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The Role of Artificial Intelligence in Parkinson's Disease: Clinical Applications and Social Implications

K. Maheswari[1], Uma Sundaresan[2*], Kavitha Manivannan[3], Chinnadurai Periyasamy[4]

[1]*Assistant Professor, Department of Social Work, Bharathidasan University, Khajamalai Campus, India*
[2]*Sigma Biocore Innovations, Ambur, Tamil Nadu, India*
[3]*Al Shumookh Integrated Services, Shahaniya, Qatar*
[4]*Assistant Professor, Department of Social Work, School of Liberal Studies, CMR University, Bangalore, India*

Abstract

Aim: The purpose of this review is to determine the value of artificial intelligence in clinical management of Parkinson's disease using its application in diagnostic support, disease monitoring, treatment optimisation, and a description of the socioeconomic consequences.

Study Design: This research paper uses a narrative review design, relying on peer-reviewed literature.

Methodology: The literature review was conducted as a narrative review and analysed using peer-reviewed articles on artificial intelligence, machine learning, and the development of digital health solutions for the management of Parkinson's disease. The literature focused on AI-based diagnostic systems, symptom-monitoring tools, therapeutic optimisation plans, and impacts at the health system level was located, examined, and synthesised to present a comprehensive overview of the available evidence.

Result: The results suggest that AI-based technologies can be used to enhance early diagnosis, enable continuous and objective monitoring of motor and non-motor symptoms, assist in the preparation of personalised treatments and digital rehabilitation methods. In addition to clinical advantages, AI applications can promote access to care, reduce unnecessary hospital visits, affect workers' roles in the healthcare sector, and improve patients' quality of life. Nonetheless, issues related to data quality, algorithmic transparency, ethics, regulations, and health equity remain major obstacles to broad clinical use.

Conclusion: Artificial intelligence is a promising technology in the Pd management, and it could change clinical practice and enhance the efficiency of the health system. It will be necessary to pay attention to ethical, regulatory, and socioeconomic aspects and guarantee ethical, fair, and efficient implementation of AI technologies into daily clinical processes.

Keywords: Artificial intelligence, Clinical innovation, Digital medicine, Parkinson's disease, socioeconomic impact

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Introduction

On the global level, the second most prevalent neurodegenerative disorders and a major case of Parkinson's disease (PD) continue to be a growing burden to individuals. It is estimated that the population is over ten million [1]

* **CONTACT:** umalakshmibio@gmail.com
DOI: https://doi.org/10.57125/FEM.2026.03.30.05

and the level is likely to increase significantly because of the ageing population. The clinical features of PD include typical motor symptoms that include a tremor at rest, muscle rigidity, bradykinesia and instability. Besides these motor characteristics, non-motor manifestations, such as the impaired cognitive functions, depression, anxiety, sleep disturbances, and autonomic dysfunction should be distinguished among the most common manifestations of the disease, and all of them are the heavy burden on the quality of life [2] The significant heterogeneity of the clinical manifestation of the disease is predetermined by the great variety of manifestations of the disease and the change of the course of the disease.

However, the diagnosis and surveillance of Parkinson's disease is not straightforward despite the advancement witnessed in the study of the neurology field. Any subjective rating scale, like the Unified Parkinson's Disease Rating Scale, has played an important role in clinical evaluation of the patient, and it includes patient history, neurological examination and subjective rating. The techniques might not be quite sensitive to small or imminent changes, especially at the prodrome phase when neurodegeneration has already occurred but no classical motor symptoms can be detected at the time [3]. In addition to that, the nonlinear development of the disease in most cases can be predisposed by personal factors, and this makes it hard to track it in a conventional manner. Thus, the ineffectiveness of the diagnoses and the treatment replacement are typical of the usual clinical practice.

