

From the Perspective of Therapists: Perceptions and Expectations to Technology used for
Non-Pharmacological Therapy for People with Dementia

by

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Defense Date: April 3, 2024

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Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in
the DKU Global Health Program in The Graduate School of
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ABSTRACT

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Abstract

Objective: This thesis investigates therapists' perceptions and expectations of technology application in non-pharmacological therapies (NPT) for individuals with Dementia, emphasizing the role of Information and Communication Technology (ICT).

Methods: Adopting a qualitative research framework, this study utilizes methodology comprising semi-structured interviews, and participatory observations. Semi-structured interviews employed convenience sampling to engage experienced therapists in in-depth discussions, while participatory observations offered a firsthand examination of therapeutic settings and methodologies, including music therapy, and reminiscence therapy.

Results: Integrating insights from therapist interviews, and immersive participatory observations, the study elucidates the ambivalent nature of ICT's role in NPT for treating dementia patients. Challenges identified include older patients' resistance to new technologies and the difficulty in quantifying the therapeutic outcomes of ICT applications. Despite these hurdles, therapists exhibit a collective optimism toward the potential of rapidly evolving technology to enhance the overall efficacy of NPT in the recovery processes for dementia patients.

Conclusion: The research underscores a complex landscape where the integration of ICT in NPT presents both opportunities and challenges. Therapists' hopeful outlook signals a broader consensus on the potential transformative impact of technology in dementia care, suggesting a need for further innovation and research in this domain. This study contributes to the dialogue on integrating ICT in therapeutic practices, offering a nuanced understanding of its implications for enhancing dementia care.

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List of Abbreviations and Symbols

Abbreviations

MCI	Mild cognitive Impairment
AD	Alzheimer Disease
NPT	Non-pharmacologic treatments
ICT	Information and Communication Technology
SIJD	Structured Clinical Interview for Insight and Judgment in Dementia
CAMCI	Computer Assessment of Mild Cognitive Impairment
PCPs	primary care physicians
ADL	Activities of Daily Living
MMSE	Mini-Mental State Examination

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1. Introduction

1.1 Background

In an era marked by a significant shift in population structure towards global aging, dementia has brought a tremendous burden to human society. Dementia is a neurodegenerative disease primarily characterized by an irreversible decline in cognitive function. According to the projections by Prince et al. (2015), the number of dementia cases will increase from 46.8 million in 2015 to 131.5 million by 2050. The continuous increase in cases exacerbates the operational burden on the healthcare system and causes a massive economic loss. Mild Cognitive Impairment (MCI) and Alzheimer's Disease (AD) are two critical stages in the development of dementia. MCI represents an early stage in the development of dementia. The main clinical symptoms of MCI are manifested as a decline in memory and cognitive abilities in the elderly (Pocnet et al., 2015). AD, on the other hand, is a later stage in the development of dementia, not only impairing the patient's cognitive abilities but also potentially affecting the daily life of the elderly. Therefore, focusing on the increasing incidence rates of MCI and AD has become a core issue that needs immediate attention. The prevalence of MCI in adults over the age of 65 is estimated to be 18.5%, and it is disheartening that the global aging population will continue to expand this number (Wolfsgrube et al., 2014). The connection between dementia, cognitive impairments, and aging has been extensively documented, with Bruscoli and Lovestone emphasizing these diseases as significant public health challenges. Their widespread prevalence and profound impact on the elderly underscore the urgent need for innovative intervention and treatment strategies. This demographic evolution not only demands the formulation of such strategies but also encourages researchers and clinicians to actively seek more effective treatment approaches.

In the current development, non-pharmacological therapies (NPTs) have become a focal area of interest, especially because they hold potential beyond traditional pharmacological therapies in certain scenarios. This interest arises because the development of current pharmacological therapies has reached a bottleneck, and the high cost of treatments along with potential side effects of drugs have exacerbated the reliance on pharmacological therapies to manage dementia.

