PORTFOLIO
ENHANCING ELDERLY CARE THROUGH TELEPRESENCE ROBOTS II

Supervisor: Sirje Virkus

Co-supervisor: Marianne Paimre

LIFE project participants: Kaidi Lees, Maria Grigorovskaya, Merle Karu, Jana Kuzmina, Jekaterina Beljajeva, Helen Sisask, Isabel Ulejev, Rita Iris Loonde, Nikita Samozvanov, Fadzai Emmah Nembaware, Martine Margna, Ana Maria Akhvlediani, Ziyanda Nonhle Zwane, Paul Uche Noubuaku, Elizabeth Ongie Monika Nganje

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PROJECT REPORT

Introduction

The growing global population of elderly individuals highlights the need for innovative solutions to support their well-being and independence. Telepresence robots (TPR) present an opportunity to address challenges in elderly care, providing remote communication, assistance, and companionship (Shishehgar et al., 2017). This report outlines the findings and insights gained from our research project on TPRs for elderly individuals aged 65 years and above.

Problem Statement

The increasing population of elderly individuals globally has led to challenges in providing adequate care, maintaining their social interaction, and supporting their independence. Many elderly individuals face isolation, reduced mobility, and limited access to caregivers, especially in regions with strained healthcare resources. Current care systems often struggle to balance physical and emotional needs, leaving gaps that negatively impact the well-being of elderly individuals.

TPRs offer a promising solution to these issues but face barriers related to usability, accessibility, and acceptance by end-users and care providers. Additionally, ethical concerns, such as privacy and autonomy, must be addressed to ensure the responsible implementation of TPRs. The central problem the project aims to solve is how to effectively integrate TPRs into elderly care settings in a way that enhances social interaction and companionship, while also addressing concerns related to usability, accessibility, and ethical implications. Key challenges include identifying the specific needs of the elderly, their caregivers and medical professionals overcoming potential barriers to acceptance and usability, and addressing privacy and autonomy concerns associated with the use of TPRs.

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Significance of the Project

The importance of this project lies in its potential to transform elderly care through technological innovation. As populations age globally, there is an increasing demand for solutions that can provide both physical assistance and social engagement for elderly individuals, particularly those who may experience isolation or reduced mobility. TPRs offer an innovative approach by enabling remote communication, companionship, and potentially health monitoring. This project will not only advance the technological development of these robots but also ensure that the implementation considers the specific needs of elderly users, their caregivers and medical professionals. Additionally, by addressing social and ethical considerations, the project will ensure responsible and empathetic use of technology in care settings.

Goal

The primary goal of the project "Enhancing Elderly Care Through Telepresence Robots II" was to explore and assess how TPRs can be used to provide support and companionship for the elderly. The project specifically looked to identify the needs and preferences of elderly individuals, caregivers, and healthcare professionals, and to evaluate how existing and emerging TPR technologies can address these needs. It focuses on enhancing social interaction, reducing isolation, and improving the overall well-being of elderly individuals in care settings.

Methodology

Our study employed a grounded theory approach to guide the research process and findings (Beer, 2012). The project was divided into three groups:

1. **Group 1:** Focused on caregivers.
2. **Group 2:** Focused on medical professionals.
3. **Group 3:** Focused on elderly individuals.

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Each group was to conduct interviews with 15 people, resulting in a total of 45 interviewees. At the end of the interviewing process, the medical professionals' group had 12 interviewees instead of 15. A total of 42 interviews were conducted in this project. The interviews were analyzed using a constant comparative analysis and thematic analysis to synthesise results and identify key insights. Personas were created based on the findings, and recommendations were developed to address common themes in order to contribute to the development of TPRs.

How the Study Was Conducted

- Participants were selected to represent diverse experiences within elderly care: caregivers, medical professionals, and elderly individuals themselves.
- Semi-structured interviews were conducted to gather qualitative data on perceptions, needs, and challenges related to TPRs.
- Thematic analysis was used to identify recurring themes and patterns in the data. Insights from the analysis informed the creation of personas and actionable recommendations.

Limitations

- Language Barriers: Many elderly participants required translators, which may have influenced the nuances of their responses.
- Sample Size: Although 42 participants provided valuable insights, a larger sample could offer more generalised findings.
- Some elderly participants and caregivers had limited exposure to technology, which may have affected their perceptions and feedback.

Summary and Project Overview

This report has highlighted the significance of TPRs in addressing the growing needs of elderly care. The introduction, importance of the project, and problem statement establish the

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foundation for understanding the context and challenges surrounding the integration of TPRs into care settings.

The following sections will detail:

- **Action Plan:** An outline of the structured approach taken during the project.
- **Interviews:** Insights and findings from the interviews conducted with caregivers, medical professionals, and elderly participants.
- **Personas:** Representative profiles created to show the needs and preferences of key stakeholders.
- **Recommendations:** Practical suggestions for advancing the use of TPRs in elderly care.
- **Conclusion:** Final thoughts and implications of the project.

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PROJECT SUPERVISORS AND TEAM

The following table provides an overview of the key individuals involved in the project, including supervisors, group leaders, and team members.

Table 1: Project Team

Project Supervisor: Prof. Sirje Virkus Co-Supervisor: Dr. Marianne Paimre		
GROUP 1	**GROUP 2**	**GROUP 3**
Kaidi Lees - Group Leader *(Community Work in Ageing Society)*	Helen Sisask - Group Leader *(Journalism)*	Fadzai Emmah Nembaware Group leader *(Human Computer Interaction)*
Merle Karu *(IT Management)*	Rita Iris Loonde *(Child Welfare)*	Anna Maria Akhvlediani *(Crossmedia)*
Jana Kuzmina *(Russian Philology)*	Isabel Ulejev *(Journalism)*	Martine Margna *(Journalism)*
Jekaterina Beljajeva *(Russian Philology)*	Nikita Samozvanov *(Biology)*	Ziyanda Nonhle Zwane *(Human Rights in the Digital Society)*
Maria Grigorovskaya *(Organizational Behavior)*		Elizabeth Ongie Monika Nganje *(Human Rights in the Digital Society)*
		Paul Uche Ndubuaku *(International Relations)*

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PROJECT ACTION PLAN

Table 2: Project Action Plan

Timeframe (which month)	Activity and short description	Stakeholders	Person (name + study field) or team responsible
18.09.24	First meeting, introduction to project, dividing participants to groups, project action plan.	Supervisor, project participants	Project participants
25.09.24	Define the stakeholders for interviews. Formulating interview questions	Carers, medical professionals, elderly	Group 1, 2, 3
27.09.24	Finalizing interview questions	Carers, medical professionals, elderly	Group 1, 2, 3
01.10.24	Select the interviewees	Carers, medical professionals, elderly	Group 1, 2, 3
02.10.24	Finalizing the interviewees and institutions	Carers, medical professionals, elderly	Each project participant.

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16.10.24	Conduction interviews.	Carers, medical professionals, elderly	Each project participant.
19.10.24 20.10.24	Preparing and sending mid-term reports and slides.	Carers, medical professionals, elderly	Group 1, 2, 3 and group leaders.
22.10.24 23.10.24	Mid- term sessions	Carers, medical professionals, elderly, students	Group 1, 2, 3
10.11.24	Analyzing the 3 individual interview results	Carers, medical professionals, elderly, elderly family members, participants	Each project participant
17.11.24	Synthesizing the interview results	Carers, medical professionals, elderly, elderly family members.	Group 1, 2, 3
01.12.24	Developing telepresence prototypes for personas emerged from interview results	Carers, medical professionals, elderly	Group 1, 2, 3
04.12.24	Present groups' developed personas	Carers, medical professionals, elderly, students	Group 1, 2, 3

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11.12.24	Put together project recommendations	All project's students	Group 1, 2, 3
18.12.24	Portfolio Assembly	All project's students	Group 1, 2, 3
02.01.25	Finalizing the project and portfolio. Self reflections.	Carer, medical professional, elderly, participants	Group 1, 2, 3
03.01.25	Portfolio and self reflection submission.	Project participants.	Appointed person for portfolio and each project participant for reflection
07.01.25	Final project presentation	Project participants, other students, Carers, medical professionals, elderly, elderly family members, supervisor.	Each project participant, supervisor

PROJECT INTERVIEWS

The interviews were conducted with three distinct groups: caregivers, medical professionals, and elderly individuals, with each group consisting of 15 participants, resulting in a total of

45 participants. At the end medical professionals' group had 12 participants who gave interviews instead of 15. A total of 42 interviews were conducted in this project. The interviews were semi-structured in nature to allow for flexibility with the participants. This interview method was chosen to gain a rich, nuanced understanding of the experiences, perspectives, and needs of the target groups. Given that some elderly participants had limited or no technology background, a short video demonstrating the telepresence robot prototype (TPRP) was shown before the interview to ensure they had a basic understanding of the technology. Ethical considerations, including informed consent, confidentiality, and respect for participants' rights, were prioritized throughout the interview process.