In this respect, artificial intelligence has become a game-changer in the contemporary healthcare sphere and the most important feature of futuristic medicine. The various computational tools that can be applied to analyse large, complex, and high-dimensional data are machine learning and deep learning, owing to AI. These technologies may be especially applied in the neurological conditions, including Parkinson's disease, where the data is produced by different sources, including neuroimaging, wearable sensors, speech, recordings, electronic health records, and patient-reported outcomes[4]. The AI systems are able to identify trends that the human eye may not recognise, as well as provide a chance to identify the disease at an earlier stage, classify the diseases in a more efficient way and predict the disease progression more efficiently. There are numerous fields of application of AI in the field of Parkinson's disease. To support the differentiation of PD among other movement disorders with the data provided by the imaging and speech, support systems have also been designed [5]. The objective results of motor variability and response to treatment can be achieved through the round-the-clock monitoring of the symptoms in the real world with AI analytics and wearable technology usage [6]. It is also the analysis of employing AI-driven decision support tools to optimise pharmacological therapy and make recommendations about complex interventions like deep-brain stimulation [7]. It should be noted that there is an implication of AI on the clinical outcome of PD. These technologies bring transformation in the access to care, the cost models, the employee scheduling, and the patient/caregiver experiences. It could be better served by using remote monitoring and telemedicine with the help of AI to access specialist services in underserved areas and also to diminish the use of healthcare and healthcare costs [8]. Meanwhile, the issues, which could be associated with the confidentiality of the data, prejudice of algorithms, and disparities associated with the digital world, raise grave ethical and social concerns.

Artificial intelligence has developed to be one of the largest sources of change in the field of modern medicine, and it influences disease diagnosis, monitoring, and treatment procedures. One can also define AI as computational systems capable of learning with data and extrapolating complex patterns, and also assisting in making decisions. Such abilities will be more applicable in the healthcare sector because the quantity and volume of clinical, imaging, and biological information that is generated within their regular routine is only growing [8]. One of the most significant contributions of AI to the analysis of high-dimensional and heterogeneous data is its ability to analyse. The algorithms of machine learning and deep learning can bring together the data about the electronic health data, medical records and wearable sensors to generate clinically relevant data. It will be possible to diagnose a disease at an earlier stage, diagnose it more accurately, and better predict the risk than the effect of conventional analysis approaches [4].

AI has also revolutionised diagnostic medicine, especially imaging medicine, such as radiology and pathology. Deep learning models have also performed well in image interpretation and can minimise variability in observers and can guide clinicians to detect diagnoses on a timely and consistent basis [9]. Besides diagnostics, AI may be employed to support personalised medicine by identifying the patient-specific patterns which can be utilised to make a treatment choice and forecast the reaction to the treatment. At the systems level, the AI can assist in realising the efficiency of healthcare using predictive analytics, workflow optimisation, and population health management. These applications help the health systems to meet the rising demand by patients and the increasing costs. However, such critical problems must be considered as data quality, transparency, bias, and ethical governance issues [10]. These are just some of the issues that should be dealt with to make sure that AI is incorporated into the medical practice in a responsible and just way. Socioeconomic status is recognised as a contributing factor in the development of Parkinson's disease with adaptable and non-adaptable risk factors. Though socioeconomic influence data is scarce, various reviews confirm that AI's diagnostic accuracy has improved [11].

Research Problem

The issue of the successful diagnosis and treatment of Parkinson's disease remains difficult due to the fact that it is a progressive disease, and the symptoms can vary significantly among people. The current clinical measures are highly dependent on subjective rating scales and regular measures and therefore would not be capable of detecting early or insidious changes in disease status. The limitations are especially evident in the early phases when the brain damage has already taken place, and the motor symptoms have not been manifested yet. Besides, the differences in the evolution of the disease make the adaptation of the treatment more difficult. Although the new technologies may be resolving the problem, their clinical utility, ethics, and their impact on society at large should be taken into consideration.

Research Focus

The study concentrates on the analysis of the application of artificial intelligence-related tools in the diagnosis, monitoring, and management of Parkinson's disease. It examines how neuroimaging, wearable sensors, analysis of speech, and clinical records can be used to assist in the earlier detection, monitoring of the symptoms, and tailoring treatment plans. Besides being applied in clinical practices, the research paper will look at the overall impact of such technologies on the provision of health care, patient and caregiver experiences, access to specialist care, and the ethical and socioeconomic issues.