A notable advancement within this realm is the evolution of Information and Communication Technologies (ICT), which introduces a groundbreaking NPT modality. This innovation marks a significant advancement in healthcare, facilitating the implementation of ICT-based interventions. Snyder et al., in their article “Assessment of cognition in mild cognitive impairment: a comparative study,” define ICT as an all encompassing term for communication devices and applications, including but not limited to, computer and network hardware and software, radio, television, mobile phones, and wireless signals, along with services and applications such as videoconferencing, tele healthcare, and distance learning. The integration of ICT-based interventions offers a promising avenue for enhancing therapeutic outcomes, necessitating a reevaluation of conventional strategies for managing cognitive impairment and dementia. This thesis is dedicated to exploring the efficacy and broader implications of utilizing ICT in interventions targeted at MCI and AD. It aims to specifically assess ICT’s capacity to transform existing diagnostic, treatment, and management paradigms for cognitive disorders. Through a detailed examination of ICT’s contributions to this field, this study endeavors to uncover potential shifts in therapeutic strategies, emphasizing the pivotal role of technology in developing more sophisticated and effective approaches to mitigate cognitive decline.

1.2 Research Aim

The primary objective of this thesis is to explore the potential applications and implications of ICT within the context of NPT for patients diagnosed with MCI and AD. This research endeavors to systematically examine the efficacy and transformative potential of ICT interventions in ameliorating the cognitive deficits associated with these conditions.

1.3 Research process

This thesis investigates the efficacy of NPT for MCI and AD, with a particular emphasis on the integration of ICT. Employing a qualitative research methodology, it begins with a comprehensive literature review to establish a foundational understanding of MCI, AD, NPT, and ICT, aiming to highlight research gaps. To enrich this foundation, the study employs a combination of semi-structured interviews, facilitated through convenience sampling, and participatory observation, gathering firsthand data on the experiences and outcomes of ICT-enhanced NPT interventions. By synthesizing insights from both the theoretical exploration and empirical findings, the research seeks to offer a nuanced perspective on the potential of ICT to improve NPT outcomes for individuals with MCI and AD. This integrated approach aims to provide a holistic view, merging academic inquiry with practical investigation, to contribute valuable insights into the treatment and management of cognitive impairments.

2. Related work

This chapter rigorously explores the foundational aspects of the thesis topic, establishing a solid foundation for the reader's comprehension of the subsequent sections. It commences with an exposition on the basic concepts of MCI and AD, followed by an analysis of the relationship between MCI and AD. Subsequently, it introduces NPT and their significance in intervening in MCI and AD conditions. The discussion extends to an enumeration of prevalent NPT methods, such as physical exercise and music therapy. The final section elucidates the role of ICT within NPT, discussing common ICT treatment modalities, including motion sensors, companion robots, and digital communication devices like computers, tablets, and smartphones, which are instrumental in monitoring behaviors of MCI and AD patients. The chapter culminates in a synthesis of existing research findings in the field, highlighting the varied perspectives of scholars, physical therapists, and patients regarding the contributions of ICT to the management of MCI and AD. This varied reception underscores the complex interplay between technology and therapeutic outcomes, paving the way for further inquiry into optimizing ICT for patient care in neurodegenerative diseases.

The concept of MCI was delineated as a nosological entity by the MCI Working Group of the European Consortium on Alzheimer's Disease (EADC), targeting elderly individuals exhibiting mild cognitive deficits without reaching the threshold of dementia. This classification, as articulated by Portet et al. (2006) underscores a tripartite diagnostic procedure for MCI. Initially, it necessitates the identification of the syndromic manifestations of MCI. Subsequently, the recognition of specific subtypes of MCI is imperative. The final stage involves determining the etiopathogenic subtypes. This structured approach significantly enhances the capacity for identifying patients at elevated risk of progressing to dementia, thereby fortifying the comprehensive management and research framework concerning MCI.

In their study, Breijyeh and Karaman (2020) discuss what causes AD and how it can be treated. They explain that AD is a condition that leads to the loss of brain cells, making it the main cause of dementia. Dementia affects a person's thinking abilities and their ability to do everyday tasks on their own. They also mention that getting older, genetics, and head injuries can increase the risk of developing AD.

Peterson et al. (2013) explain that there's a gradual progression from MCI to AD, starting with slight memory problems and leading to full-blown dementia. They emphasize the importance of spotting and managing MCI early on to slow down the progression to AD and improve people's lives.

