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# **The Role of Artificial Intelligence in Enhancing Nursing Practices for Chronic Disease Management in Geriatric Care: A Systematic Review**

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**ABSTRACT:** The surge in the global geriatric population has led to significant healthcare challenges, particularly in managing chronic diseases prevalent in older adults. This systematic review examines the role of Artificial Intelligence (AI) in nursing for enhancing chronic disease care among the elderly. Focusing on AI techniques, such as Machine Learning (ML) and Deep Learning (DL), this study evaluates AI's potential to improve disease diagnosis, patient monitoring, and treatment personalization. It highlights the contributions of AI in assisting nurses with data analysis, predictive modeling, and decision-making, which collectively elevate the quality of care for geriatric patients. The review also addresses the limitations in current AI applications, emphasizing threats to validity due to technological and disease-focus biases and the challenges in data quality and interpretability. Furthermore, it discusses future directions, advocating for explainable AI (XAI) to improve transparency and trust in clinical settings. This study underscores the transformative potential of AI in geriatric nursing, aiming to enhance patient outcomes through informed, data-driven approaches in chronic disease management.

## **I. INTRODUCTION**

As we navigate through the complexities of modern society, one of the most pressing issues we face is the unprecedented increase in the population of older adults, which presents a myriad of challenges for healthcare systems around the globe. This demographic shift is characterized by a rapidly growing segment of the population aged 65 and older, who are more likely to suffer from chronic diseases such as diabetes, heart disease, arthritis, and dementia. These conditions are not only prevalent but often multifaceted, requiring intricate long-term management and comprehensive care strategies that extend far beyond simple medical interventions. The burden of chronic diseases is substantial, impacting not only the patients who live with these conditions but also their families, caregivers, and the healthcare providers tasked with their care. In this context, the complexities of managing chronic diseases often result in increased healthcare costs, strained resources, and a heightened demand for skilled professionals equipped to address the needs of this vulnerable population.

Nurses, as frontline healthcare professionals, are pivotal in addressing the challenges posed by chronic diseases in older adults. They provide holistic care that encompasses not just the physical health of their patients, but also their emotional, psychological, and social well-being. This multifaceted approach is essential, as many older adults experience a decline in their overall health, which can be exacerbated by social isolation, cognitive decline, and the challenges of managing multiple chronic conditions simultaneously. Nurses are often the first point of contact for patients and are responsible for assessing their needs, developing care plans, and coordinating interventions that are tailored to the individual. Their extensive training and patient-centered focus make them uniquely qualified to deliver high-quality care, but they also face significant challenges due to the increasing complexity of patient needs and the sheer volume of information that must be managed. In this rapidly evolving healthcare landscape, the integration of Artificial Intelligence (AI) into nursing practice holds substantial promise for enhancing the quality and efficiency of care delivery. AI technologies, particularly those encompassing Machine Learning (ML) and Deep Learning (DL), are

being increasingly recognized for their potential to revolutionize how chronic diseases are diagnosed, monitored, and managed. These advanced technologies can analyze vast amounts of data, uncovering patterns and insights that may not be immediately apparent to human clinicians. By leveraging AI, nurses can improve their decision-making processes, enhance patient monitoring, and personalize treatment strategies to align more closely with the individual needs of their patients. For instance, AI algorithms can assist in predicting disease progression, identifying risk factors, and recommending timely interventions, thereby enabling nurses to proactively manage patient care and improve outcomes.

## II. LITERATURE SURVEY

### A. THREATS TO VALIDITY

The literature on AI in geriatric chronic disease management has notable limitations, particularly regarding disease focus and technological bias. Many studies concentrate on prevalent conditions like diabetes and cardiovascular disease, often overlooking other significant chronic conditions such as chronic pain and obesity, which restricts the generalizability of findings. Vincent [2] highlights the diverse health issues faced by the elderly, stressing the need for AI applications to address a broader range of conditions for a more comprehensive understanding. Furthermore, there is a noticeable emphasis on traditional machine learning techniques over advanced methods like deep learning, which can analyze complex data types, including medical imaging and electronic health records. According to Poodineh Moghadam [1], deep learning could yield richer insights in managing complex geriatric conditions, yet it remains underrepresented, potentially limiting the full scope of AI's impact in this field.