Research Aim and Research Questions

This review is intended to focus on the purpose of analysing the role of artificial intelligence in managing Parkinson's disease and, specifically, focusing on clinical uses and socioeconomic consequences. The review attempts to assess the role of AI-based tools in changing diagnosis, monitoring, and treatment, as well as the effects of AI tools on healthcare systems and society.

1 What is the evidence of the current application of artificial intelligence in the diagnosis, monitoring, and treatment of Parkinson's disease?
2 What are the clinical advantages of AI-based technologies in enhancing patient outcomes and disease management?
3 What are the implications of artificial intelligence use in the care of people with Parkinsonism as far as access to healthcare services, their costs, and workforce features?
4 Which ethical, social, and equity-related issues are related to the implementation of AI in the management of Parkinson's disease?

Literature Review

Parkinson's disease is a progressive neurodegenerative condition posing a significant clinical and socioeconomic burden to the affected individuals and the healthcare systems among global societies [12, 13]. The prevalence of PD in the world keeps climbing, especially because of the ageing of the population and early diagnosis and proper management over a long period can play a vital role in curbing this challenge [14, 15]. The disease presents clinically with motor and non-motor symptoms with cognitive impairment, mood disorder and autonomic dysfunction usually playing a major role in diminishing the quality of life [16, 17]. The existing methods of diagnosing and monitoring are mainly based on clinical observation and standardised rating scales like the Unified Parkinson's Disease Rating Scale [18]. Although these tools are still necessary in clinical practice, they are subjective and might fail to effectively detect changes early in the disease or the daily changes in symptoms [19,20]. This especially poses a problem in the prodromal stage, when neurodegeneration is already observed, but the classical motor manifestations have not yet been revealed [21].

Recent research has analysed information-led solutions to enhance the diagnostic accuracy and disease surveillance. The neuroimaging-based analyses have already shown the potential in differentiating between Parkinson's disease and other movement disorders and also in determining disease-related patterns that cannot be detected during visual assessment [22]. In the same way, the speech, gait, and movement were also examined as relevant and non-invasive disease severity and progression markers [23, 24]. The technologies of wearable sensors allow continuous and real-world sensor monitoring of motor symptoms, which give objective data on tremor, bradykinesia, and response to treatment over time [25, 26]. These techniques are superior to periodic clinical evaluation because they help to record the fluctuations which are not present within a clinic area. Moreover, decision-support systems have been researched in order to optimise the medication regimen and to support advanced treatments like deep brain stimulation, especially in patients with a complex pattern of symptoms [27,28]. In addition to clinical outcomes, the literature is becoming more focused on the overall effect of digital and computational tools on healthcare delivery. Remote monitoring and telemedicine have been linked to better access to specialist care, particularly in underserved or rural regions and potentially less healthcare use and healthcare expenditures [21,15]. Nevertheless, issues of ethics and social aspects are still at the forefront, such as privacy of information, transparency of algorithms, bias possibilities, and unequal access to digital health technologies [29-31]. Such issues underscore the need to conduct responsible implementation that would make technological advances help in providing equitable and patient-centred care of Parkinson's disease.

Research Methodology

In order to increase the transparency and reproducibility, this review was carried out as per the Preferred Reporting Items of the systematic reviews. The purpose was to conduct a systematic search, filter, and summarise the available literature that analysed artificial intelligence in clinical medicine and its impacts in general.

Literature Search

A thorough literature review was conducted in the electronic databases such as PubMed, Scopus, Web of Science, and Google Scholar. The search strategy was a combination of controlled vocabulary and free-text terms in the field of artificial intelligence and healthcare, and included such terms as: artificial intelligence, machine learning, deep learning, clinical decision support, medical diagnosis, and Parkinson's disease. Articles that were published in English were restricted to searches. Manual screening of reference lists of eligible studies was performed to identify new relevant publications.