In the scholarly work conducted by Wang (2023), the study explores nine NPT for AD, including ways to reduce harmful proteins in the brain, brain stimulation, cognitive therapy, exercise, social activities, memory therapy, diet changes, support for caregivers, and overall lifestyle care. Wang also suggests that diet might play an important role in how Alzheimer's develops. The research focuses on how these NPTs can affect AD and how they can be used. In an endeavor to elucidate the efficacy of NPT for ameliorating the symptoms of MCI in the elderly, the research conducted by Kim and Baek (2015) introduces an innovative cognitive and physical training regimen. Their study rigorously compares the outcomes of this novel intervention against those derived from traditional cognitive training methodologies. The findings suggest that the newly developed program significantly enhances cognitive function, social abilities, and physical health in individuals with MCI. Simultaneously, Wei and Ji (2014) from the Department of Medical Nursing at Weifang Medical University embarked on a study to evaluate the cognitive benefits of handball training for older adults diagnosed with MCI. Their results indicate a potential improvement in cognitive functions attributable to the engagement in handball exercises, positing handball training as a viable method for cognitive enhancement in

this demographic. Moreover, Devenney et al. (2017) sought to assess the impact of a comprehensive exercise program on the progression of MCI. Their research highlights a deceleration in cognitive decline among participants who engaged in an extensive exercise regimen, with those in the aerobic exercise group exhibiting markedly improved cognitive performance. This study sheds light on the potential mechanisms by which physical activity influences brain structure and function, offering a deeper understanding of how exercise can contribute to cognitive improvement. Collectively, these studies underscore the positive impact of exercise programs as an NPT on cognitive function and quality of life for patients with MCI. Through the lens of these investigations, it becomes evident that incorporating physical activity into the treatment and management of MCI can yield substantial benefits, thereby enriching the arsenal of strategies aimed at mitigating the effects of cognitive impairments.

Exercise can help with MCI, and studies show music therapy can too. Han et al. (2014) studied 50 older people with memory problems and gave them music therapy for 8 weeks. They found it made them less depressed and anxious and improved their daily activities. Similarly, Kim and Yang (2013) found that music therapy helped people feel better emotionally and less helpless compared to those who didn't receive the therapy. These studies suggest music therapy could be a good way to help improve the lives of people with MCI.

As the exploration of NPT for MCI and AD progresses, it becomes apparent that the core technologies integrated within NPT are fundamentally rooted in ICT. This pivotal insight is jointly corroborated by two distinct research teams: an expert panel from Monaco, led by Robert et al. (2013) and the researchers Lauriks et al. (2007) Both teams underscore the significant role that modern ICT can play in augmenting traditional care approaches, offering symptomatic relief to patients afflicted with MCI and AD. This insight underscores the evolving landscape of MCI

and AD interventions, where ICT is emerging as a vital adjunctive resource, offering novel avenues for patient support beyond the scope of conventional care methods.

Table 1: Features of NPT interventions employing ICT for managing dementia-related behavioral and psychological symptoms.

Author, (year)	Intervention	Technology
Domenicucci et al. (2022)	Offers safe, engaging activities.	Virtual Reality (VR)
Davison et al. (2016)	Plays participants’s favorite music, movies, videos, and photos.	Memory Box
Ghafurian et al. (2021)	Interacts with humans by responding to voice and touch, simulating intimate interactions with animals.	Robotic pet (PARO)
Chen et al. (2020)	Interacts with humans by talking, singing, and response with head nodding	Humanoid robot (Kabochan)
Laver et al. (2020)	Using telehealth technologies for online consultations.	Online meeting
Malmgren Fänge et al. (2020)	developed safety and independence in the homes of MCI patients.	Sensor based technology
Costanzo et al. (2019)	Reduced caregivers’ burden in remote area.	Telemedicine
Tierney et al. (2017)	Improved the feasibility and validity of the self-administered	Computerized Assessment
Millett et al. (2017)	Saves more time than usual cognitive testing.	Computer Assessment

In the context of various ICT interventions, researchers exhibit divergent view points concerning the application and implications of these technologies. Malmgren Fänge et al. (2019) elucidate that individual with dementia, alongside their families, encounter challenges in the utilization of sensor technology. These challenges stem from a perceived lack of control over the devices, ambiguity regarding their operational mechanisms, and a deficiency in support for addressing technical difficulties. Concurrently, Chen et al. (2020) offers insights into the heterogeneous effectiveness of robot assisted applications. They observe that reactions to such interventions vary among individuals, with a notable subset of participants opting out of interactions with robots, such as Kabochan. This variability underscores the complex and multifaceted perspectives towards ICT, encompassing users,

therapists, and researchers alike, all of whom navigate a landscape of uncertainty in relation to the adoption and efficacy of ICT solutions.