### B. COMPREHENSIVE REVIEW OF EXISTING RESEARCH

AI applications have shown promise in managing chronic diseases among older adults, particularly in diagnosis, prognosis, and treatment optimization. Miller et al. [3] underscored the importance of early intervention through predictive models to mitigate disease progression. Barrio-Cortes et al. [5] demonstrated that AI-based risk assessment can enhance geriatric primary care by tailoring interventions based on patients' risk levels, thereby improving outcomes and reducing morbidity. In diagnostics, Tawhid et al. developed a CNN-based CAD system for identifying neurological disorders from EEG data, showcasing AI's utility in complex diagnostic tasks [2]. Mujahid et al. applied an ensemble model combining VGG16 and EfficientNet on MRI data to diagnose Alzheimer's disease, utilizing adaptive synthetic oversampling to improve model accuracy on imbalanced datasets.

AI's potential extends to enhancing care practices; Hawk et al. [4] discussed how data-driven insights could improve chiropractic care for the elderly. Overall, Poodineh Moghadam's study [1] advocates for better data quality and transparency in AI models to maximize their effectiveness in geriatric care, reinforcing the transformative role AI could play in chronic disease management.

## III. METHODOLOGY

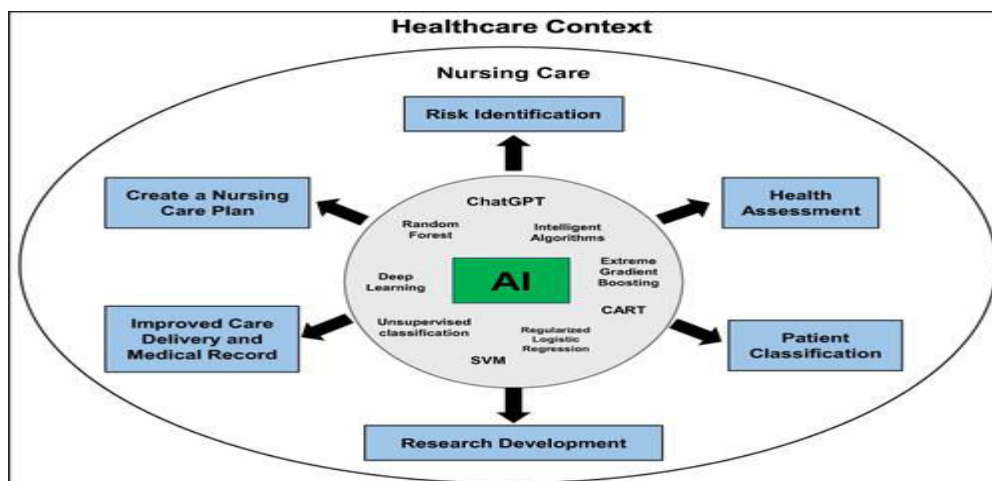


FIGURE 1. Healthcare Context Methodology.

- Context:** The AI is used within the larger context of healthcare, particularly focusing on nursing care.
- Risk Identification:** This is the first step, where AI helps identify potential risks in patient care.
- ChatGPT & AI Techniques:** Various AI techniques like Random Forest, Deep Learning, Intelligent Algorithms, Extreme Gradient Boosting, and CART are used for tasks like creating nursing care plans, improving care delivery, and predicting health assessments.
- Outcomes:** The AI helps create nursing care plans, improve patient care delivery and record- keeping, and predict patient classifications.
- Research and Development:** The use of AI in nursing care is constantly evolving and being developed.

TABLE 1. Comparison of systematic review studies focusing on AI in the context of healthcare, chronic conditions, and geriatric care.