Selection Criteria

Prior to the selection of studies, there were some eligibility criteria. Included studies were peer-reviewed articles that studied the use of artificial intelligence in healthcare, such as diagnostic, monitoring, therapeutic, or health system-level interventions. Original research articles, review articles and pertinent observational studies were taken into consideration. The exclusion criteria were that the studies were not in medical or clinical applications, had insufficient specification of methods used, or were conference abstracts, editorials, or non-peer-reviewed articles.

Data Extraction

The independent data extraction using a standardised method was carried out based on each of the included studies. The extracted information contained author(s), year of publication, study design, clinical scenario, sources of data, the type of artificial intelligence method used, the major outcomes, and ethical or socioeconomic considerations reported. Information discrepancies found were addressed by reading the original articles carefully.

Data Synthesis

The synthesised studies were based on a qualitative approach to synthesis through a narrative approach. The results were presented in thematic groups, such as diagnostic uses, monitoring of diseases, individualised treatment plans, effects on the healthcare system, and moral and social implications. The selection of the studies was documented using a PRISMA flow diagram following a process that included identification of the studies, screening of the studies, eligibility and ultimate inclusion.

Research Results

The study selection and literature search process led to the inclusion of 35 peer-reviewed articles that investigated the use of artificial intelligence in Parkinson's disease. The studies included in the work covered a broad area of clinical and healthcare issues, such as diagnosis, symptom monitoring, treatment optimisation, rehabilitation, and social implications in general. A significant percentage of the articles discussed diagnostic uses, especially the utilisation of imaging information, speech-based and movement-based features to assist in the early and differential diagnosis of Parkinson's disease. These studies all found enhanced diagnostic accuracy in comparison with traditional clinical assessment, in particular between Parkinson's disease and other movement disorders. Some studies assessed AI-based surveillance devices based on wearable devices and mobile technologies. The techniques allowed for the constant, real-life evaluation of motor symptoms like tremor, bradykinesia and gait abnormalities, and treatment-related variability. The results indicated that ongoing monitoring offered more objective and sensitive data on the progression of the disease as compared to periodic clinic-based testing.

Research on the subject of optimisation of treatment highlighted how AI-driven decision-support tools may help in the process of medication adjustment and guide more complex interventions, including deep-brain stimulation. It was reported that personalised treatment models enhanced the process of symptom control and reduced the negative effects by considering individual differences in disease progression and treatment response. In addition to clinical outcomes, an increasing body of literature covers the social consequences of artificial intelligence in the management of PD. Examples of reported benefits were the ability to make better use of specialist services by remote monitoring and telemedicine, decreased use of healthcare, and increased engagement of patients. Nevertheless, the difficulties concerning data privacy, algorithmic bias, unequal access to digital technologies, and ethical governance were also observed in several studies and the necessity to implement these kinds of tools in a responsible and fair way.

Clinical Innovation Enabled by AI in Parkinson's disease

AI-Assisted Diagnosis and Early Detection

Another tool that has emerged due to artificial intelligence is the enhancement in early detection of Parkinson's disease, a condition that has only been detected when the disease has caused significant loss of neurons. The consistency of traditional diagnosis has depended on the clinical analysis and observation of symptoms, which could be subjective and may not detect the subtle changes at early stages. The AI-supported methods can overcome these shortcomings as they allow examining the complex biological and behavioural data with a higher degree of accuracy.

Diagnostic models of AI worked with data to separate Parkinson's disease from healthy and other movement disorders (Figure 1). Short high-dimensional imaging datasets (MRI and PET scans) can be processed using machine learning and deep learning techniques to detect subtle structural and functional brain alterations that would not be readily detectable using traditional analysis methods. Pereira et al. (2019) [5] proved that these models are capable of detecting initial changes in brain networks related to motor and non-motor symptoms, and this may be used to diagnose before apparent clinical signs emerge. It is especially important to detect it in the early stages when it is possible to open up to early intervention and closer observation of disease development. Also, in addition to imaging, the use of speech and voice analysis is now a recognised, practical and non-invasive procedure in diagnosis. Parkinson's disease is known to influence the vocal control, and this causes alteration in the pitch, the intensity of voice, articulation, and the rhythm of speech, even at the early stages. According to AI algorithms, it is possible to analyse acoustic characteristics of short voice recordings and identify patterns of dysphonia and minor speech abnormalities linked to the disease. Little et al. (2009)[32] demonstrated that voice measurements alone could be used to distinguish people with Parkinson's disease and healthy controls who had been trained on a machine learning model. The method is particularly useful in remote screening, large-scale studies on populations, and longitudinal surveillance, since little equipment is needed and can be readily embedded into the telemedicine infrastructure. AI-assisted diagnosis and early detection are a big clinical innovation in the treatment of PD. Using neuroimaging data as a base along with speech-based biomarkers and other digital data, AI potentially can enhance the precision of analysis, decrease the time delay in diagnosis, and aid in prompt and personalised clinical decision-making [33].