CARERS

The following link CARERS' INTERVIEWS leads to a google drive folder holding all the information about the conducted interviews with the carers. Also audio files, transcriptions, analysis etc.

MEDICAL PROFESSIONALS

The following link Medical professional's interviews leads to a folder holding all the information regarding conducted interviews with medical professionals.

ELDERLY

The following linkElderly Interviews leads to a google drive folder holding all the information about the conducted interviews with the Elderly. Also audio files, transcriptions, analysis etc.

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PROJECT PERSONAS

To better understand the diverse needs, preferences, and challenges faced by the elderly, caregivers, and medical professionals in relation to TPRs, we developed personas based on insights gained from our interviews. Personas are fictional yet research-based representations of the primary user groups, designed to encapsulate the characteristics, goals, and pain points of these stakeholders.

The purpose of creating these personas is to presenting findings in a relatable and actionable way, guide the design process by ensuring that TPR development aligns with the actual needs of users, and bridge understanding by helping stakeholders such as designers, developers, and decision-makers empathise with the users and prioritise their needs. Personas also established a foundation for deriving meaningful recommendations and envisioning how TPRs can be effectively tailored to improve the well-being of elderly individuals while supporting caregivers and medical professionals.

CAREGIVERS

The carer personas outline the challenges, motivations, and goals of caregivers using telepresence robots. These insights will guide the development of functionalities and features for TPRs to address real-life issues. From our 15 interviews, we identified 6 distinct personas. We utilized AI to generate initial suggestions for these personas based on the interview analysis. These suggestions were then carefully reviewed, refined, and merged.

Persona 1: Care home carers open to the use of robots to increase residents' levels of social interaction and through it better their well-being.

- **Name:** Mara
- **Age:** 50 years

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- **Gender:** Female
- **Experience in Caregiving:** 4 years in care homes.
- **Relationship to the Care Recipient:** Professional caregiver.
- **Current Role in Caregiving:** Caregiver in a care facility.
- **Typical Tasks:** Monitoring health, providing companionship, assisting with daily activities (feeding, mobility, personal hygiene etc), and responding to emergencies.
- **Care Environment:** Care home with residents aged 80- 95 years. Half of them are in need of significant assistance. Care for elderly clients with a range of health conditions, including dementia.
- **Number of Recipients Cared For:** Multiple residents in a group setting. 37 residents in a care home.
- **Technological Comfort Level:** Limited exposure to assistive technologies (ex iPads), cautious but open to training.
- **Familiarity with Assistive Technology:** No prior experience with telepresence robots.
- **Preferred Devices for Communication:** Simple and intuitive devices like tablets with large screens.
- **Primary Goals:**
    - Facilitate communication between elderly residents and their loved ones, especially for those who cannot visit in person.
    - Manage time effectively across multiple caregiving tasks.
- **Secondary Goals:**
    - Reduce social isolation for elderly residents.
    - Enhance caregiving efficiency by reducing the burden on staff and enabling more time for personal care.
- **Core Motivations:**
    - Enhance resident well-being through better communication.
    - Build trust and alleviate loneliness in elderly recipients.
- **Current Challenges:**

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- o Elderly recipients' lack of interest and familiarity with technology.
- o Residents' disinterest in activities and lack of engagement, especially those with dementia.
- o Difficulty ensuring that elderly residents stay emotionally and mentally engaged with the outside world.
- o Time constraints and staff limitations prevent in-depth interactions with each resident.
- o Balancing multiple responsibilities across different care settings.

- **Concerns about Telepresence Robots:**
  - o Elderly residents may resist adapt to the robots.
  - o Dementia or cognitive impairments could lead to confusion or frustration.
  - o Privacy concerns in shared spaces like care homes.
  - o Environmental obstacles, such as stairs, could hinder robot functionality.
  - o The need for continuous supervision, especially with elderly residents who may not fully understand the robot's capabilities.
  - o Limited space and physical infrastructure to accommodate robots

- **Desired Features:**
  - o Simple, user-friendly interfaces with minimal buttons.
  - o Durable design for everyday use in a nursing facility.
  - o Safety features, such as obstacle detection and speed limits, to prevent accidents.
  - o A design that feels non-threatening to elderly residents, including avoiding overly mechanical or intimidating appearances.
  - o Audio features (such as speakers or headphones) that can help residents hear the robot clearly without disturbing others.

- **Training Preferences:**
  - o Step-by-step TPR training with hands-on demonstrations.
  - o Individualized training sessions for residents to ensure they can use the robot comfortably.

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- o   Ongoing support as caregivers and residents adapt to new technology.
- **Areas for Skill Development:**
  - o   Engaging elderly recipients through technology.
  - o   Safeguarding privacy and adapting to resident resistance.
- **Success Indicators:**
  - o   Increased resident happiness and improved communication with families.
  - o   Positive feedback from residents and families about communication improvements.

Persona 2: Care home carer focused on using robots mainly in care tasks easing carer's workload, residents' social interaction through robots is secondary.

- **Name:** Liina
- **Age:** 55 years

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- **Gender:** Female
- **Experience in Caregiving:** 3 years in a care home.
- **Relationship to the Care Recipient:** Professional caregiver.
- **Current Role in Caregiving:** Full-time caregiver in a care facility.
- **Typical Tasks:** Monitoring health, providing companionship, assisting with daily activities (feeding, mobility, personal hygiene etc), and responding to emergencies.
- **Care Environment:** Care home with residents aged 80- 95 years. Half of them are in need of significant assistance. Care for elderly clients with a range of health conditions, including dementia.
- **Number of Recipients Cared For:** Multiple residents at once.
- **Technological Comfort Level:** Open to technology if it simplifies and speeds up caregiving tasks.
- **Familiarity with Assistive Technology:** No prior experience with telepresence robots but motivated to learn.
- **Preferred Devices for Communication:** Mobile, iPads and other personal devices used by residents for communication. Residents' family members call carers for information on residents.
- **Primary Goals:**
  - Ensure that elderly residents receive timely assistance, especially in emergency situations.
  - Improve the caregiving experience by introducing technologies that aid in monitoring and communication.
  - Enhance caregiving efficiency, making it easier to monitor multiple residents at once.
- **Secondary Goals:**
  - Streamline caregiving through automated updates and monitoring tools.
  - Communication with family members, reducing feelings of loneliness.
- **Core Motivations:**
  - Enhance the efficiency of responses to critical incidents.

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o   Ensure safety and security for residents.

o   Interest in finding innovative solutions to caregiving challenges.

- **Current Challenges:**

    o   Adapting to emergencies quickly without technological aid.

    o   Managing multiple residents' needs simultaneously, especially in a facility with many elderly individuals.

    o   Resistance from both staff and residents due to unfamiliarity with the technology.

    o   The cost of purchasing robots and potential budget constraints.

- **Concerns about Telepresence Robots:**

    o   Fear that robots might be intimidating to elderly residents, especially those with cognitive impairments.

    o   Residents with dementia or cognitive impairments may find it difficult to adapt to new technologies.

    o   Potential for robots to disrupt established routines, causing anxiety or discomfort.

    o   The challenge of integrating robots into a caregiving environment that is not entirely technology-driven.

- **Desired Features:**

    o   Real-time monitoring and alerts for emergencies.

    o   Strong privacy and safety features to build trust.

    o   Lightweight design.

    o   Simple and intuitive so that elderly residents can use easily.

    o   Features that help monitor the safety and well-being of residents (e.g., fall detection, emergency alerts).

    o   Ability to facilitate communication with family members, reducing feelings of loneliness.

    o   Non-intrusive design that does not disrupt the natural routine of residents.