3. Methodology

This chapter is dedicated to elucidating the methodological underpinnings of my qualitative study, delineating the multifaceted approach employed to collect and process data. This thesis is grounded in a comprehensive literature review, semi-structured interviews employing convenience sampling techniques, and participatory observation. Each segment of the methodology is elaborated upon in terms of data collection and analysis procedures. It is pertinent to note that this study has received approval from the Institutional Review Board (IRB) of Duke Kunshan University, ensuring adherence to ethical standards and integrity in research practices.

3.1 Semi-structured interviews

In the realm of psychiatric disorders research, particularly concerning MCI and AD, there is a noted deficiency in reliable and effective instruments for measuring cognitive structures. Parrao et al. (2017) undertook the development and validation of a semi-structured interview, initiating their study with 124 patients diagnosed with AD. They tested the Structured Clinical Interview for Insight and Judgment in Dementia (SIJID) and, based on a 1-year follow up of patient clinical outcomes, concluded that the SIJID is a reliable and effective tool for assessing insight and judgment in AD patients. Similarly, Okereke et al. (2012) conducted a study utilizing a brief interview protocol. Specifically, they selected 342 community dwelling, non demented elderly individuals and employed an algorithm to extract 60 questions from clinical physician interviews. Moreover, they ran a model that included age, gender, and education as predictive factors in comparison with interview outcomes, demonstrating the high predictive capability of this brief interview protocol. Beard and Neary (2012) enhanced the convenience of their interviews significantly by employing convenience sampling in their research article.

Accordingly, this method was employed in my research to examine the application of non-pharmacological therapies by physical therapists, integrating technological approaches. The study was meticulously organized and conducted from March to July 2023. It specifically targeted therapists with expertise in non-pharmacological therapies and relevant technological knowledge, aiming to explore their experiences and viewpoints. Thanks to the close communication and collaboration with the nursing home Aizhaohu among the research team members, the study utilized convenience sampling and selected three experienced physiotherapists from this institution as interviewees. This sampling technique was chosen for its efficacy in accessing hard-to-reach populations, starting with a few key informants and expanding the sample through their networks. This approach facilitated an in-depth understanding of the perspectives and practices of therapists in the application of non-pharmacological therapies, underlining the significance of integrating technology in enhancing patient outcomes.

Preparatory measures included obtaining written informed consent from all participants, with interviews being conducted both online via platforms like ZOOM and in-person in various settings such as Aizhaohu, community elderly care centers, and aged care institutions. All interactions were carried out in Chinese, ensuring clear communication.

The interviews, lasting from 30 to 120 minutes, were structured around three principal themes: the therapists' experiences with non-pharmacological therapies, their use and perception of technology in therapeutic interventions, and their expectations for the future integration of technology in their field. The interviews were not only meticulously led by the research team but were also recorded (with participants' consent) and extensively documented. To refine the interview process, weekly meetings were held to review and adjust the interview guide based on ongoing literature review and data analysis, ensuring subsequent discussions would effectively contribute to addressing the research questions.

Participants were compensated 200 RMB (approximately 29 USD) for their time and insights.

From the initial pool, 8 participants were ultimately included in the analysis, representing a diverse range of institutions including Aizhaohu Elderly Care Center—a technology driven caregiving facility, Shanghai Mental Health Center (MHC), community nursing home (NH) in Shanghai or Changchun, and hospital in Shanghai (refer to Table 2).

Table 2: Participant Information

ID	Work Exp.	Background	Institution	Therapy
1	3 Years	Rehabilitation	Aizhaohu	NPT-multi ways
2	8 Years	Rehabilitation	Aizhaohu	NPT-multi ways
3	2 Years	Geriatric Nursing	Aizhaohu	NPT-multi ways
4	3 Years	Nursing	MHC	NPT-multi ways
5	4 Years	Social work	NH	NPT-multi ways
6	8 Years	Nurse and social worker	Hospital	NPT-multi ways
7	7 Years	Social work	NH	NPT-Rec Therapist
8	4 Years	Geriatric Nursing	NH	NPT-multi ways

