



A review summary:

Human Factors: Technology in Aged Care

February 2023

Prepared by Dr Claire Gough, Dr Bethany Wilton-Harding and Tania Marin. Knowledge and Implementation Hub, Aged Care Research and Industry Innovation Australia, Flinders University

Key Points

- A scoping review found 111 studies and reviews published since 2012 describing the human factors that may influence how technologies are used in aged care.
- The key themes identified from the research evidence are technology usability, technology acceptance, attitudes towards robots, attitudes towards telehealth, cybersecurity concerns, maintaining dignity, ethics and technology, quality of human interaction, privacy and safety, dementia and technology, and staff technology training.
- We continue to analyse the findings for themes that can inform and support the aged care sector to engage effectively with new and emerging technologies.

Background

The role of the Knowledge and Implementation Hub (The Hub) within Aged Care Research and Industry Innovation Australia (ARIIA) is to identify and synthesise the existing evidence of best practices in aged care. The importance of human factors in the use of technology was nominated as a priority topic during consultations with the Aged Care Industry Information Technology Council (ACIITC) and other leading aged care stakeholders. This report summarises preliminary findings of a scoping review of the existing research on the impact of human factors on the acceptance and integration of technologies into aged care workplace practice.

When introducing new technologies into aged care, it is important to consider the human factors associated with their use, just as much as issues of functionality, cost reduction, and efficiency gains. An important human factor to consider in the context of aged care is people's ability to interact with technology. This might relate to a product's design features which make it complex to use or 'user-friendly'. Products that do not account for the user experience are unlikely to be accepted or become a normal part of aged care workflows or care practices. Other human

factors relate to people's attitudes and beliefs towards technology or their concerns about the impact it may have on their lives. People may also lack the confidence, knowledge, or skills to engage with new technology.

The aim of this review

We undertook a scoping review of the research evidence to understand the specific human factors associated with technology acceptance and use in aged care settings. By mapping the key themes within this literature, we were able to identify 'evidence themes' and write short summaries of the key issues that have concerned researchers. Here we summarise the processes used and our initial findings.

Methods

A librarian created a search strategy in Ovid Medline which was then translated for PsycINFO, CINAHL, Embase (Ovid) and Scopus. All database searches were run on 9 January 2023. The strategy included the following concepts:

- Aged care settings (residential and home care)
- Technology
- The people within the aged care sector engaging with technology products (e.g., staff, residents, managers, nurses etc.)

We used many terms and synonyms to describe each concept within the search strategy. This included a wide range of generic terms for technology, including digital, smart, mhealth, and automation. We also included terms for specific types of technology likely to be found in aged care settings (e.g., telehealth, robots, virtual reality). We did not search using terms for 'human factors' as we needed the research to tell us what these factors are within the aged care context. The Ovid Medline search strategy showing the search terms used is available in the Appendix of this document.

Eligibility criteria

We included articles:

- Set in an aged care service (home care or residential)
- Reporting the perceptions, attitudes, and experiences of people receiving or providing aged care services, including older people's families and/or informal carers
- Published in English between 2018 and January 2023.

We excluded technology development or evaluation studies that did not report on user experiences of the technology. We also excluded:

- Reports that included some participants from an aged care setting but did not report on their perceptions of technology separately from non-aged care participants.
- Studies using technology to obtain research data (e.g., online surveys or video recordings).
- Diagnostic technologies unless their purpose is to avoid an unnecessary hospital transfer (e.g portable imaging systems for detecting fractures).
- Perspectives of technology developers or vendors.
- Protocols and conference abstracts.

Screening and data extraction

The citations retrieved by the database search strategies were uploaded to the Covidence system where two reviewers independently checked them against the eligibility criteria for their relevance to the topic. Reviewers discussed any disagreements until they reached a consensus.

Results

The database searches found a total of 2491 citations after duplicates were removed. (Full details are available in the Appendix.) Of these, 111 articles were judged relevant and have been used to map the human factor themes across the technology in aged care research.