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- o Audio features for better communication with residents who may have hearing impairments.
- o Robots could reduce the workload of caregivers by monitoring residents and providing assistance with non-urgent matters.

- **Training Preferences:**
  - o Initial practical training for staff on robot functionality, with a focus on troubleshooting and maintenance.
  - o Continuous support for both staff and residents as they adjust to using the robot.
  - o Training for residents and their family members on robots.

- **Areas for Skill Development:**
  - o Emergency management using telepresence tools.
  - o Getting residents familiar with telepresence robots.

- **Success Indicators:**
  - o Quicker response times and improved preparedness for incidents.
  - o Enhanced efficiency in daily operations.
  - o Increased communication and connection between residents and their families.
  - o Positive feedback from staff and families regarding robot effectiveness.

Persona 3: Care home carer mostly skeptical toward TPR robots with fleeting thought how robots could help with some care tasks.

- **Name:** Natalia
- **Age:** 45 years
- **Gender:** Female

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- **Experience in Caregiving:** 10 years of experience with elderly residents.
- **Relationship to the Care Recipient:** Professional caregiver.
- **Current Role in Caregiving:** Caregiver providing personal care.
- **Typical Tasks:** Daily activities like feeding, administering medication, assisting with hygiene, and administering medication.
- **Care Environment:** Care home with small, shared spaces with existing technological infrastructure (e.g., Internet access).
- **Number of Recipients Cared For:** Several residents in a care home.
- **Technological Comfort Level:** Limited experience and hesitant toward telepresence robots.
- **Familiarity with Assistive Technology:** No prior use of telepresence robots.
- **Preferred Devices for Communication:** Simple devices with large buttons and minimal controls.
- **Primary Goals:**
  - Ensure high-quality personal care.
  - Create a safe and supportive environment for elderly residents.
- **Secondary Goals:**
  - Provide training to adapt to new technologies without additional burden.
  - Maybe use robots for practical caregiving tasks like feeding, administering medication, and hygiene.
- **Core Motivations:**
  - Maintain the dignity and comfort of elderly residents.
  - Care for residents with traditional caregiving methods.
- **Current Challenges:**
  - Belief that robots will be of no use and just a trending thing at the moment.
  - Lack of clear expectations for the role and benefits of robots.
  - Fear of potential harm or misuse of robots in caregiving environments.
  - Limited space and concerns about robots intruding into caregiving workflows.
  - Difficulty envisioning how robots will align with human caregiving tasks.

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- o Residents will not understand how to use them.
- **Concerns about Telepresence Robots:**
    - o Elderly residents may struggle to use or trust the technology.
    - o Robots may create safety risks, such as accidents or causing distress.
    - o Safety risks from moving robots in shared spaces.
    - o Potential for residents to accidentally damage robots or be startled.
    - o Violating personal boundaries if they always follow residents.
- **Desired Features:**
    - o Large screens with clear visuals.
    - o Simple interfaces with basic "on" and "off" buttons.
    - o Compact, durable designs that can be stored easily. Possible to hang up like TVs.
    - o Clear and simple visual design to avoid intimidating residents.
    - o Advanced capabilities like wash, feed, give medication etc to residents.
    - o Safe, stable designs suitable for small spaces.
- **Training Preferences:**
    - o In-depth sessions with hands-on experience.
    - o Opportunities to test robots in real caregiving scenarios.
    - o Courses and on-site support to address caregiver concerns.
- **Areas for Skill Development:**
    - o Managing resistance or fear from residents and caregivers toward new technology.
    - o Leveraging robots for hands-on caregiving tasks.
    - o Encouraging elderly residents to engage with robots comfortably.
    - o Understanding ethical considerations in using robots with elderly residents.
- **Success Indicators:**
    - o Positive feedback from residents and families.

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Persona 4: Care home carer focused on residents' well-being through current caregiving methods and in-person interaction, does not see the benefits of robot integration.

- **Name:** Leena
- **Age:** 55 years
- **Gender:** Female
- **Experience in Caregiving:** 7 years

- **Relationship to the Care Recipient:** Professional caregiver in care homes.
- **Current Role in Caregiving:** Full-time caregiver in a care facility. Caregiver, providing personal care and emotional support to elderly residents.
- **Typical Tasks:** Assisting with daily living activities, companionship, administering medication, and ensuring safety.
- **Care Environment:** Small, space-constrained care facility with elderly residents with mobility challenges and/or dementia.
- **Number of Recipients Cared For:** Multiple residents at once.
- **Technological Comfort Level:** Limited exposure to technology, cautious about new tools. Doesent' trust new technology much if she doesn't understand them.
- **Familiarity with Assistive Technology:** No previous experience with telepresence robots.
- **Preferred Devices for Communication:** Simple, easy-to-use devices (large screens, basic functions, telephones) and in-person interactions.
- **Primary Goals:**
  o   Ensure that elderly residents are comfortable and safe.
  o   Maintain the integrity of human interaction, avoiding the replacement of live communication.
  o   Believe current caregiving methods are sufficient.
- **Secondary Goals:**
  o   Maintain current practices without integrating robots.
- **Core Motivations:**
  o   Enhance quality of life for elderly residents, particularly those with dementia.
  o   Maintain dignity in caregiving and foster direct emotional connections.
- **Current Challenges:**
  o   Small spaces and lack of resources to introduce and implement new technology.
  o   Residents' potential fear, frustration or confusion when interacting with robots.

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- o Carers do not see the point for these robots. Robots will add to workload, not help.

- **Concerns about Telepresence Robots:**
  - o Fear of accidents, residents becoming startled or scared. Resident resistance particularly those who are bedridden or have dementia.
  - o Ethical concerns regarding the privacy of residents (e.g., cameras, monitoring).
  - o Worries about safety and physical damage to robots.
  - o Consents from family members.
  - o High cost of robots.

- **Desired Features:**
  - o Human-like appearance to appeal to residents' need for social interaction.
  - o Soft, huggable features to encourage tactile engagement.
  - o Simple interfaces that don't overwhelm residents or staff.

- **Training Preferences:**
  - o Hands-on training to understand robot functionality, with a focus on troubleshooting.
  - o Clear, simple instructions to ensure both staff and residents can interact comfortably.

- **Areas for Skill Development:**
  - o Facilitating technology adoption in environments where residents and carers are skeptical.
  - o Technology basics for caregivers.
  - o Helping elderly residents feel at ease with new devices.
  - o Managing space constraints while integrating new technologies.

- **Success Indicators:**
  - o Positive feedback from residents, family members and carers.
  - o Resident engagement with robots in positive ways (e.g., increased connection with family).

Persona 5: Care home carer with TPR experience. Looking to use robots in simpler care tasks and to lessen elderly social isolation.

- **Name:** Jevgeni
- **Age:** 50 years
- **Gender:** Male
- **Experience in Caregiving:** 2 years in elderly care.
- **Relationship to the Care Recipient:** Professional caregiver.

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- **Current Role in Caregiving:** Caregiver in a care home.
- **Typical Tasks:** Escorting residents, assisting with daily routines, providing emotional support, delivering medications, monitoring health conditions, meal distribution, ensuring resident safety, facilitating activities.
- **Care Environment:** Care home with elderly residents of varying abilities.
- **Number of Recipients Cared For:** Multiple residents.
- **Technological Comfort Level:** Moderately comfortable; familiar with telepresence robots.
- **Familiarity with Assistive Technology:** Limited basic familiarity, open to learning new tools, prior experience using telepresence robots for escorting residents and communication purposes.
- **Preferred Devices for Communication:** Basic familiarity with video calls and telepresence robot. In-person interactions; sometimes use digital communication tools
- **Primary Goals:**
  - Enhance elderly care by improving communication and interaction.
  - Provide tools that enable efficient communication and reduce isolation among residents and their families.
  - Support cognitive and psychological well-being of residents through companionship features.
  - Simplify caregiving tasks, such as reminders for meals or medications.
  - Reduce the physical workload on staff by delegating routine tasks to robots.
- **Secondary Goals:**
  - Increase caregiving efficiency by incorporating assistive technology for routine tasks.
  - Free up time for more complex caregiving duties by delegating simpler tasks to robots.
  - Help residents maintain independence through guided interactions with robots.

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- o Assist with emergencies or quick needs (turning on TVs or making announcements).