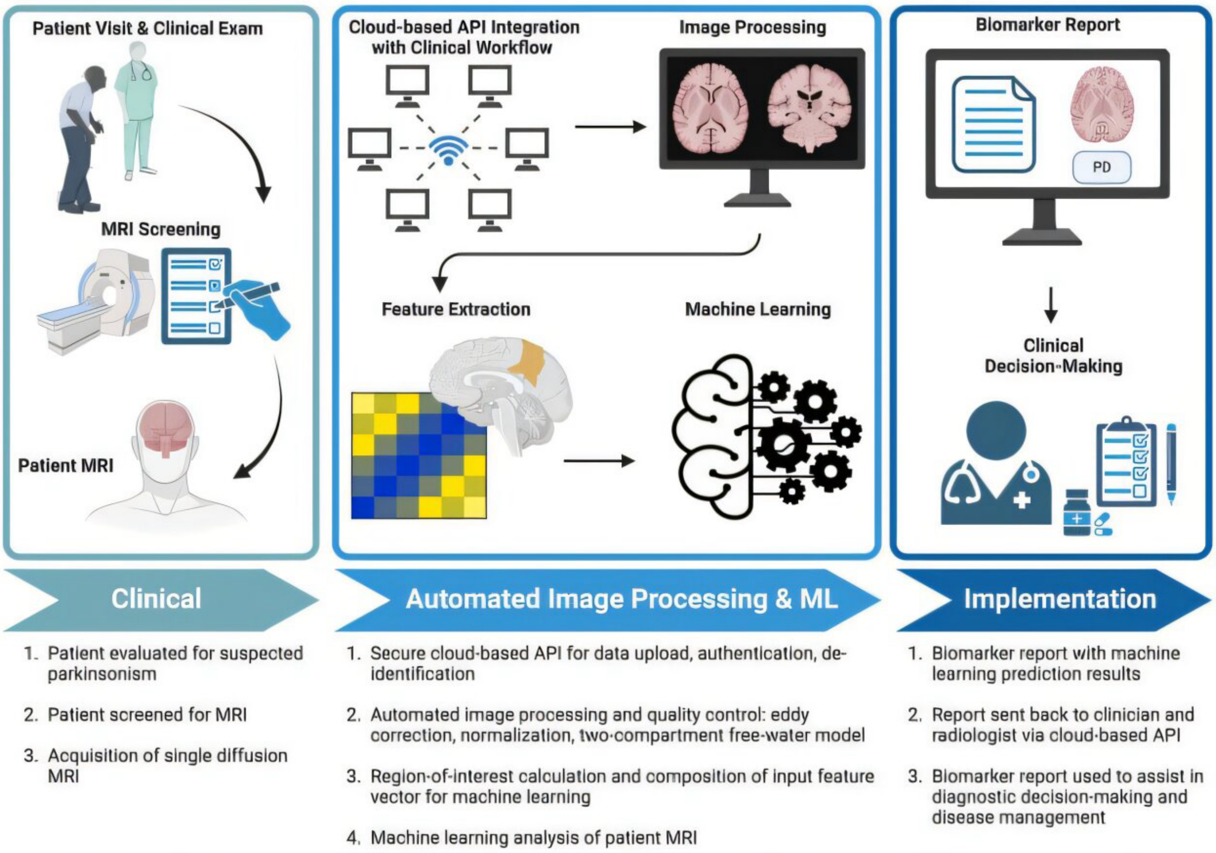

Figure 1. Artificial Intelligence-Enabled Workflow for MRI-Based Diagnosis and Clinical Decision Support in Parkinson's *disease*

