

How do nurses work in chronic management in the age of artificial intelligence? development and future prospects

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Abstract

AI is undeniably revolutionizing medical research and patient care across diverse fields. Chronic disease nursing care, a pivotal aspect of clinical management, has significantly reaped the benefits of AI across numerous dimensions. Understanding the operational principles of artificial intelligence before implementation is crucial, avoiding indiscriminate replacement of all tasks with AI. Nurses serve as the primary force in symptom group research, expanding beyond diabetes to encompass various chronic diseases; their primary responsibility involves recording patients' daily symptoms and vital signs. However, a substantial portion of current AI research excludes nurses from the developmental phase, encompassing them solely in user and feedback populations. The comprehensive design of the symptom analysis and long-term management approach necessitates the guidance and oversight of nurses; however, their current insufficient involvement might stem from nursing staff's comparatively limited comprehension of AI and their ambiguous perception of their role's value in AI. Therefore, an imperative exploration of nurses' roles in symptom analysis and long-term management, leveraging the latest research in these areas, is vital to pinpoint breakthroughs in nurses' AI involvement in the future.

Keywords

artificial intelligence, chronic, nursing

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Introduction

According to the latest Tortoise Intelligence report, global investment in Artificial Intelligence (AI) reached 77.5 billion dollars in 2021, marking a 115% increase from the prior year's 36 billion dollars—a record surge in AI investment over the past two decades.¹ Undoubtedly, AI is revolutionizing medical research and patient care across diverse fields with a myriad of applications.² Presently, China hosts over 300 million patients with chronic diseases, where chronic diseases contribute to 80% of total disease-related deaths, and the management expenses account for 70% of the national disease expenditure.³ This has emerged as a significant public health concern impacting the nation's economic and social development.

Chronic disease nursing care, an integral component of clinical management, has significantly reaped the benefits of AI across multiple dimensions. Principles of machine learning have been utilized to construct algorithms supporting

predictive models for the risk of developing chronic diseases or their associated complications.⁴ This study entailed an exploration of high-quality journals to identify and

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This study aimed to help nursing staff figure out the possible devotion in the age of artificial intelligence. It is very necessary to explore the role points of nurses in symptom analysis and long term management, and to analyze the breakthrough points of nurses' work in AI in the future by drawing on the latest research in symptom analysis and long-term management.

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review the most recent articles concerning AI applications in the domain of chronic disease nursing care. Following an exploration of cutting-edge applications in nursing, two categories were identified: symptom analysis and long-term management. This review encapsulates recent advancements in chronic disease nursing care and furnishes researchers with insights into the progression and potential of AI in chronic nursing care.

Artificial intelligence-assisted symptom analysis

Chronic ailments like diabetes, hypertension, and Alzheimer's disease often lack evident symptoms, and early signs are challenging to detect. Nevertheless, late diagnoses necessitate substantial human and material resources for daily patient care, significantly impacting both health and quality of life.⁵ Thus, symptom-centered management becomes imperative.

Advancements in symptom clusters aid individuals in quantifying their symptoms and monitoring daily health-care. Nonetheless, symptom-based management has received less focus, and understanding the utilization of symptom clusters in disease diagnosis remains limited. Nurses play a central role in symptom cluster research, extending their focus from diabetes to various chronic diseases; their primary responsibility involves recording patients' daily symptoms and vital signs. Assisted by tele-medicine and big data-driven predictions remotely, the advancement of AI-based data phenotyping undoubtedly holds unmatched advantages and potential.⁶

Regarding disease prediction, one of the most advanced applications of digital phenotypes involves predicting the behavior of individuals with bipolar disorder. Through the analysis of individuals' cell phones, psychiatrists have detected subtle indicators before events unfold. During depressive episodes in people with bipolar disorder, GPS sensors on their phones reveal reduced activity.⁷ They tend to answer calls less frequently, make fewer outgoing calls, and spend increased screen time. Conversely, before the onset of the manic phase, they exhibit increased walking, texting frequency, and phone usage. Another recent study involves glucose sensors that continuously monitor blood glucose levels in patients with type 2 diabetes.⁸ Patients can continuously gather blood glucose values around the clock without the need for finger pricking. The amalgamation of blood glucose data, dietary patterns, insulin intake details (uploaded by the patient through the diabetes monitoring app on their phone), and activity data from the linked wristband enables an inclusive forecast of future blood glucose levels. Individuals with complex and urgent inpatient requirements due to chronic illnesses will receive more efficient care in smart hospitals, homes, and communities integrated with intelligent monitoring devices.⁹

Clusters of symptom data offer ongoing assessment and monitoring mechanisms. Data on treatment effects derived

from chronic patients' data obtained through wearable devices, mobile devices, social media, etc., serves as a crucial complement to conventional efficacy evaluation, offering a novel approach to disease prediction and management.¹⁰ The online tracking of patients' digital symptom clusters to evaluate treatment regimen efficacy aids in modifying treatment plans and formulating personalized treatment strategies. Continuous monitoring yields more informative disease signals compared to intermittent clinical interview assessments.¹¹

Nevertheless, current assessments for chronic diseases have numerous limitations since each individual's metabolic level and genetic composition are unique, necessitating the implementation of personalized models. Moreover, assessments are intermittent, and the methods lack standardized scales. Additionally, certain assessment data are prone to recall errors and subjective biases. Most daily assessments in clinical settings are conducted by nurses, who could offer guidance for the data phenotype assessment process. Nevertheless, numerous AI research studies exclude nurses from the developmental phase and only engage them in the utilization and feedback stages.¹²