- **Core Motivations:**
  - o Desire to improve elderly care quality through innovative means.
  - o Motivation to make residents feel less isolated and more connected.
  - o Leverage technology to address gaps in caregiving capacity.
  - o Enable residents to stay connected with family and maintain autonomy.
  - o Desire to improve the care environment and enhance residents' quality of life.
  - o Desire to introduce innovative solutions that complement human caregiving.
  - o Ensuring safety and comfort for elderly residents.

- **Current Challenges:**
  - o Limited time to provide individualized support to each resident.
  - o The need for more advanced functions in robots to provide better assistance.
  - o Adapting to residents' varying comfort levels and familiarity with technology.
  - o Addressing elderly residents' reluctance to engage with new technologies and ensuring they are comfortable with them.
  - o Difficulty in meeting the emotional and social needs of all residents.
  - o Limited training and familiarity with advanced technology.

- **Concerns about Telepresence Robots:**
  - o Safety concerns such as robots navigating around wheelchairs and sudden movements startling residents.
  - o Privacy concerns, especially regarding sensitive interactions.
  - o Limited functionalities in current robots, which only offer basic escorting tasks.
  - o Elderly residents' acceptance and comfort with using telepresence robots in their daily routines.
  - o Ethical concerns over privacy and data security.
  - o Some elderly residents may struggle with adapting to robots, especially with complex interfaces.

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- **Desired Features:**
  - Conversational AI for answering questions and providing companionship (e.g., quizzes, storytelling, video calls).
  - Multi-functional capabilities like medication reminders and video communication.
  - Obstacle detection to ensure safety for elderly residents.
  - A friendly, human-like design that inspires trust and engagement.
  - Database for recognizing residents by name or face.
  - Simple voice commands for functionality like reminders (meals, medication, and other daily activities) and virtual tours.
  - Simple controls that can be easily used by elderly people and caregivers alike.
  - Basic social functions like conversation or showing residents a video call.
  - Ability to assist with physical tasks, such as distributing food.

- **Training Preferences:**
  - Hands-on training sessions to develop skills in robot operation.
  - Step-by-step, simple guides on robot functionalities and troubleshooting.
  - Continuous support and refresher courses as the technology evolves.
  - Training for staff on the robot's functionalities and how to integrate it into daily caregiving tasks. Added video tutorials.
  - Orientation for residents to introduce them to the robot, including hands-on sessions.

- **Areas for Skill Development:**
  - Adapting technology to improve caregiver efficiency.
  - Building trust and comfort among residents unfamiliar with robots.
  - Handling resistance or fear among elderly residents.
  - Improving elderly engagement and interaction through technology.
  - Learning about safety and privacy protocols in using telepresence robots.
  - Familiarizing with troubleshooting and basic maintenance of robotic devices.
  - Building confidence in using robots for caregiving tasks.

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● **Success Indicators:**

    o   Enhanced efficiency in managing caregiving tasks.

    o   Positive feedback from residents regarding companionship and interaction.

    o   Reduced loneliness and increased engagement in elderly residents.

    o   Improved time management and efficiency in routine caregiving tasks.

    o   Reliable, consistent operation of the robot with minimal technical issues.

    o   Effective integration of robots into caregiving workflows.

    o   Increased resident engagement and reduced feelings of isolation.

    o   Improved caregiving efficiency and time management.

    o   Positive feedback from residents and family members regarding the robot's utility.

Persona 6: Home caregiver who can see the benefits of using robots in care tasks and social interaction.

● **Name:** Helmi

● **Age:** 60 years

● **Gender:** Female

● **Experience in Caregiving:** 20 years in elderly care.

● **Relationship to the Care Recipient:** Professional caregiver in home care.

- **Current Role in Caregiving:** Caregiver ensuring residents' physical and emotional well-being.
- **Typical Tasks:** With home visits assisting with daily activities, care, medication, providing companionship, emergency responses.
- **Care Environment:** Home care, with recipients facing different levels of dementia, mobility challenges, advanced in age, with disabilities etc.
- **Number of Recipients Cared For:** Multiple care recipients, but one elderly at a time.
- **Technological Comfort Level:** Sceptical of new devices, cautious about their introduction.
- **Familiarity with Assistive Technology:** No experience with telepresence robots.
- **Preferred Devices for Communication:** In-person interaction, occasional phone or video calls for communication.
- **Primary Goals:**
    - Alleviate loneliness for elderly through communication and companionship.
    - Maintain trust and emotional safety in caregiving environments.
    - Use technology to monitor and assist residents remotely in emergencies.
    - Reduce caregiver workload through automation and remote monitoring tools.
- **Secondary Goals:**
    - Introduce technology that supports simple tasks, like reminders for medication or scheduled visits.
    - Provide accessible healthcare solutions, such as virtual doctor consultations.
    - Ensure residents remain connected with loved ones and their communities.
- **Core Motivations:**
    - Strengthen emotional bonds between elderly and their loved ones.
    - Ensure dignity and trust in caregiving relationships.
    - Introduce tools that enhance caregiving efficiency and safety.
    - Leverage technology to bridge the gap in healthcare accessibility for residents.

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- **Current Challenges:**
    - o Overcoming resistance from elderly who fear or distrust new technologies.
    - o Managing physical and cognitive limitations of elderly, such as arthritis or dementia.
    - o Integrating robots into spaces with limited infrastructure (internet) or accessibility.
    - o Ensuring affordability and practicality of new technologies.
    - o Limited ability to train elderly residents to use robots effectively, especially due to memory issues.

- **Concerns about Telepresence Robots:**
    - o Fear of elderly rejecting robots due to unfamiliarity or fear.
    - o Scepticism whether robots can meaningfully assist with caregiving tasks.
    - o Practical limitations in homes, such as space and internet access.
    - o Ethical concerns about privacy and data security.

- **Desired Features:**
    - o Large screens for clear visuals and communication.
    - o Simple, intuitive designs that inspire trust and ease of use.
    - o Functions that support basic caregiving needs, like reminders (medication, hydration, daily appointments, visits), communication aids.
    - o Remote control capabilities for monitoring elderly's environment for safety when needed and emergency alert capabilities.
    - o Features supporting virtual consultations with doctors or caregivers.
    - o High functionality in constrained environments, such as cluttered homes.
    - o The robot should be customizable based on the elderly person's specific preferences and needs, such as volume control, camera positioning, and interface language.

- **Training Preferences:**
    - o Practical, hands-on training for caregivers and elderly.
    - o Gradual introduction to help elderly when needed to build trust in robots.

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- o Comprehensive training focused on advanced features and troubleshooting.
- o Continuous assistance and updates as technology evolves.
- o The focus would be on making caregivers comfortable with remote control features, managing emergency functions, and ensuring that residents can use the robot with minimal instruction.

- **Areas for Skill Development:**
  - o Managing resistance from carers.
  - o Navigating and managing (emotional) resistance from elderly and families.
  - o Leveraging technology for emotional support and caregiving efficiency.
  - o Encouraging residents to engage with and accept new technologies.

- **Success Indicators:**
  - o Home care recipients engage positively with robots.
  - o Improved communication and reduced loneliness for elderly at home.
  - o Enhanced caregiver efficiency through practical robot applications.
  - o Increased safety and accessibility for elderly in homes.
  - o Elderly residents successfully using the robot for medical consultations.
  - o Caregivers feel more confident using the robot to support elderly and provide remote assistance as needed.

MEDICAL PROFESSIONALS

From the twelve interviews gathered from various medical professionals, such as cardiologists, nurses and internal doctors, three different personas emerged from the information given to the interviewees. The creation of additional personas was deemed unnecessary due to the considerable similarities identified across most interviews. However, the third persona emerged as uniquely distinct from the other two.

Persona 1: Liina

Name: Liina

Age: 35

Gender: Female

Professional Role: Nurse and a teacher

Years of Experience: 10+ years

Specialization: Elderly care and education

Primary Responsibilities in Elderly Care

Monitoring elderly patients' health conditions, guiding patients on medical procedures, including medication management, educating others about elderly care best practices

Work Environment

Combination of hospital settings, home care, and educational institutions

Number of Patients Typically Cared For

Approximately 15–20 elderly patients weekly

Technological Comfort Level

Comfortable with technology

Experience with Telemedicine

Occasional use of telemedicine tools (e.g., video calls for consultations)

Primary Devices for Medical Interactions

Tablet, smartphone, computer

Familiarity with Telepresence Robots

New to telepresence robots, has never encountered them.