It is readily apparent that the participants in our study possess over two years of professional experience, with backgrounds intricately aligned with the nursing sector. Furthermore, their affiliations are predominantly with institutions that specialize in geriatric rehabilitation, a field directly pertinent to the NPT under investigation in our research. This alignment not only enriches the validity of our study but also ensures a high degree of relevance between the participants' expertise and the therapeutic modalities explored. In the interview process, data was recorded and coded in Chinese to facilitate comprehension and analysis. Open coding was performed using NVivo 12, a software for researchers to study and understand data from interviews and surveys, making analysis simpler and more effective. Wherein each statement was systematically coded based on its literal meaning and contextual relevance. Subsequently, key excerpts were translated into English for reporting

purposes, ensuring accessibility and comprehensibility of research findings to a broader audience.

3.2 Participatory observations

Qaddo (2019) elucidates that participant observation is adept at capturing the subtleties of human interaction and the complexities of social phenomena, elements that might be elusive through more quantitative research approaches. Pure numerical data often falls short in encapsulating the nuanced differences in human behavior and interactions, nuances that are pivotal in comprehensively understanding the conditions of MCI and AD, as well as the processes and effects of NPTs. By employing participant observation methodologies, researchers are enabled to deeply immerse themselves in environments such as nursing home communities. This immersion, through active participation in community activities, aims to gain a nuanced understanding of the community's behaviors, values, rituals, and social dynamics from an insider's perspective. This research methodology is purposefully structured to integrate the viewpoints of both patients and physiotherapists, facilitating firsthand observations of reactions to various therapeutic interventions. Adopting this dual perspective approach is crucial for drawing more balanced and objectively grounded conclusions, as it incorporates the experiences and insights from both the patients and healthcare providers.

In the context of participatory observations, the researchers immersed themselves in a comprehensive examination of four distinct settings. This involvement spanned a total duration exceeding three hours, during which the methodologies employed by therapists in administering NPT to the elderly population diagnosed with MCI or AD were meticulously documented. The compilation of these therapeutic interventions is detailed in seven categories, as delineated in Table 3.

Table 3: Summary of Participatory Observations

Date	Main Content
2023.4.21	Elderly participation in gardening, music, learning, and reminiscence therapy. The theme was childhood games, which stimulated memories through props and interactive games, with music played via Bluetooth.
2023.5.5	Elderly participation in music and reminiscence therapy to stimulate memory, promote social interaction, and enhance mood, with activities conducted through Bluetooth music playback.
2023.5.9	Elderly participation in reminiscence therapy and physical therapy, guided through PowerPoint presentations.
2023.5.25	Elderly participation in movement therapy, dance therapy, reminiscence therapy, and art therapy.

4. Findings

In the preceding research, the inquiry was conducted through a methodological framework comprising semi-structured interviews and participatory observations. This chapter synthesizes the findings derived from these distinct yet complementary approaches, elucidating the insights and patterns observed across the various dimensions of the study.

4.1 Characteristics of NPT Implementation

Through participatory observation, researchers found that therapists need to undertake multiple responsibilities when implementing NPT: 1. Therapists need to face multiple elderly individuals simultaneously. 2. Therapists need to constantly monitor the progression of the NPT process. 3. Therapists need to maintain order on site.

Field observations revealed that therapists implement NPT entirely in groups, with each session involving at least five elderly participants, none of whom have severe cognitive decline. According to interview results, this approach is adopted because one-on-one NPT, although it allows for personalized intervention based on the elderly's condition, requires the elderly and their families to bear a high cost. Therefore, therapists need to simultaneously consider each elderly participant involved in the activity. During their work, therapists not only need to ensure that each elderly person has the opportunity to participate in NPT but also need to take care of each person's emotions. In a field observation on April 21, 2023, when the elderly discussed games from their childhood, the therapist particularly praised two individuals who actively participated in the discussion and encouraged others who were reluctant to join the discussion to share their past experiences.