Artificial intelligence-conducted long-term management

Delivering compassionate, personalized, and family-centered care is a crucial and esteemed element within nursing theory and practice. AI is poised to instigate a paradigm shift in chronic disease care, transitioning from conventional management approaches to the formulation of precise, data-driven care. Equipped with AI tools, nurses can effectively strategize and synchronize care according to individual patient requirements, leading to enhanced outcomes at reduced expenses.^{13,14}

Care management solutions are frequently devised to address chronic conditions in outpatient environments. Sonoma County, located in California, USA, established the Access to Coordinated Care to Enhance Self-Sufficiency (ACCESS) initiative with the aim of assisting its most vulnerable residents by connecting them with services to enhance their well-being and resilience.¹⁵ The establishment of a personal health data repository for patients with chronic illnesses further aids in their long-term self-management. The SHAPES (Smart and Healthy Aging through People's Participation in Supportive Systems) innovation initiative, co-funded by the EU Horizon 2020, is led by the National University of Ireland Maynooth and engages 36 partner organizations across Europe. SHAPES aims to develop an open European health digital platform that advocates comprehensive and meaningful support for independently living elderly individuals, simultaneously monitoring data of elderly individuals with chronic illnesses and predicting disease deterioration.¹⁶

AI chat agents and comparative analyses among various chronic health conditions significantly contribute to the

long-term management of chronic diseases. Enhancing the comparability and quality of chatbots designed for specific chronic conditions, and their subsequent impact on targeted patients, can be achieved through a more structured development and standardized evaluation process. Constructing a comprehensive perspective on AI-driven conversational agents for nursing care in chronic health conditions.¹⁷

Moreover, with the advancement of “Internet+” in nursing, an increasing number of nursing models have been established for chronic care, including nutritional and exercise recommendation models.¹⁸ The most prominent aspect of AI technology lies in its capacity to assist patients in formulating personalized care strategies. Artificial intelligence facilitates the creation of predictive models to assess the risk of chronic diseases and their related complications. This will facilitate the integration of personalized care into the management of chronic illnesses. Patients now have the capacity to self-manage their health, while physicians can offer prompt and tailored interventions via technological platforms. These advancements economize time and expenses by enabling remote data collection and substituting routine clinic visits with virtual management.^{19,20}

Artificial intelligence-enhanced chronic nursing care

Social media has emerged as a pivotal element in the person-centered disease care management model, offering people a platform to access information, share experiences, express themselves, seek support, acquire skills, and enhance self-management of diseases through immediate, convenient, and interactive communication. This fosters a gradually evolving symbiotic mechanism.²¹ Internet healthcare has the potential to address the issue of repeated patient visits and numerous follow-ups, enabling the implementation of continuous management throughout the entire disease process, transitioning from in-hospital to out-of-hospital, and finally to home, intervening and guiding their health behaviors.²² Additionally, internet healthcare can offer enhanced health education support to enhance individuals’ behavior and bolster the long-term sustainability of chronic disease management.

Online communities serve as effective interventions to enhance health outcomes and drive individual behavioral changes in patients with chronic diseases.²³ Gradual health interventions can be executed leveraging established and well-developed online communities. Furthermore, social support emerges as a significant factor within online communities to foster individual behavior change, indicating the potential development of virtual community interventions to address these social support factors.²⁴ Despite the increasing utilization of online community studies in health-related domains, such as disseminating health information, providing health education, and promoting health, there remains a scarcity of randomized controlled trial studies.²⁵

Furthermore, the current study fails to identify the specific characteristics of social media or online communities that influence individual behavior change, and the causative factors behind the promotion of individual behavior change remain unclear.^{21,22}

Conclusion

Digital therapies have become a well-established intervention for lifestyle and clinical care in managing chronic diseases. Individuals are progressively gaining the ability to self-manage their chronic conditions, leading to benefits for both patients and medical professionals through intelligent support. Artificial intelligence enables uninterrupted and non-intrusive remote monitoring of patient symptoms and biomarkers. Moreover, social media and online communities amplify patient engagement in chronic care.

Technological advancements have notably enhanced the efficient use of resources in chronic disease management. Artificial intelligence stands poised to revolutionize chronic nursing care, transitioning from traditional management methods to targeted, data-driven precision care. The fundamental contribution of AI in chronic disease care rests in its capacity to analyze imperceptible symptom changes using data from various sources—electronic health records, wearables, and Internet of Things devices—to discern subtle patterns in chronic diseases, enabling early detection of deterioration or complications. Concurrently, automating departmental nursing care reduces repetitive tasks, allowing nurses to focus on intricate and critical patient care. Moreover, the continuous progression of artificial intelligence offers opportunities for remote nursing, decreasing patient visits for care and enabling real-time remote feedback on nursing services.

However, concerns regarding security, data protection, and regulatory hurdles hinder the smooth integration of technology in chronic care. Additionally, inadequate training in AI tool usage for many caregivers restricts their ability to effectively adapt to changes in the care environment and decision-making processes, also hindering the full utilization of AI’s effectiveness. Hence, it is imperative for nursing professionals to undergo comprehensive training and education to proficiently employ AI tools and judiciously leverage the chronic disease data provided by big data resources. This will further optimize the synergy and integration between humans and machines.

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