Primary Goals

Ensure elderly patients feel supported emotionally and socially.

Use technology to improve access to healthcare without compromising physical contact or the quality of care.

Confirm that telepresence robots are co-developed with elderly patients for practicality and ease of use.

Secondary Goals

Enhance patients' integration into family and social circles, even when distance is a barrier.

Reduce loneliness and somatic health issues by providing consistent virtual contact with healthcare providers and loved ones.

Core Motivations

Improve the elderly's quality of life through accessible healthcare tools.

Ensure technology doesn't replace human connection but supplements it effectively.

Advocate for inclusivity by involving elderly individuals in the creation and testing phases of technological tools.

Current Challenges

Over-reliance on technology could distract from essential human touch in caregiving.

Elderly patients often struggle with cognitive issues, making it hard for them to understand or retain instructions given remotely.

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Financial investments for staff and patient training are essential but can be barriers to adoption.

Concerns about Telepresence Robots

Ensuring data protection and obtaining informed consent, especially for patients with cognitive challenges like dementia or schizophrenia.

Preventing misuse or unintended consequences, such as liability issues.

Designing robots for inclusivity, accommodating poor eyesight and hearing.

Navigating in homes of the elderly which usually are cluttered

The robot should be very easy to use

Can't trust technology all the way

Desired Features

Ease of Use - simple interfaces tailored for elderly users
Video and Audio Quality - High-resolution features for accurate remote assessments.
Health Monitoring Tools - Integration of tools to track vitals such as heart rate and oxygen
Alerts and Notifications - Real-time notifications for abnormal health readings, also an SOS button for emergency calls
Reminding elderly of everyday things like "have you eaten today?", "have you been drinking enough liquids?" etc
AI features for communication and questions (also a preference or a choice to change the voice of the robot and the appearance of the AI character)
Administration of medicines

Additional Functionalities

Access to patient records during virtual consultations.

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Communication tool to connect elderly patients with their family members

Having the choice of choosing the screen size (for people with poor eyesight)

Training Preferences

Interactive tutorials for healthcare professionals and elderly patients.

Comprehensive documentation on privacy and compliance

On-demand technical support for troubleshooting

A family member or acquaintance should be present to learn about the robot with the elderly person

Starting off slow: elderly can start as little as doing FaceTime calls or video calls to get familiar with newer technologies

Support groups for the elderly to discuss the robot and learn together

Areas for Skill Development

Learning effective methods for conducting remote health assessments.

Training on data privacy, compliance, and ethical considerations.

Familiarization with basic technical maintenance and troubleshooting of telepresence robots.

Success Indicators

Elderly patients experience improved health outcomes and reduced loneliness.

Higher satisfaction and engagement reported by both patients and caregivers.

Telepresence robots seamlessly integrate into care routines without adding complexity or reducing care quality.

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Positive feedback from elderly patients and families about improved accessibility and communication.

Nationally approved programme (helps build trust)

Persona 2: Marge

Name: Marge

Age Range: 56

Gender: Female

Professional Role: Physiotherapist and nurse

Years of Experience: 20+ years

Specialization: Rehabilitation and nursing
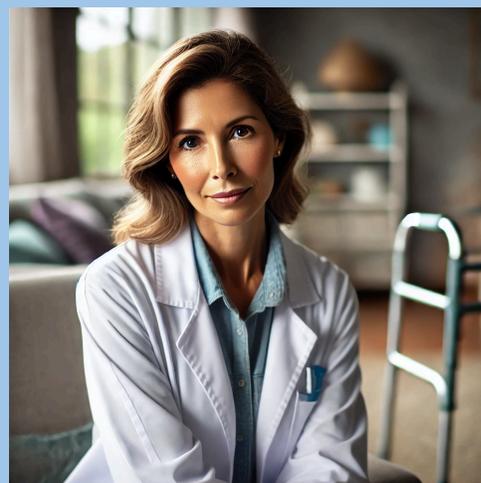
Primary Responsibilities in Elderly Care

Providing physical therapy and rehabilitation support, assisting with patient counseling and mental well-being, monitoring patients' recovery and progress in daily activities

Work Environment

Nursing homes, in-home care, and rehabilitation centers

Number of Patients Typically Cared For

Around 10–15 elderly patients weekly

Technological Comfort Level

Low to moderate comfort with technology

Experience with Telemedicine

Minimal, no prior experience with telepresence robots

Familiarity with Telepresence Robots

No experience with telepresence robots

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Primary Goals

Enhance communication for counseling and motivation, fostering active engagement in elderly patients.

Prevent mental isolation by encouraging meaningful conversations.

Provide an easy-to-use platform that is accessible for elderly individuals with minimal technical skills.

Secondary Goals

Enable professionals to allocate their time more efficiently without compromising care quality.

Ensure the robot supports physical and emotional well-being without overwhelming or scaring elderly users.

Promote safe use by addressing potential risks such as tripping hazards or panic /crisis situations.

Core Motivations

Support elderly patients' emotional health and encourage social engagement.

Bridge the gap when physical presence isn't possible due to time or distance constraints.

Create a tool that is intuitive and comforting for elderly individuals.

Current Challenges

Elderly patients often struggle with poor computer skills and low IT awareness, making technology adoption challenging.

Limited motivation among elderly patients to engage with technological tools.

Concerns about Telepresence Robots

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Data privacy depends heavily on the user's understanding of security and IT basics.

Telepresence robots may not be suitable for patients with advanced dementia or severe mental health challenges.

Physical design must avoid intimidating users or causing safety hazards like tripping.

Risk of not being able to respond quickly to emergencies observed through telepresence robots.

Telepresence robots may not be suitable for use in smaller or cluttered homes

Telepresence robots are too expensive to be effective. Costs must be reduced.

Desired Features

Compact Design - small, user-friendly robots that minimize the risk of physical obstruction. Compromise must be made with the size of the screen as poor eyesight may affect the user experience.

Ease of Use - a simple interface that requires minimal technical skills for operation.

Enhanced Communication - high-quality video and audio to enable meaningful interactions and counseling.

Additional Functionalities

Encourage elderly users to engage in conversations and learn new things through the platform.

Ability to monitor physical and mental well-being remotely while offering real-time updates to caregivers. Ability to monitor temperature, blood pressure.

Serve as a companion to reduce loneliness and promote mental health.

Training Preferences

Clear instructions and hands-on training for professionals on how to introduce robots to elderly patients.

Workshops to address privacy concerns and IT security for staff and users.

Ongoing support and resources for troubleshooting and adapting to telepresence technology.

Areas for Skill Development

Building relationships and motivating patients through remote communication tools.

Addressing ethical concerns and privacy compliance effectively.

Managing situations like panic attacks or crises observed through the robot.

Success Indicators

Increased communication and social engagement among elderly patients.

Reduction in mental isolation and improved emotional well-being.

Ease of adoption by elderly users, with positive feedback on usability and comfort.

Efficient use of medical professionals' time, enabling more consistent care.

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Persona 3: **Siiri**

Name: Siiri

Age: 82 years

Gender: Female

Professional Role: Doctor

Years of Experience: ~50 years

Specialization: Internal medicine at nursing and care clinic, palliative care

Primary Responsibilities in Elderly Care

Admitting and enrolling new patients, patient analysis, making a diagnosis, drawing up medical documents, writing a treatment plan, night watch

Work Environment

Working in a care clinic

Number of Patients Typically Cared For

Admitting 3-4 new patients per day on average

Technological Comfort Level

Very low, only familiar with smartphones and computers provided by work

Experience with Telemedicine

None

Primary Devices for Medical Interactions

In-person communication, computer

Familiarity with Telepresence Robots

No hands - on experience, but they had an AI robot for testing in their ward

Primary Goals

- Providing communication

Concerns about Telepresence Robots

- The elderly lose their ability to learn and have poor memory, therefore it's not really realistic for the elderly to learn to use robots

- Robots are not real people and do not fulfill the communication needs like a conversation with a real person would do, patients are scared of robots

- Too early to introduce robots in healthcare

- The use of robots in elderly care is quite limited

- The robots are too expensive

Desired Features

- They could carry food in front of the patient

- Being a conversation partner

Additional Functionalities

- Delivering packages

- The robot could be used for monitoring or communication when the doctor is not present in the clinic.