Moreover, therapists need to continuously advance the NPT process. Observations showed that NPT content is primarily displayed in the form of pictures or photographs through PowerPoint. Therefore, therapists advance the NPT process by switching slides in

PowerPoint. It is worth mentioning that advancing the process might mean interrupting the elderly's discussions, which could likely reduce their willingness to participate subsequently. Hence, when therapists need to interrupt the elderly to move the process forward, they try to do so with a gentle tone and phrasing. Lastly, therapists need to maintain order on site. Through four participatory observations, researchers found that more extroverted elderly individuals tend to be more active, but this could also mean they might disrupt discussions or cause arguments with others. In such cases, therapists intervene in the elderly's behavior timely through verbal persuasion to ensure no further conflicts occur. "One-on-one, actually, is not cost effective for us, right? It's not a feasible thing." (Therapist 2)

4.2 Benefits of ICT of NPT

Researchers have discerned that ICT implementations within NPT significantly contribute to the rehabilitation of patients with MCI and AD, demonstrating accessibility and efficacy. This observation holds true both from the perspective of existing literature and our empirical research, including interviews and observational studies. In the domain of literature review, pioneering research led by Robert et al. and Lauriks et al. (2007) has collectively affirmed the pivotal role modern ICT plays within traditional caregiving paradigms, offering symptomatic relief to patients with MCI and AD. Similarly, a study by Domenicucci et al. (2022) employing VR technology has been shown to provide patients with safe and engaging activities. Complementing these findings, additional literature underscores the potential of ICT solutions, such as the Memory Box or PARO (a robotic pet), to significantly enhance the emotional well-being and quality of life of patients.

During an observational study conducted on May 9, 2023, it was evident that the elderly participants exhibited unparalleled enthusiasm when childhood games were depicted through PowerPoint presentations. This reaction underscores the profound ability of visual

stimuli to resonate emotionally with individuals, particularly the elderly, evoking feelings of familiarity and comfort upon witnessing scenes reminiscent of their youth. Such observations reinforce the notion that ICT, when thoughtfully integrated into therapeutic interventions, can deeply touch the hearts of patients, mobilizing emotions and fostering a sense of well-being among older adults.

Costanzo et al. argue that ICT plays a crucial role in enhancing the care of patients with MCI and AD through NPT. They highlight that ICT applications facilitate remote diagnosis, treatment, and monitoring, thereby expanding access to care, fostering continuous patient engagement, and alleviating caregiver burden through early diagnosis and intervention, especially in remote regions. Furthermore, ICT allows for the customization of interventions to meet individual needs, potentially improving patient outcomes.

There is not only one example of how the efficiency of diagnosing cognitive disorders can be enhanced, the literature review reveals significant insights from studies by Tierney et al. and Millett et al., both of whom investigated the Computer Assessment of Mild Cognitive Impairment (CAMCI), an instance of remote online assessment falling under the umbrella of ICT. Tierney et al. commented on the benefits of such technology, stating that it “allow[s] early screening and detection to be more feasible in comparison with traditional paper and pencil instruments,” Similarly, Millett et al. (2017) directly mentioned in their research that primary care physicians (PCPs) appreciated the “time saving advantage of the CAMCI and the immediately generated report.” These studies underscore the transformative potential of ICT in streamlining the process of diagnosing cognitive disorders, highlighting the convenience and efficiency afforded by remote assessments like CAMCI.

4.3 Problems of ICT of NPT

Researchers have identified several issues concerning the use of ICT for NPT in the rehabilitation of MCI and AD patients. These challenges primarily stem from the following aspects: the elderly's resistance to adopting ICT, the difficulty in quantifying the therapeutic outcomes of ICT for NPT, challenges in transferring non-pharmacological therapy implementation knowledge to caregivers, and the irreplaceable role of human interaction in supporting MCI patients.

Elaborating on the elderly's resistance to ICT, the majority of therapists observed that MCI patients exhibited reluctance when learning new technologies. This negative attitude towards learning necessitated therapists to invest additional time and effort in repeatedly instructing the elderly on how to use the technology. "It's very difficult for the elderly to accept these devices. For instance, if we introduce a new device, you need to explain where it comes from, its purpose, and how to use it. Even after you've explained it once, you need to do it all over again next time," (Therapist 7) noted.

The second challenge is the difficulty in quantifying the outcomes of ICT for NPT. Almost all therapists expressed the challenge of systematically quantifying the effects of non-pharmacological therapy. Understanding the recovery process depends on the therapist, for example, two therapists believed that improvement in cognitive ability should reflect in enhanced Activities of Daily Living (ADL), while two others suggested that the effects of non-pharmacological therapy should manifest in the elderly's participation in activities and their daily mood. Therapist 2 mentioned, "It's challenging to grasp the quality, method, and outcomes of implementing non-pharmacological therapy in a data driven and unified way.

