Chapter 3
Human–Machine Interaction in Home Healthcare

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ABSTRACT

Human-Machine Interaction (HMI) is the interaction of patients, families and healthcare staff with technologies such as sensors, software and robots in home healthcare. It offers elderly and chronic patients the opportunity to live independently at home. Due to the aging population and the increase in chronic diseases, the desire of individuals to live independently in their own homes has stimulated the development of these technologies. In this context, HMI should be designed in accordance with the physical and cognitive capacities of the users, as well as to improve health outcomes. HMI consists of physical devices, social relationships and data layer. User-centered design and accessibility are important. Home care is supported by monitoring systems, security solutions and emergency assistance technologies.

INTRODUCTION

In recent years, the convergence of technology and healthcare has catalyzed profound transformations in the way medical services are delivered, accessed, and experienced. Among the most significant developments in this domain is the rise of Human-machine Interaction (HMI) in home healthcare. This advancement has not only redefined the landscape of patient care but also opened new frontiers for research, innovation, and policy-making. As societies worldwide grapple with

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aging populations, rising healthcare costs, and the persistent need for accessible, high-quality care, the integration of intelligent machines into home environments emerges as a compelling solution. This chapter explores the evolution, significance, challenges, and future directions of HMI in home healthcare, emphasizing its potential to reshape the fabric of modern medicine (Thacharodi et al., 2024).

The demographic shifts occurring globally are both striking and consequential. According to the World Health Organization (WHO), the proportion of the global population aged 60 and above is expected to nearly double by 2050, reaching over 2 billion people. This demographic trend is accompanied by an increase in chronic illnesses such as diabetes, cardiovascular disease, and neurodegenerative disorders, which often require long-term management rather than acute intervention (World Health Organization [WHO], 2024). Traditional healthcare systems, primarily hospital-centric and reactive in nature, are increasingly inadequate to meet the evolving needs of this demographic. Consequently, there is a growing impetus to develop home-based care models that are proactive, patient-centered, and technology-enabled.

Human–machine Interaction, as applied to home healthcare, encompasses a wide range of technologies and systems designed to support individuals in maintaining their health, managing chronic conditions, and accessing medical services without leaving their homes. These systems include but are not limited to wearable health monitors, telepresence robots, intelligent voice assistants, automated medication dispensers, and AI-driven diagnostic tools. The common thread linking these innovations is the interface between the human user and the machine—an interface that must be intuitive, responsive, and adaptive to individual needs. The success of HMI in this context hinges on its ability to foster trust, ensure safety, and enhance the user experience, particularly among populations that may be less technologically literate (Demiris & Olson, 2010).

The home setting presents unique opportunities and challenges for HMI. Unlike clinical environments, which are controlled, standardized, and staffed by trained professionals, home environments are heterogeneous, dynamic, and populated by individuals with varying degrees of health literacy and physical ability. Designing HMI systems that can function effectively in such contexts requires a multidisciplinary approach, drawing on insights from computer science, engineering, medicine, psychology, and design. Moreover, these systems must be sensitive to cultural, socioeconomic, and linguistic differences that influence how users interact with technology. Inclusivity and accessibility are not optional features but essential components of effective HMI in home healthcare.

One of the most promising aspects of HMI in home healthcare is its capacity to enable continuous monitoring and early intervention. For example, wearable sensors can track vital signs such as heart rate, blood pressure, and oxygen saturation in real-time, transmitting this data to healthcare providers who can intervene promptly if