Authors	Key Focus	Main Findings	Significance	Limitations
Poodineh moghadam[1]	Application of AI in nursing for geriatric care, specifically in managing chronic diseases	The study systematically reviews the use of AI technologies, particularly machine learning (ML) and deep learning (DL), in geriatric nursing care for chronic diseases.	Highlights the potential of AI to improve clinical outcomes in geriatric care, enhance efficiency in nursing workflows, and provide personalized care for older adults with chronic diseases.	The study is limited by the availability of high-quality data for AI applications in geriatric nursing, challenges related to AI model interpretability in clinical settings, and the generalizability of
Vincent [2]	Aging Population in the U.S.	Projects an increase in the older population in the U.S. from 2010 to 2050, emphasizing future healthcare needs.	Highlights the need for preparing healthcare systems to handle the increased demand for geriatric care.	Focuses on U.S. data, which may not apply globally; projections may be influenced by unforeseen demographic changes.
Miller et al. [3]	Geriatric Health Maintenance	Recommends a systematic approach to maintaining health in geriatric patients to prevent chronic diseases.	Provides a foundation for primary care physicians in managing the health of elderly patients.	Based on older data; may not account for advancements in healthcare or demographic shifts since 2000.
Hawk et al. [4]	Chiropractic Care for Older Adults	Establishes best practice recommendations for chiropractic care in elderly populations through a consensus process.	Offers guidelines for safe and effective chiropractic treatment for older adults.	Limited to chiropractic care and may not apply to other therapeutic modalities or all geriatric conditions.
Barrio-Cortes et al. [5]	Chronic Diseases in Geriatrics	Examines chronic disease morbidity and the utilization of primary care based on risk levels among older adults.	Helps to identify risk-based management approaches in primary care for the elderly.	Study focuses on specific regions and risk categories, which may limit generalizability to a broader population.
Mancin et al. [6]	Nutritional Knowledge in Nursing	Reviews the level of nutritional knowledge among nursing students, highlighting areas for educational improvement.	Points out gaps in nursing education, suggesting enhanced training in nutrition for better patient outcomes.	Focuses on nursing students, which may not reflect the knowledge levels of currently practicing nurses
Yakar et al. [7]	Compassion Fatigue in Nurses	Investigates the prevalence of compassion fatigue in nurses caring for patients with chronic diseases.	Sheds light on mental health issues faced by nurses, emphasizing the need for support programs.	Limited to nurses in chronic disease care, which may not represent experiences of nurses in other specialties.

Akleman [8]	Overview of Deep Learning	Provides an overview of deep learning techniques and their relevance in various fields.	Highlights the growing role of deep learning in modern technology applications, including healthcare.	Brief overview; lacks specific applications or in-depth discussion of implementation challenges.
Mavaddat et al. [9]	Polygenic Risk Scores for Breast Cancer Prediction	Studies the use of polygenic risk scores for predicting breast cancer and its subtypes.	Demonstrates the potential of genetic risk scores in personalized cancer prevention and management.	Limited to breast cancer; findings may not apply to other types of cancers or broader populations.
Hong et al. [10]	AI-Based 3D Reconstruction of Lung Tumors	Proposes a GAN-LSTM-3D approach for reconstructing 3D models of lung tumors, improving imaging accuracy in lung cancer.	Enhances precision in lung tumor imaging, which could aid in diagnosis and treatment planning.	Focused specifically on lung tumour's; requires further validation in clinical settings for broader application.