Not only is there ambiguity in the procedure of recovery, but there's also a lack of uniformity in assessment strategies. Upon interviewing therapists, it was found that common assessment strategies generally fall into two categories: first, by inspection of the elderly's everyday behavior, performance, or emotions. However, this method does not directly aid

therapists in determining the effectiveness of non-pharmacological therapy, as many other factors could influence the elderly's behavior and emotions, such as sleep and bowel movements. Therapist 5 stated, "When assessing the effects, some observations are made, such as observing emotions. But no formal records are made. We interact with the elderly daily and are very familiar with their personalities. Currently, there's a lack of a systematic professional record for intervention outcomes in China." Another method involves using professional questionnaires, such as the Mini Mental State Examination (MMSE) for cognitive status assessment. However, the scores from these questionnaires do not fully reflect the effects of non-pharmacological therapy on the elderly, as the scoring range encompasses various scenarios, making it difficult to clearly represent progress made during intervention within the questionnaire scores. Secondly, the administering therapist can also influence the outcome of the questionnaire. If different therapists are involved in the assessment, the elderly's performance might be affected, leading to potential discrepancies in results. Therapist 1 commented, "There's an inherent issue of consistency with assessment questionnaires, as they are quite subjective. Therefore, ideally, the same person should conduct the assessment to minimize errors, but it's not guaranteed to be completely accurate. Moreover, the broad intervals used in these assessments do not readily indicate the patient's condition."

Thirdly, during our interviews, Therapist 3 highlighted a challenge regarding standardization: "On a practical level, my current concern is about standardization, specifically whether caregivers can achieve the same effects as professionals. Often, caregivers may not notice many characteristics and behaviors of the elderly, and they might even struggle to engage in conversation with them. I'm unsure how to address this issue." In practice, the attitude and behavior of caregivers during the delivery of NPT using ICT also impact the effectiveness of the therapy. Moreover, therapists must consider the caregivers'

ability and willingness to learn, adding complexity to the treatment approach.

Lastly, Therapist 5 stated, “I believe that the process of human companionship cannot be replaced by technology. It can only serve as a part, a complementary or supportive element, but not as a complete substitute.” Through our interviews, six therapists expressed that technology cannot fully replace human care and companionship for the elderly. As social beings, humans fulfill their emotional needs through social interactions. Although technology can meet the basic communication needs of the elderly, they still require the companionship of lively humans.

4.4 Futures of ICT of NPT

The preceding section highlighted the absence of quantitative standards in the evaluation of NPTs. In interviews discussing the future prospects of ICT in NPT, therapists expressed hope in this area. Four therapists believe that the use of technology to monitor the vital signs of MCI patients in real time could provide therapists with a more accurate and universal assessment of the effects. For instance, during reminiscence therapy, therapists could monitor changes in the patients’ brainwaves or cerebral blood flow in real time. Therapist 2 stated, “If possible, during reminiscence therapy, being able to monitor some changes in the patients’ brainwaves or cerebral blood flow, including data variations, would inform us that the therapy indeed has some effect.”

Similarly, five therapists discussed the relationship between human resources and technology in the implementation of NPTs during semi-structured interviews. They unanimously expressed a keen anticipation for technology to reduce the physical and mental exertion of therapists and caregivers in the caregiving process. Therapist 8 mentioned, “Technology could be used to manage some of the music and videos during activities, sparing us the hassle of searching and adjusting the volume and rhythm manually. We have

previously used some multimedia tools for projecting and playing music, but it still required manual control. If some assistive technologies were available, I could focus more on the activities.” This approach would eliminate the need to expend significant time and energy maintaining order and harmony at the scene, preventing disputes among the elderly, and enhancing interaction and communication with them.

An innovative perspective emerged from our interviews, where therapists suggested that emerging generative artificial intelligence could assist individuals with MCI in a more personalized manner, especially as a companion chat tool. Therapist 7 articulated, “There’s a significant need for tools akin to companion chat. Many of our elderly residents desire continuous conversation, which is challenging to provide. The cost of human interaction is prohibitive. Even though our facility has a relatively high staff to resident ratio, it’s still not enough to fully meet this need. If there were a product that could engage in companion chat based on topics of interest to the elderly, I believe it would be well received and highly appreciated.”