Training Preferences

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- Can't say because of lack of knowledge

Areas for Skill Development

- Can't say because of lack of knowledge

Success Indicators

- Can't say because of lack of knowledge

ELDERLY

Development of Personas

Using the insights gathered in the interviews, five distinct personas were created that represent the diversity within the elderly population. These personas reflect diverse experiences and preferences, highlighting varying levels of technological familiarity, social engagement, and health conditions that influence their interaction with TPRs.

Method

The personas were developed using thematic analysis of the data collected during interviews with elderly participants. This process involved identifying recurring patterns and key insights related to their daily lives, challenges, and expectations for telepresence robots. By analyzing this data, we were able to distill essential characteristics, motivations, and pain points into well-rounded personas. Each persona represents a unique aspect of the elderly population, providing a comprehensive foundation for deriving actionable recommendations and envisioning how TPRs can enhance elderly care. The full personas can be accessed in the folder PERSONAS.

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Summary of the personas

Persona 1

Name: Mathilda

Age: 72 years old

Gender: Female

Living Situation: Lives in another country with one of her daughters and 2 grandchildren.

Marital Status: Widowed

Support System

lives with family and has always lived with either one or her other daughter.

General Health Condition

Fair, chronic Conditions, blood pressure problems.

Current Level of Mobility

fully mobile, but because of excess weight gets tired easily

Cognitive Status

sharp. She loves doing crossword puzzles, reading books and watching movies in different languages(Russian). occasionally does Duolingo.

Health and Wellness Goals

Maintain independence, Stay mentally active

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Typical Daily Activities

Cooking for the family, tidying up, picking children up from school, playing Joker online, Facebook, Communicating with loved ones, reading and watching films.

Social Interaction

video calls with family and friends abroad,and everyday interaction with the family she lives with.

Hobbies and Interests

watching films, reading books, knitting and sewing(overall making clothes), and music(Georgian)

Frequency of Physical Activity

moves around in the house, cleans, and goes outside every day to take the children home from school

Technology Comfort Level

comfortable with smartphones, uses it daily to stay in touch with friends and family, as well as watch YouTube, play games, and use Facebook.

Primary Devices Used

Everyday smartphone users use laptops and tablets.

Current Use of Assistive Technologies

None; hadn't owned or used it on her own but had a heart monitor and medical alert system in the hospital when she had a heart attack

Familiarity with Video Calls

regularly uses Video calls with family and friends.

Primary Goals

Making daily chores and tasks easier, giving herself more time and energy

Secondary Goals

Getting help with language issues

Core Motivations

Feeling less tired after doing things e.g. chores or taking grandchildren to school

Having more time and energy for herself

In general, likes and is open minded about new technology

Current Challenges

Getting tired quickly after walking around or doing household chores

Language barrier issues (lives in a foreign country)

Concerns about Telepresence Robots

That they would be careful with things and objects around the house

Her personal data privacy

That they should have some "child lock" system, in case of users with harsher diagnoses e.g. Alzheimers

That they might look a bit too uncanny / weird

Desired Features

Multiple language support, language translation

Assistance with household chores

Additional Functionalities- If it could assist her outside the house as well (e.g. as a live translator)

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Training Preferences

Hopeful that the robot will be easy enough to use and understand

At first, someone to show her in person how to operate it and fix any common issues that might arise

Assistance with Robot Use- Hopeful, that it will not have many problems and will get regular updates and new generations of robots based on client needs

Persona 2

Name: Kersti Kask

Age: 74 years

Gender: Female

Living Situation: Lives alone, about 45 minutes from her kids and grandkids.

Marital Status: Widowed

Support System

Her kids and grandkids visit her weekly

General Health Condition

Has hearing issues - uses a hearing aid, had a heart attack a few years back and now has a heart monitor. Also has glasses.

Chronic Conditions

Heart monitor

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Current Level of Mobility

She has good mobility and keeps healthy by taking daily walks

Cognitive Status

Her memory is good and mind is sharp, only things impaired are hearing and vision

Health and Wellness Goals

She likes to keep up with her grandkids, but only sees them once a week - a telepresence robot would allow for more communication.

Typical Daily Activities

Long walks, cleaning, knitting and phone calls with family and her friends, reading the paper to stay in touch with the world and books.

Social Interaction

She and her girlfriends are part of a book and knitting club - they have weekly meetings, rotating at who's, so every month she hosts her friends.

Hobbies and Interests

Reading and knitting

Frequency of Physical Activity

Daily walks

Technology Comfort Level

Doesn't love technology, but is open to it and familiar with it thanks to her grandkids

Primary Devices Used

Mobile phone and computer

Current Use of Assistive Technologies

None

Familiarity with Video Calls

She facetimes with her grandkids, so quite familiar

Primary Goals

- Help with feelings of loneliness due to living alone

Secondary Goals

- Get on better terms with technology

Core Motivations

-to feel apart of family's daily lives

Current Challenges

- Loneliness due to living alone and husband's death

Concerns about Telepresence Robots

- distrust towards the internet - afraid their information and videos will leak

Desired Features

-Simple use - big buttons
 - Screen display for video calls

Additional Functionalities

- Reminders for medication and moving, drinking water etc.
 - Video call function to communicate with family and friends

Training Preferences

- Hands-on, in-person guidance with family or caregiver support.
 - Continuous support available as needed via phone call, optional in house help

Assistance with Robot Use

- Regular follow-ups from robot's support team - like people who specialize in them, to check on comfort and use with the device.
 - Hands-on and in person support during setup and use.
 - 24/7 phone line for help with the device

Success Indicators

- less lonely, more frequent communication with family and friends
- Guaranteed to remember medications and physical movement
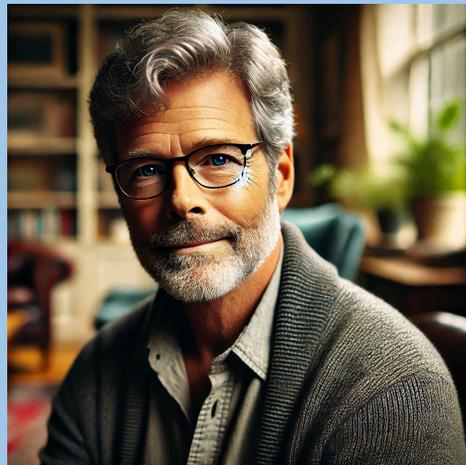- More comfortable and in touch with technology

Persona 3

Name: Jeff Helsinger

Age: Approximately 65 years

Gender: Male

Living Situation: Lives alone in a small suburban home

Marital Status: Widowed

Support System

Limited external support; occasional visits from neighbors and weekly calls with his children who live abroad

General Health Condition

Fair

Chronic Conditions

Mild hypertension & occasional back aches

Current Level of Mobility

Walks unaided but experiences stiffness and pain during extended activities

Cognitive Status

Enjoys mental challenges like puzzles and crosswords

Health and Wellness Goals

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Manage chronic conditions with minimal external help

Typical Daily Activities

Reading novels, watching documentaries, light gardening, and cooking

Social Interaction

Limited to occasional neighborly chats and video calls with family

Hobbies and Interests

 Chess, gardening, music (classical and jazz), and bird watching

Frequency of Physical Activity

Takes short walks daily and stretches for joint flexibility

Technology Comfort Level

Comfortable using a smartphone for calls and simple apps; avoids overly complex technology

Primary Devices Used

Occasionally uses video calls with guidance from family

Current Use of Assistive Technologies

None; unfamiliar with smart or assistive technologies

Familiarity with Video Calls

Unfamiliar; phone calls used primarily for communication

Primary Goals

- Enhance connection with family through video calls
- Assist with reminders for medications and appointments
- Provide companionship during moments of loneliness

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Secondary Goals

-Facilitate participation in virtual social events and activities

-Enable family members and caregivers to check in remotely

-Provide entertainment like playing chess or streaming classical music

Core Motivations

-Reduce feelings of isolation

-Maintain autonomy in daily life

-Enhance safety at home

Current Challenges

-Managing medication schedules and doctor appointments

-mobility when back aches

Concerns about Telepresence Robots

- Concerned about ease of use; may find operating technology challenging.