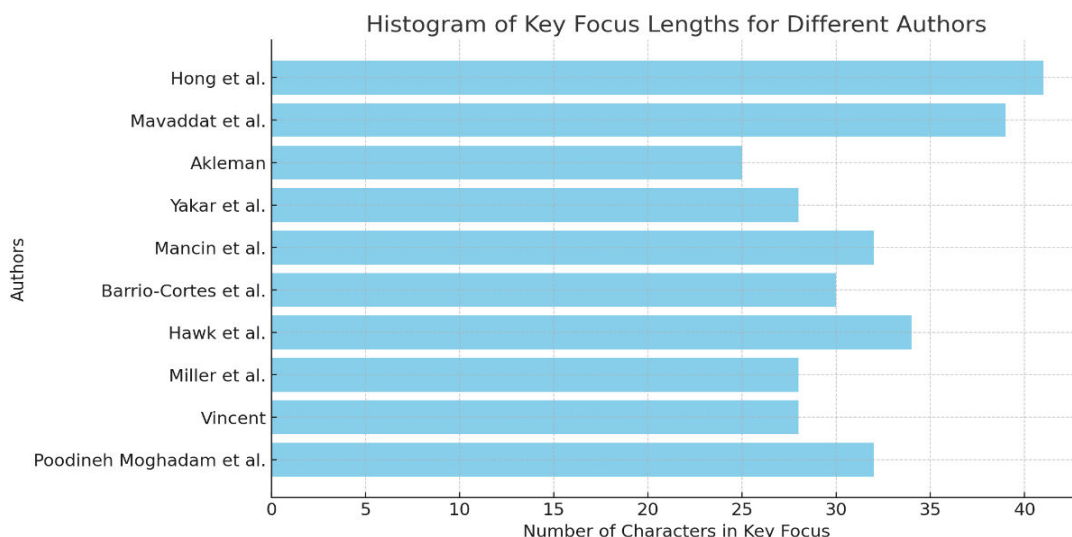


FIGURE 2. Histogram of key focus lengths for authors

## OVERVIEW OF ML AND DL METHODS

The integration of Machine Learning (ML) and Deep Learning (DL) techniques into healthcare has emerged as a transformative force, driven by their remarkable capabilities to analyze complex and multifaceted datasets. As the healthcare sector grapples with vast amounts of medical data, including electronic health records, imaging, and genomic information, the ability of these technologies to uncover intricate and often non-linear patterns is becoming increasingly vital. This section presents a comprehensive overview of the most widely employed ML and DL algorithms, elucidating their unique characteristics, advantages, and applications in the diagnosis and management of chronic conditions.

### 1. Support Vector Machine (SVM)

The Support Vector Machine algorithm is renowned for its efficacy in managing non-linear relationships inherent in healthcare data. Utilizing kernel functions, SVM facilitates the effective separation of distinct classes, enabling the classification of data points that are not linearly separable. This capability makes SVM particularly powerful for tasks such as biomarker detection, where it has demonstrated significant promise in identifying relevant predictors for various chronic diseases. By optimizing the margin between different classes, SVM enhances predictive accuracy, making it a valuable tool for clinicians seeking to interpret complex medical data.

## 2. Random Forest (RF)

Random Forest is an ensemble learning method that combines multiple decision trees to improve prediction accuracy and control overfitting, a common issue in statistical modeling. This algorithm is highly regarded for its ability to provide insights into feature importance, allowing healthcare professionals to identify the most significant variables influencing disease outcomes. RF has been effectively utilized in predicting both the presence of chronic diseases and the severity of disease progression. Its versatility across various medical conditions makes it an invaluable asset in the healthcare landscape, aiding in the decision-making process and enhancing patient care.

## 3. Logistic Regression (LR)

Logistic Regression is a foundational statistical model widely utilized for both binary and multiclass classification tasks in clinical settings. Its effectiveness in predicting outcomes based on patient data has made it a staple in healthcare analytics. LR provides interpretable results, allowing healthcare professionals to understand the likelihood of various outcomes, which is critical in chronic disease management. By modeling the relationship between independent variables and a binary outcome, LR enables clinicians to make informed decisions about patient care and treatment strategies.

## 4. Extreme Gradient Boosting (XGBoost)

Extreme Gradient Boosting is renowned for its robustness in addressing various data-related challenges, including overfitting, which can significantly impact model performance. XGBoost enhances predictive accuracy by optimizing the learning process through regularization techniques, thereby mitigating the risk of overfitting. Its application in healthcare has been instrumental in improving diagnostic outcomes and treatment predictions for chronic diseases. The algorithm's ability to handle large datasets with numerous features makes it a powerful tool for data-driven decision-making in clinical settings.