Although the current market offers numerous conversational agents, such as robots mentioned in our literature review by Chen et al. and Ghafurian et al., which discuss robots like PARO and Kabochan designed to provide companionship to the elderly, these solutions still fall short of meeting the personalized needs of the elderly. Thus, therapists express a strong anticipation for personalized companion robots.

Regarding the future of ICT in NPT for addressing MCI and Alzheimer’s Disease in older adults, the utilization of ICT tools is increasingly becoming a trend. This was evident in each participatory observation, where ICT tools were employed across different therapeutic interventions. Whether it was playing music using Bluetooth and music players during music therapy, displaying images with PowerPoint during reminiscence therapy, or engaging in in-depth discussions with therapists about the benefits of VR for patients, the

integration of ICT tools within NPT methods is unmistakable. Similarly, in the literature review, researchers have highlighted various ICT applications in NPT, including robotics, online meetings.

5. Discussion

5.1 Summary and interpretation of findings

This research integrates insights from four participatory observations and interviews with eight physiotherapists to explore the application of ICT in the rehabilitation of patients with dementia through NPT. The study shows that ICTs, which are already widely used in daily life, such as projectors and Bluetooth music players, have provided significant assistance to physiotherapists in implementing NPT. These mature ICT tools have become indispensable when physiotherapists deliver interventions. Therapists have used mature ICT as a medium to display NPT content, thereby integrating ICT into NPT. Nonetheless, this application still faces numerous challenges, including resistance from the elderly to new technologies, difficulties in quantifying NPT outcomes, barriers to transferring knowledge to nursing staff, and the irreplaceability of human interaction. Despite these obstacles, therapists maintain an optimistic outlook on the prospects of applying ICT in NPT. As emerging technologies continue to develop, developers need to consider more how technology can assist physiotherapists, especially in accurately assessing treatment effects through real time monitoring of vital signs, reducing the psychological and physical burden on therapists and nursing staff. Emerging ICTs have a broad development horizon, offering potential enhancements in the effectiveness and efficiency of NPT for dementia care. These advancements are anticipated to offer more tailored and efficient rehabilitative support for individuals with MCI and AD.

5.2 Limitations

This study is subject to several limitations. Firstly, the use of semi-structured interviews with a limited number of participants may not adequately represent the diversity of the target population. This limitation restricts the generalizability and external validity of

the findings, as the results may not be extendable to a broader population. Additionally, the sample exhibits geographical bias, with all experiments conducted in Shanghai, China. This localization potentially limits the applicability of the research findings globally, particularly in contexts where technology availability and the feasibility of technology-based interventions are lower in low income countries. At the same time, given that the concept of dementia encompasses a very broad range of conditions, and due to the small sample size, therapists might not have encountered many types of dementia patients, but instead have predominantly dealt with patients in the MCI or AD stages. This situation could introduce a certain level of bias. Additionally, in this study, there exists the possibility that therapists might fear the development of technology could replace their jobs, leading to a risk of them concealing their true opinions about technology during in-depth interviews. This risk could also introduce bias into the study. Lastly, the application of convenience sampling presents its challenges, primarily concerning sample representativeness. This method's reliance on participant networks and referrals can result in a sample that may not comprehensively represent the entire target population, especially if the initial participants' social networks are homogeneous. Furthermore, ethical and privacy concerns arise with snowball sampling, as participants may need to disclose information about other potential participants they know. Researchers must ensure privacy and choice are respected throughout this process.

6. Conclusion

The findings of this study, supported by literature reviews, interviews, and participatory observations, uniformly indicate that the integration of ICT in NPT for treating MCI and AD faces significant practical challenges. These insights reveal that the application of ICT in such therapies is in an embryonic stage, demonstrating initial promise yet not fully realizing its potential benefits. Despite these hurdles, therapists maintain an optimistic view on the development of ICT, looking forward to its potential to alleviate their workload and enhance patient well-being in the future. This dual aspect—of ICT’s potential to revolutionize early screening and detection, coupled with the existing reliance on traditional clinical settings and personnel—signals a critical area for future development and research in enhancing the accessibility and effectiveness of cognitive disorder diagnostics.

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