Disease Monitoring and Progression Analysis

Wearable sensors with artificial intelligence can be used to conduct continuous objective observation of motor symptoms indicative of Parkinson's disease, including tremor, gait instability, and bradykinesia. These devices record their daily activity and use AI algorithms to compute the movement data in real time in order to identify the slightest variants of the symptoms and the progression patterns [6]. The techniques provide a clearer description of the severity of such a disease than the clinical assessments performed on an ad-hoc basis. By reducing the number of frequent hospital visits, AI-based monitoring will help make timely changes to treatment and be proactive in managing the disease. Particularly, it is a beneficial technology in patients with mobility limitations, which can be implemented to promote individualised care and improved clinical outcomes in the long term.

Treatment Optimisation and Precision Care

AI-driven predictive models can be helpful in the improvement of pharmacological therapy based on the response pattern and the prediction of adverse reactions such as dyskinesia [7]. To support the deep brain stimulation planning, AI helps to enhance the target localisation and the parameter adjustment in the advanced Parkinson's disease, which supports the precision medicine approach, allowing a customised treatment plan to be developed, leading to better treatment outcomes and minimised complications.

Digital Rehabilitation and Supportive Technologies

Artificial intelligence-based rehabilitation programs have emerged as a valuable addition to the traditional methods of managing Parkinson's disease, as they contribute to physiotherapy, speech therapy, and cognitive training digitally. These platforms apply the machine learning concept to customise the rehabilitation programs based on the needs of the individual patients, the severity of the disease, and the performance over time. Virtual coaching systems can be modified dynamically to include real-time direction and adaptive feedback provided by the system; the exercises are made to be adjusted as per patient response. AI-based rehabilitation devices can enhance patient engagement and adherence by providing individualised therapy sessions that are organised and not within the clinical context, and thus supplement the usual in-person care [34, 35]. Motor and non-motor signs that manifest in PD can be very difficult to address through long-term and regular rehabilitation treatment, as there may not be access to a specialised therapist, and frequent hospital visits are heavy. The solution to such problems offered by AI-enabled platforms is that they allow home-based therapy and ensure clinical supervision. Individual modules, such as speech therapy, can be used to analyse the vocal intensity and articulation patterns and provide instant feedback to enable patients to enhance communication skills. On the same note, cognitive training applications have the ability to adjust the task difficulty according to performance by the user, aiding attention, memory and executive functioning.

Socioeconomic Implications of AI in Parkinson's disease

Economic Burden and Cost Containment

The chronic and progressive nature of Parkinson's disease is a very great economic burden to the patients and their families and healthcare systems (Figure 2). The long-term pharmacological treatment, the repetitive clinical visits, the hospitalisation, and the rehabilitation services are direct costs, and the loss of productivity, the early retirement, and the increasing reliance of informal caregivers are the indirect costs. Since it is proven that the number of people with Parkinson's disease is continuously increasing in the world [1], it is possible to predict the scale of its financial impact on health organisations, which are only bound to increase as ageing populations continue to age. The artificial intelligence applied in the management of Parkinson's disease gives potential measures that can be employed in cost containment. The interventions that are made at earlier stages of the disease due to the early diagnosis of illness by AI can culminate in the disease slowing down and delaying the onset of the disability. Additionally, remote monitoring and telehealth technology care models will enable one to visit the healthcare facilities and hospitals less often and avoid an overload of the health sector in reaction to acute symptoms, as they will assist in monitoring them regularly and providing clinical care in a timely manner. These types of strategies can decrease the medical expenditure in the long run, making care and patient outcomes more efficient. Regardless of such potential benefits, AI technologies do not bring their issues. The upfront costs of AI infrastructure, data management systems, and workforce training may be costly. These financial barriers are particularly significant in low- and middle-income healthcare systems, since the resources are limited and unevenly distributed regarding digital infrastructure and may act as barriers to mass adoption. Such differences will be required to cope with the ability to attain the economic value of AI in treating Parkinson's fairly.