- Privacy concerns related to data collection.

- Worry about relying on technology over human support.

Desired Features

-Simple, intuitive interface with voice command functionality

-Clear video and audio quality for effective communication

-Emergency alert system with real-time health notifications

-Adjustable height and friendly design to match his home aesthetic

Additional Functionalities

-Integration with his existing health monitoring devices

-Automated reminders for tasks like taking medication or watering plants

Training Preferences

-Short tutorials with family or caregiver involvement

-Simple video guides and easy troubleshooting

-24/7 technical support for immediate issue resolution

Assistance with Robot Use

-Automated prompts for use (e.g., reminders for daily check-ins)

-Regular follow-ups by caregivers or family to ensure continued comfort with the robot

Success Indicators

-Increased frequency of communication with loved ones

-Improved health and medication management

-Independence in daily activities

-Reduced feelings of loneliness

Persona 4

Name: Gugu Dlamini

Age 75 years

Gender: Female

Living Situation: Lives on the farm with her family (kids and grandkids), currently using a wheelchair because of her Osteoarthritis..

Marital Status: Widow

Support System

Family and grandkids

General Health Condition

Osteoarthritis

Chronic Conditions

Arthritis;uses a wheelchair

Current Level of Mobility

She currently can't stand on her own and needs support.

Cognitive Status

She is well , smart, funny and communicates well.

Health and Wellness Goals

Wants to reduce the burden on her family and is generally interested in trying assistive technology.

Typical Daily Activities

Bath , 10 minutes exercise from physiotherapy , 3 square meals , scroll around the farm and watch tv

Social Interaction

Attends Church every Sunday , hospital visits and sometimes grocery shopping with the family.

Hobbies and Interests

Farming , reading , watching TV and being a granny

Frequency of Physical Activity

10 minutes exercise at least 3/4 times a week

Technology Comfort Level

Very Open minded and interested

Primary Devices Used

Cellphone

Current Use of Assistive Technologies

None

Familiarity with Video Calls

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Very Familiar

Primary Goals

- Make life a bit easier

Secondary Goals

- Enjoy the technology

Core Motivations

-Keep busy and entertained

Current Challenges

- Immobility due to Osteoarthritis

Concerns about Telepresence Robots
 - Malfunction feature

Desired Features

-Voice and Sound

- Vital Signs

- Automatic shut down during malfunction

Additional Functionalities

-Entertainment (News, audio books, music)

Training Preferences

-Family should be included during training

- Comfort of her home

Assistance with Robot Use

- Taking of vital signs
- Initial hands-on support during setup and initial use.

Success Indicators

- Reduce family burden

-Reduce hospital visits

- Entertainment

Persona 5

Name: Blendina Marere

Age 75 years

Gender: Female

Living Situation: Lives alone, takes 10-15 minutes' walk daily, rare a good number of Chickens for sale.

Marital Status: Happily Married and lives with her spouse

Support System

Gets visits from children and inlaws.

General Health Condition

Arthritis and occasional fatigue

Chronic Conditions

Arthritis; mostly use walking stick

Current Level of Mobility

Not bad, walking aid is applied to prevent further hurt but she can walk just as good as her age

Cognitive Status

Sharp, very insightful, thought process is smooth and she communicates well.

Health and Wellness Goals

Wants to be able to live freely without bothering anyone, hence assistive technology is ideal for her.

Typical Daily Activities

Short walks, Feeding the chickens, garden/household chores and general accounting.

Social Interaction

Have a weekly town hall meeting a few kilometers away. Maintains relationships with distant family members through social media.

Hobbies and Interests

Gardening, Praying, telling stories and raising kids.

Frequency of Physical Activity

Always, everyday maintenance of the garden.

Technology Comfort Level

Very Open Minded about high technology

Primary Devices Used

Cellphone

Current Use of Assistive Technologies

None

Familiarity with Video Calls

Very familiar, she only calls video or audio, she rarely texts but can send voice notes.

Primary Goals

- Remove loneliness sometimes felt from living in the countryside.
- Manage effective communication through video call while executing her daily activities.

Secondary Goals

- Screen time to enable visuals

Core Motivations

- Reduce isolation.

Current Challenges

- Loneliness due to family migration

Concerns about Telepresence Robots

 - Illegal use of private information by the government.

Desired Features

- Voice Command.
 - Gas Leak Detector
 - Screen display for video calls

Additional Functionalities

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- Audio prompts and reminders for hydration and wellness.
 - Video call function to communicate with family.
 - Simple entertainment features (e.g., audio books, music).

Training Preferences

- Hands-on, in-person guidance with family or caregiver support.
 - Basic, easy-to-understand video guides.
 - Continuous support available as needed.

Assistance with Robot Use

- Regular follow-ups from family to check on comfort with the device.
 - Initial hands-on support during setup and initial use.
 - Simplified troubleshooting resources.

Success Indicators

- Greater comfort with technology, reducing hesitation.
 - Improved social engagement with family and friends.
 - Enhanced safety and independence at home.
 - Decreased feelings of loneliness.

PROJECT RECOMMENDATIONS

<u>CAREGIVERS' Recommendations Related to Telepresence Robots</u>

<u>Carers:</u>

Design and Functionality

- ○ Robots should be non-threatening, simple to use, and lightweight for easy transport.
- ○ Include quiet motors, durable materials, compact build, and stable mobility.
- ○ Adjustable speed and emergency stop functions to enhance safety during operation.

Navigation and Safety

- ○ Obstacle detection and sensors for navigating safely around limited spaces, uneven floors, and furniture.
- ○ Capability to map and learn the environment, similar to robot mowers and vacuum cleaners.
- ○ Emergency call functions for relatives or rescue services.

Communication Features

- ○ High-quality video and audio for effective communication.
- ○ Automatic camera focus on the speaker or call receiver with an option to disable this feature.
- ○ Adjustable audio settings for hearing impairments and noise reduction to prioritize speaker's voice.

Efficiency

- ○ Long battery life, easy charging, and reminders for charging.

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- ○ Low power consumption and backup battery for power outages.
- ○ Compatibility with reliable Wi-Fi, 4G, and 5G networks.

Training and Familiarization

- ○ Step-by-step training with hands-on demonstrations for carers.
- ○ Ongoing technical support to ensure adaptability to the robot's functionalities.

Care Home and Home Care Elderly:

Ease of Use

- ○ Simple interface with minimal buttons, large high-contrast screens, and adjustable font and icon sizes.
- ○ Speech customization options for language, clarity, and tone.
- ○ Friendly appearance to inspire trust and comfort.

Safety and Independence

- ○ Emergency alert functions for immediate assistance.
- ○ Automated reminders for daily routines, such as medication and appointments.
- ○ Robots should support physical assistance, like helping elderly in case of falls or carrying objects.

Personalization and Learning

- ○ Adaptive interaction based on user behavior (e.g., adjusting tone for residents with dementia).
- ○ Guidance features to assist with first-time usage and suggest help if users seem lost.

Health Monitoring

- ○ Real-time monitoring of vital signs (pulse, blood pressure, temperature).

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- Assistance in emergencies and capability to manage multiple residents' health statuses simultaneously.

Introduction and Training

- Gradual introduction of robots, starting with simple tasks.
- Individualized training for elderly to ensure comfort in using the robots.
- Special considerations for elderly with dementia, ensuring appropriate usage.

<u>Elderly's Family Members:</u>

Communication and Interaction

- Enable seamless communication with high-quality video and audio.
- Emergency call functionality to keep family members informed of critical situations.

Training

- Provide accessible training to family members so they can teach elderly users and build confidence in using robots.
- Familiarize family members with robot functionalities to assist in remote caregiving.

<u>General Recommendations from carer group for Robots</u>

Modular Functionality

- Develop robots with interchangeable modes or modules to suit different user needs:
    - Care home carer mode
    - Care home elderly mode
    - Home care carer mode
    - Family member as carer mode

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- - ■ At-home helper for independent elderly
    - ■ Medical professional mode
  - ○ Allow simultaneous activation of multiple modes to expand utility and reduce the need for multiple robots.

Advanced Features

- ○ Incorporate artificial intelligence for companionship and task assistance.
- ○ Speech recognition systems that allow hands-free interaction.
- ○ Voice prompts to confirm actions, such as, "Would you like me to call your family?"
- ○ Real-time health and emergency monitoring capabilities.

