical and healthcare programs. Incorporating technologies such as AI and machine learning into electronic health records may support a complete end-to-end data scientist/patient care team view and may one day contribute toward the ability to create dashboards that reflect the activities of the electronic team across and within a healthcare setting.

7. Challenges and Future Directions

The integration of AI tools can potentially improve chronic disease management. However, the tasks associated with the extraction of relevant features and analysis of increasing data collection and storage are challenges that need to be addressed. Additionally, AI tools should be customizable to different patient populations and must be secure and compliant with data privacy regulations. Some critical factors associated with predicting disease severity can introduce biases in AI models and should be assessed and counteracted. As such, AI solutions must be developed, validated, and used in a clear regulatory framework to ensure both quality and safety. In summary, the integration of AI-driven tools in healthcare can support different tasks, including patient education, workup and diagnosis, personalized planning, coordinated care, and outcome measurement. Nonetheless, some challenges must be addressed, such as the quality of the available technological infrastructure, as well as patient-related issues and privacy. Future work should therefore adopt a patient-centric approach to the development of technology. Collaboration among healthcare stakeholders, technological

developers, and policymakers should be agreed upon and established. Some pioneering work has been done in AI research and application in digital medicine, novel technological solutions for data collection, optimization of combined therapy in chronic disease, disease prevention, and decision support systems. Thus, efforts in multidisciplinary research and development must be collectively strengthened. Chronic diseases are responsible for the highest death rates worldwide, as well as a significant burden on healthcare systems. Successful chronic disease management would lead to improved patient quality of life and a much less overstrained healthcare system. However, important challenges impede the implementation of effective disease management processes in healthcare. First, the global infrastructure for disease data collection and reporting lacks real-time integration. As a result, vital real-world data is collected and stored in different hospital servers, individual laboratories, or health registries in separate countries or even continents. Finally, national health authorities should influence the innovation landscape of AI-driven disease management. Stakeholder engagement in an open dialogue is fundamental to address these challenges meaningfully. The global chronic disease pandemic is reaching uncontrollable levels, and providing safe and effective management has a direct impact on the overall balance of healthcare services. A proactive AI and chronic disease approach can thus create several benefits for embedded patients in communities and in the healthcare ecosystem.

7.1. Ethical Considerations in AI-Driven Healthcare

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With great potential comes great responsibility. The use of AI for healthcare purposes brings a number of ethical considerations in its wake, predominantly related to the nature and use of data, consent, and transparency. AI contributes to developing a more personalized and patient-centered approach in medicine, but being heavily data-driven, AI algorithms need access to raw data to use in the prediction of an outcome. This may include electronic health records, databases of medical procedures, and medical images. In the context of chronic diseases, this also means tracking the patient's health behavior and their vital functions through an increasingly wide portfolio of smart devices that enable tracking of heart rhythm, blood pressure, weight, temperature, and oxygen levels in the blood, to name but a few. Ensuring proper informed consent from patients and stakeholders is thus crucial.

Furthermore, biases in AI algorithms, with the potential to treat patients differently, may often be an issue. Biases could occur in the creation of a dataset and in the programming of the algorithm. Related to this is the requirement for transparency: patients should be informed about which computational methods are being applied to their data, how results are generated, who is monitoring and using the algorithms, and with whom the results may be shared. The right to use AI should thus be based on ethical principles related to both data and algorithmic management, whether AI focuses on clinical purposes, patient education, care delivery and management, or institutional responsibilities. In the healthcare sector, the fact that healthcare professionals are liable for AI predictions must also be taken into account. Delegating an ever-increasing number of tasks to AI tools should not make healthcare professionals lose sight of the importance of their professional judgment and decision-making.

There is ongoing debate between high-level stakeholders on a number of ethical topics essential to the development of ethical guidelines for AI in healthcare to protect fundamental human rights and promote more inclusive access. The next subsections will focus on the potential, the barriers, and high-level guidelines to ensure responsible use of AI in healthcare and to ensure access to personalized data, algorithms, and related results to facilitate compliance with ethical principles, even when AI is involved. Ethical aspects are essential for the development and wide implementation of effective, ethically aligned, and fair AI-based solutions, and guidelines cannot be disregarded when the creation and use of predictive models by AI algorithms are taking place. How to ensure fair, unbiased, and transparent use of the data for important use cases, such as the increasing number of AI systems employed for diagnosis or treatment of chronic diseases, poses a number of ethical and privacy-related questions that are yet to be addressed in detail.

8. Conclusion

As we have demonstrated through an in-depth discussion of three AI-driven platforms, machine learning technologies hold great promise in enhancing current practices in chronic disease management. Data analytics can provide a more connected view of the pathways between social determinants of health and outcomes to enhance tracking systems. Educational research is informing how patient education can be designed to lead to behavior change and better adherence if delivered with a focus on emotional and contextual relevance. Finally,

interdisciplinary collaboration strengthens the design of care coordinating technologies that span beyond a single intervention. Importantly, digital health is hopefully aiding longstanding issues in patient outcomes within chronic disease management and not simply monopolizing conversation and resources.

Even if solutions such as those we present do not meet the highest standards of current literature, they may lead to innovative forms, and, given the challenges of chronic disease described in the Introduction, need to be the subjects of ongoing investigation. Interdisciplinary collaboration and a focus on mixed methods and measurement that reflect patient and provider experience should be a priority in future work.

Importantly, protecting already vulnerable patient groups from potential exploitation via AI is essential, and thus the development of an interdisciplinary ethical framework for medicine and technology is crucial. The discussions of these innovative platforms provide a fresh account of the potential of AI-driven technologies to improve the tracking of chronic diseases, deliver patient education, and enhance patient pathways and coordination of care.

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