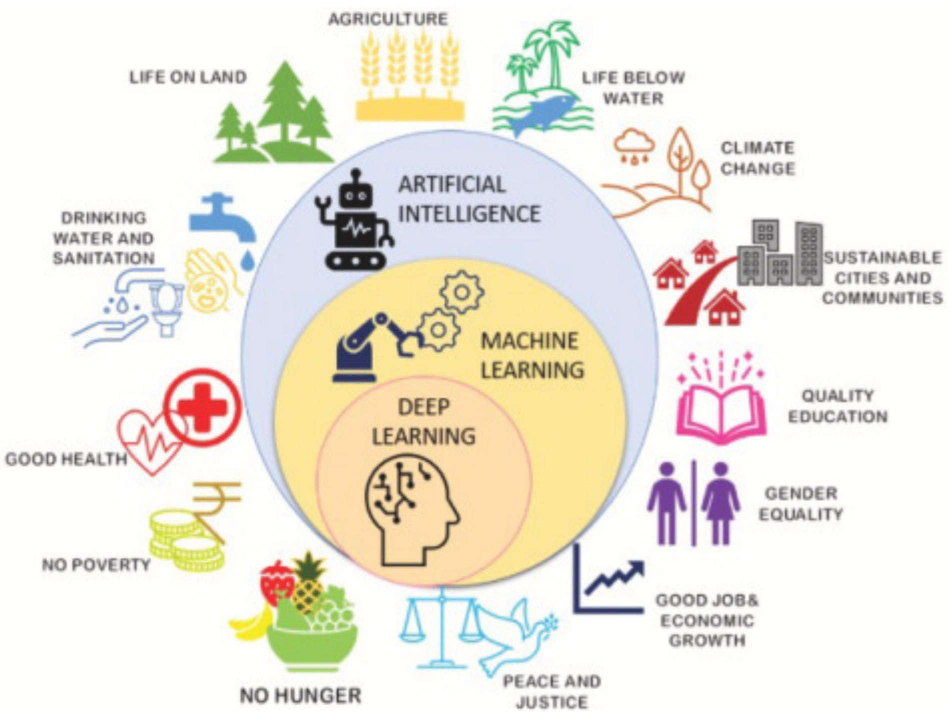

Figure 2. AI and Machine Learning [36-38]

Access to Care, Health Equity, and Workforce and Caregiver Dynamics

Artificial intelligence applications in the operation of Parkinson's disease have a far-reaching impact on the accessibility of health, inequalities and the location of the health practitioners, as well as the care. Examples of AI-based tools that can be used to facilitate access to specialist care among patients in rural or underserved settings include telemedicine platforms, remote monitoring tools, and digital rehabilitation software. These technologies help get rid of geographic and socioeconomic inequalities in care provision and help to provide more equal care to different populations by reducing the necessity to travel on a regular basis and maintain face-to-face consultations.

Concerning the workforce angle, AI can stream clinical operations and automate the normal analysis of data, symptom monitoring, and recording. This will reduce the number of patients that clinicians will be attending to and allow healthcare providers to focus more on complex decision-making and patient-centred care. Still, it should be put correctly into practice and educate the clinicians to be digitally literate and trust the outcomes of the AI-based technology. Without suitable training and institutionalisation, the benefits of AI will not be realised. The caregivers are also in the centre stage when managing the disease of Parkinson's, in which they tend to experience physical strain, emotional strain, and financial strain. Some of the pressures that caregivers face can be alleviated with the aid of monitoring and digital assistance technologies founded on AI, as they will signal about timely care, organise the care delivery, and enhance communication with medical staff. In the meantime, the accessibility of digital devices and technological literacy may be a restrictive circumstance to the range of families that could be addressed with these solutions. The gaps in infrastructure, affordability, and user-friendly design that will facilitate the use of AI-driven innovations to promote access to health, health equity, and support the healthcare workforce, in addition to caregivers, in treating PD, will be significant to address[39,40].