## 5. Deep Learning Frameworks

The rise of Deep Learning has revolutionized the field of healthcare analytics, particularly in the context of complex data types such as images and time-series data.

- Artificial Neural Networks (ANNs): These networks are designed to mimic the functioning of the human brain, learning from vast amounts of data to identify complex patterns. ANNs have been employed in various applications, from predicting disease progression to enhancing diagnostic accuracy in chronic disease management.
- Convolutional Neural Networks (CNNs): CNNs are particularly adept at processing image data, making them suitable for analyzing medical imaging modalities such as MRI, CT scans, and X-rays. Their ability to automatically extract features from images allows for the detection of subtle anomalies, significantly enhancing the diagnostic capabilities in geriatric care.
- Recurrent Neural Networks (RNNs): RNNs are designed to handle sequential data, making them essential for understanding time-series data in patient monitoring. Their capacity to remember previous inputs allows for better predictions of future outcomes, which is crucial in managing chronic diseases that require continuous monitoring and timely interventions.

## IV. DISCUSSION

This study provides critical insights into the application of cutting-edge technology in the automated diagnosis of chronic diseases, demonstrating that Machine Learning has been the predominant method utilized across 65 studies focused on automatic detection. In contrast, only 11 studies have employed Deep Learning models, illustrating a clear trend wherein Machine Learning was the dominant approach until 2019. However, following this period, the popularity of Deep Learning has surged, recognized for its unparalleled ability to manage large datasets and achieve enhanced outcomes. One of the fundamental differences between Deep Learning and traditional Machine Learning is that Deep Learning requires minimal manual feature engineering and selection, offering a more automated process that streamlines data processing. This automation supports the flexible application of various algorithms, making Deep Learning a powerful and increasingly preferred tool in the realm of chronic disease diagnosis.

Moreover, the reliability and overall success of AI applications in diagnosing chronic diseases are deeply intertwined with the integrity of the underlying data. AI systems necessitate a robust dataset—one that is complete, consistent, and accurate—to facilitate precise predictions and diagnoses. The data collection process, which often falls under the purview of nursing staff, emerges as a critical step in this process; any discrepancies, omissions, or inaccuracies at this

stage can significantly compromise the effectiveness of AI diagnostic tools. Nurses play an indispensable role in ensuring the quality of patient data, as they are positioned on the front lines of care delivery, meticulously documenting various patient metrics and clinical findings. Their contributions to the medical records form the essential foundation upon which AI algorithms are trained and tested, highlighting the necessity of maintaining high standards in data quality. Consequently, any variation in data quality, whether arising from human error or systemic issues, can lead to AI systems making unreliable predictions.

## V. CONCLUSION

The systematic review of AI applications in geriatric nursing care for chronic disease management illustrates the transformative potential of AI in enhancing care quality and efficiency. Machine Learning and Deep Learning models enable predictive insights and personalized care plans, which are invaluable in managing complex chronic conditions prevalent in older adults. However, the effectiveness of these AI tools depends heavily on data quality and model interpretability. High-quality, representative data is critical for accurate predictions, while interpretable AI models are essential for trust and usability in clinical decision-making. Nurses play a pivotal role in ensuring data quality and adopting AI insights within care plans.

The study acknowledges existing challenges, including the need for scalable AI models that can manage the growing data demands of healthcare and the imperative for ethical, transparent AI applications. Future directions should prioritize developing explainable AI models, expanding datasets to cover diverse patient profiles, and integrating multimodal data for a comprehensive patient view. Additionally, addressing privacy, security, and ethical considerations in AI adoption is vital to ensuring safe and effective AI integration in geriatric nursing care. Through focused advancements in these areas, AI has the potential to significantly improve outcomes and optimize healthcare resources for geriatric chronic disease management.

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