Safety and Privacy

- ○ Connection encryption to ensure secure communication.
- ○ Features to navigate safely in all types of care environments, including uneven terrain.

Energy Efficiency and Durability

- ○ Ensure energy efficiency with low power consumption and easy charging mechanisms.
- ○ Include robust designs that can withstand daily wear and tear.

Scope Expansion

- ○ Consider enhancing TPRs with physical assistance capabilities, such as robotic arms, to:
    - ■ Help elderly dress or reach objects.
    - ■ Perform basic caregiving tasks, such as feeding or holding items.

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Introduction Strategy

- ○ Gradual roll-out with initial focus on simple and non-intrusive tasks.
- ○ Provide ongoing training and technical support to both carers and elderly users to build familiarity and confidence.

Link: LIFE -GROUP 1- CARERS- FINAL RECOMMENDATIONS

MEDICAL PROFESSIONALS ' Recommendations Related to Telepresence Robots

1. **Design and functionality**

- The robot should have a distinctive SOS button for a direct crisis response from a medical professional, additional monitoring options like thermometers/thermal cameras, blood pressure monitor

- The robot could help monitor simple tasks like taking meds, checking the meds (the name of meds, the dosages), reminding the elder to eat and drink etc

2. **Training and support**

- Study groups for elders: Studying together and discussing problems so tackling them wouldn't be so intimidating, also more fun to do things in groups since elderly lack communication

- The elderly should learn to use the robot with a family member or someone they trust, so when an elderly has problems using the robot, they could help out

- When introducing a robot seems scary, the elderly could start their learning journey using FaceTime calls (little steps at a time)

3. **Privacy**

- The robot shouldn't intrude when the elderly is changing clothes or going to the toilet (but in this case, the robot could miss an emergency)

4. **Other**

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- Elderly with cognitive health problems, who may have bad memory or are unable to learn new things might not accept the robot

- Robots should not be combined with media platforms, they should exist in its own ecosystem

- Nationally approved and funded programme would ensure more trust

Link: TPR Group 2 Recommendations

ELDERLY' Recommendations Related to Telepresence Robots

1. **Addressing Social Isolation**
○ Participants expressed loneliness and a desire for more frequent interaction with family and friends.
○ **Recommendation:** Add a feature that helps families schedule regular video calls or virtual visits through the robot.

2. **Simplified User Interfaces**
○ The persona, Kersti Kask represented elderly individuals with difficulties using complex technology due to physical limitations, hearing, and vision impairment.
○ **Recommendation:** Design intuitive interfaces with large buttons, clear audio-visual cues, and customizable accessibility features for users with hearing or vision impairments.

3. **Mobility Support and Assistance**
○ Persona Gugu emphasized the need for mobility-focused solutions to improve independence and health management.
○ **Recommendation:** Equip the telepresence robot with features like mobility tracking, voice-guided physiotherapy exercises, and compatibility with walking aids or wheelchairs. Examples include:
  ■ Adjustable height mechanism to align with users sitting in wheelchairs or using walkers.

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- Stable bases with advanced sensors to navigate safely around wheelchairs and walking aids.
- Smart navigation algorithms that recognize and follow wheelchairs or walking aids.

4. **Cognitive and Emotional Engagement**
○ Users like our personas Jeff and Mathilda prioritized staying mentally active and entertained.
○ **Recommendation:** Include features for mental stimulation such as games, puzzles, music, and virtual social events to combat boredom and cognitive decline.

5. **Privacy and Security Assurance**
○ Concerns about data security and misuse of personal information were consistent among interview participants.
○ **Recommendation:** Strong privacy controls, clear privacy policies, and customizable sharing settings.

6. **Multilingual and Cultural Adaptability**
○ The participants we interviewed were from culturally diverse backgrounds.
○ **Recommendation:** Provide multilingual support and culturally relevant functionalities, such as live translation and region-specific entertainment options.

7. **Training and Support**
○ Almost all personas emphasized the importance of ease of use and continued guidance for telepresence robot use.
○ **Recommendation:** Offer hands-on training sessions with family or caregivers, video tutorials, and ongoing technical support accessible via the robot.

8. **Health Monitoring and Emergency Alerts**
○ Many participants expressed concerns about managing chronic conditions and needing timely medical assistance.

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- ○ **Recommendation:** Integrate sensors for vital sign tracking, medication reminders, and an emergency alert system linked to caregivers or health services.

9. **Customization and Personalization**

- ○ Interviews revealed individual preferences for hobbies, routines, and features, such as TPRs that make tea or exhibit human-like features.

- ○ **Recommendation:** Provide customizable options for the physical appearance of a TPR and the user interface, including personalized settings and preferred communication methods.

10. **Durable and Aesthetic Design**

- ○ Users like Jeff and Blendina preferred unobtrusive, friendly-looking designs that complement their daily lives.

- ○ **Recommendation:** Make the telepresence robot visually appealing, lightweight, and sturdy to fit into the user's home environment.

COMMON AND OVERLAPPING Recommendations Across Groups

The following are recommendations based on the interviews and feedback from carers, medical professionals, and elderly participants. These shared insights highlight overlapping priorities and suggest a unified direction for telepresence robot (TPR) development.

Table 3: Recommendations Across Groups

CATEGORY	RECOMMENDATIONS
Design and Functionality	- Lightweight, compact build for portability. - Friendly, approachable appearance. - Adjustable screen size with large fonts and buttons. - Durable materials and quiet motors. - Modular design for multiple user groups.

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Navigation and Safety	- Obstacle detection and avoidance sensors. - Environment mapping for efficient navigation. - Emergency stop button. - Stable mobility for uneven floors. - Real-time surroundings monitoring.
Communication and Interaction	- High-quality video/audio with adjustable settings. - Noise reduction for clarity. - Games, puzzles, and virtual events for mental stimulation. - Multilingual support with live translation. - AI integration for companionship.
Health Monitoring and Emergency Alerts	- Integrated sensors for vital tracking (e.g., pulse, temperature). - Medication reminders and emergency alerts. - Voice-guided exercises for physiotherapy. - Compatibility with mobility aids.
Privacy and Security	- Encrypted data for secure communication. - Transparent privacy policies. - Limited call logs for trusted contacts. - Settings for non-intrusive operation during private moments.
Energy Efficiency	- Long battery life with reminders for recharging. - Backup battery for emergencies. - Energy-efficient operations for prolonged use.
Training and Familiarization	- Simplified controls with minimal buttons. - Step-by-step guidance for new users. - Video tutorials and ongoing technical support.

Customization and Personalization	Adjustable speech, language, and tone. - Personalized appearance and communication settings. - Adaptable features for physical or cognitive limitations. - Learning user habits for tailored interactions.
Cost and Implementation	- Flexible cost models, including rentals. - Scalable integration into public healthcare. - Compatibility with existing networks (Wi-Fi, 4G, 5G).
Aesthetic and Ergonomic Design	- Modern, unobtrusive designs that fit home environments. - Lightweight yet sturdy build. - Easy-to-clean surfaces for hygiene. - Adjustable mechanisms for ergonomic convenience.

COMMUNICATION TO STAKEHOLDERS

Communication with stakeholders was facilitated through various methods for inclusivity, clarity, and effectiveness. The primary stakeholders were elderly individuals, medical professionals, and caregivers. For the elderly participants, interviews were conducted over the phone, video calls in form that made the participant feel comfortable and encouraged to share their thoughts. These interactions often required the use of local languages alongside English, to bridge any language gaps. Short videos were played for demonstrations of the telepresence robot functionalities to ensure participants understood the context of the discussions.

Medical professionals were engaged through face-to-face interviews and phone calls. Feedback was actively sought on health-related functionalities and emergency response features. Caregivers participated in both in-person and phone interviews, with conversations conducted in a mix of local languages and English. Efforts were made to create a relaxed atmosphere, enabling carers to openly discuss their challenges, preferences, and concerns.

As researchers, we met weekly on Wednesdays for updates and discussions facilitated by our supervisors. These meetings allowed us to consolidate findings, address challenges, and plan next steps collaboratively within our groups. This structured approach ensured consistency in our research and effective integration of stakeholder feedback.

We plan to disseminate the project's results in a digital newsletter of Tallinn University both in Estonian and English.

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