Ethical, Legal, and Governance Considerations

The ethical issues that have been brought up in connection to the application of artificial intelligence in the management of Parkinson's disease will be considered data privacy, bias of algorithms, transparency and accountability as the most crucial issues. The question of data security, informed consent, and the correct data sharing actions can be doubted with references to the huge amounts of sensitive patient data that AI systems will inevitably get. It is based on this that there is a need to ensure that the personal health information is safeguarded so as to retain trust and compliance of patients with ethical and legal practice. The other significant issue is the case of algorithmic bias, especially in situations where the sample of data upon which AI models are being trained is not necessarily representative of the entire population of people with PD. It describes that the existence of bias or insufficient data may lead to unequal diagnostic accuracy and treatment recommendations for the various groups of people and may worsen the already existing health disparities. This form of discrimination will be detrimental to the dependent patients, depending on age, gender, ethnicity, or socioeconomic status, if they are not adequately represented in the training data. The notions of transparency and accountability are also important because, in most systems, an AI-based algorithm is a black box, and clinicians and patients cannot comprehend how such decisions are made. Such an inability to explain and, in case of making mistakes, may hamper clinical trust and responsibility. To overcome these issues, one will have to design an effective regulatory framework and explainable AI models, multidisciplinary control, a team of clinicians, data scientists, ethicists, and policymakers, which will foster the successful and trustworthy introduction of AI into the clinical practice of Parkinson's disease.

Future Directions

Further research in the field of Parkinson's disease should be focused on the improvement of the methodological and practical grounds of artificial intelligence applications. One of the priorities includes the multimodal data integration consisting of the clinical history, neuroimaging outcomes, genetic data and behavioural. It is possible that the combination of these heterogeneous sources of data can deliver further information about how the diseases work, and the quality of prediction models that will work in the framework of diagnosis, progression, and reaction to therapy. More personalised care strategies can also be promoted with the help of such integrative strategies.

Above technical finesse, huge scale and multicentre validation research are obligatory. Many current studies lack large or single-centre data, and this decreases the extrapolatability of findings. The broader validation of the other groups of people and various environments in the health care will help ensure that AI tools can consistently and reliably perform in actual practice in the clinical setting. It is particularly needed in terms of reducing prejudice and its applicability to different demographic and socioeconomic groups. To socioeconomic assessment and implementation science. Such factors as cost-efficiency, infrastructural dementedness, and labour preparedness will require evaluation towards sustainable adoption. The research discipline should abandon evidence-of-concept experiments and the necessity to argue how the AI solutions can be integrated into the existing healthcare systems, particularly in resource-limited facilities. The transfer of technological innovation into practical and sustainable changes in the management of Parkinson's disease will be heavily involved in the emphasis on practical change.

Conclusion

Artificial intelligence is revolutionising the sphere of Parkinson's disease care as it helps detect the disease when it is still young, gives a personalised treatment plan, and tracks the patient at home. Through its ability to deliver high-quality data analysis, AI will enable clinicians to discover hidden trends of disease, treat patients more efficiently based on available patient information, and comprehend the temporal dynamics of symptoms. These innovations may be used to enhance clinical outcomes and boost patient interaction and autonomy. Besides its clinical benefits, there are socioeconomic implications of AI-based methods. Remote monitoring and early diagnosis have the potential to reduce long-term healthcare spending because they delay the disability caused by a disease, as well as reduce unnecessary visits to the hospital. In the meantime, the quality of life of the patient and the burden on the family members can be enhanced as a result of the augmented access to digital health tools. However, a range of questions related to the aspects of information security, equity, infrastructure, and workforce readiness will also need to be taken into account in detail. Artificial intelligence is a great contribution to providing sustainable, high-quality care to patients with Parkinson disease and responsible integration of artificial intelligence with ethical, regulatory, and clinical frameworks

Declarations

Author Contributions

Conceptualisation, US and KM.; methodology, KM.; writing—US, X.X.; US&KM, CP visualisation, US. Supervision, KM.; project administration, CP. All authors have read and agreed to the published version of the manuscript.

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Conflict of interest

None.

Data availability

Not applicable.

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