Most of the included studies (n=105) described original research, four were high-quality systematic reviews, and two were scoping reviews that reported quality appraisal.

From a preliminary scan of the included studies, the following themes were identified:

- Technology usability
- Technology acceptance
- Attitudes towards robots
- Telehealth acceptance
- Cybersecurity concerns
- Maintaining dignity
- Ethics and technology
- Privacy and safety
- Quality of human interaction
- Dementia and technology
- Staff technology training

Some of the evidence themes are available on the ARIIA website, and others are currently being written by The Hub team. Table 1 lists these human factor 'issues' with a brief description of each. Additional themes may be added as the evidence is analysed.

Table 1. Current themes identified by scoping the human factors evidence.

Theme	Studies informing theme
Attitudes towards robots The use of a wide range of robot technologies is becoming increasingly popular in the delivery of aged care. Despite potential benefits, their successful integration into care processes will depend on the perceptions and experiences of staff, people receiving care, and aged care providers.	24
Privacy and safety Some technologies pose a higher threat to the personal privacy of older people and care workers, particularly those with integrated cameras for monitoring people as they go about their daily activities.	10
Ethics and technology Each new technology introduced to aged care needs to be assessed against the basic moral and ethical principles of care. These include respect for autonomy and privacy and doing no harm. Technology should not threaten human rights or the quality of life of older adults.	9
Staff technology training With technological advancements, aged care staff need the knowledge, skills, and confidence to engage with new products to capitalise on their benefits. Most studies in this review highlight the importance of staff training when implementing technology into aged care.	7
Cybersecurity concerns With the increased uptake of technology in aged care services cybersecurity has become a significant concern for people receiving care and their families, staff, and provider organisations. Without precautions in place, people view their personal data and business systems as vulnerable to hacking and cyber-attacks.	6
Quality of human interaction People providing or receiving aged care services believe forms of technology, particularly robots, may impact the quality of human-to-human interaction.	5

Table 2. Potential themes identified by scoping the human factors evidence.

Theme currently under development
Maintaining dignity The integration of technology into aged care requires service providers and care workers to consider how to maintain the dignity of older adults especially when using technologies with integrated cameras.
Attitudes towards telehealth The use of telehealth in aged care has become increasingly popular to allow older people to access healthcare services. Despite the potential benefits, successful integration, and use of telehealth in aged care depends on the perceptions and experiences of providers, staff, aged people receiving care.

Theme currently under development

Dementia and technology

The use of technology to support older adults living with dementia receiving aged care is growing. Considerations for cognitive functioning and the appropriateness of technology use for people living with dementia should be considered in the delivery of quality care.

Technology acceptance

Technology acceptance refers to how users come to accept a technology and considers the barriers to acceptance in aged care for service providers, care workers, and care recipients.

The usability of technology refers to how successfully technology can be integrated into everyday tasks and support the aged care working environment. Usability is determined by the interaction of the user, system, and specific task.

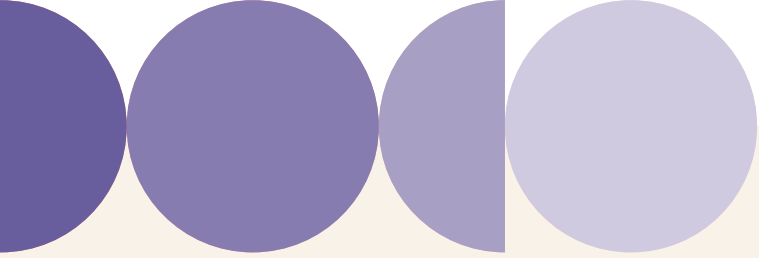
Limitations

The results of this scoping review are intended to map the published research in this area. Our findings reflect the current state of the evidence which we note is limited in breadth and quality. We continue to synthesise and summarise the evidence associated with each of these issues. Additional 'evidence themes' will be developed and made available on the Knowledge and Implementation Hub website.

Appendix

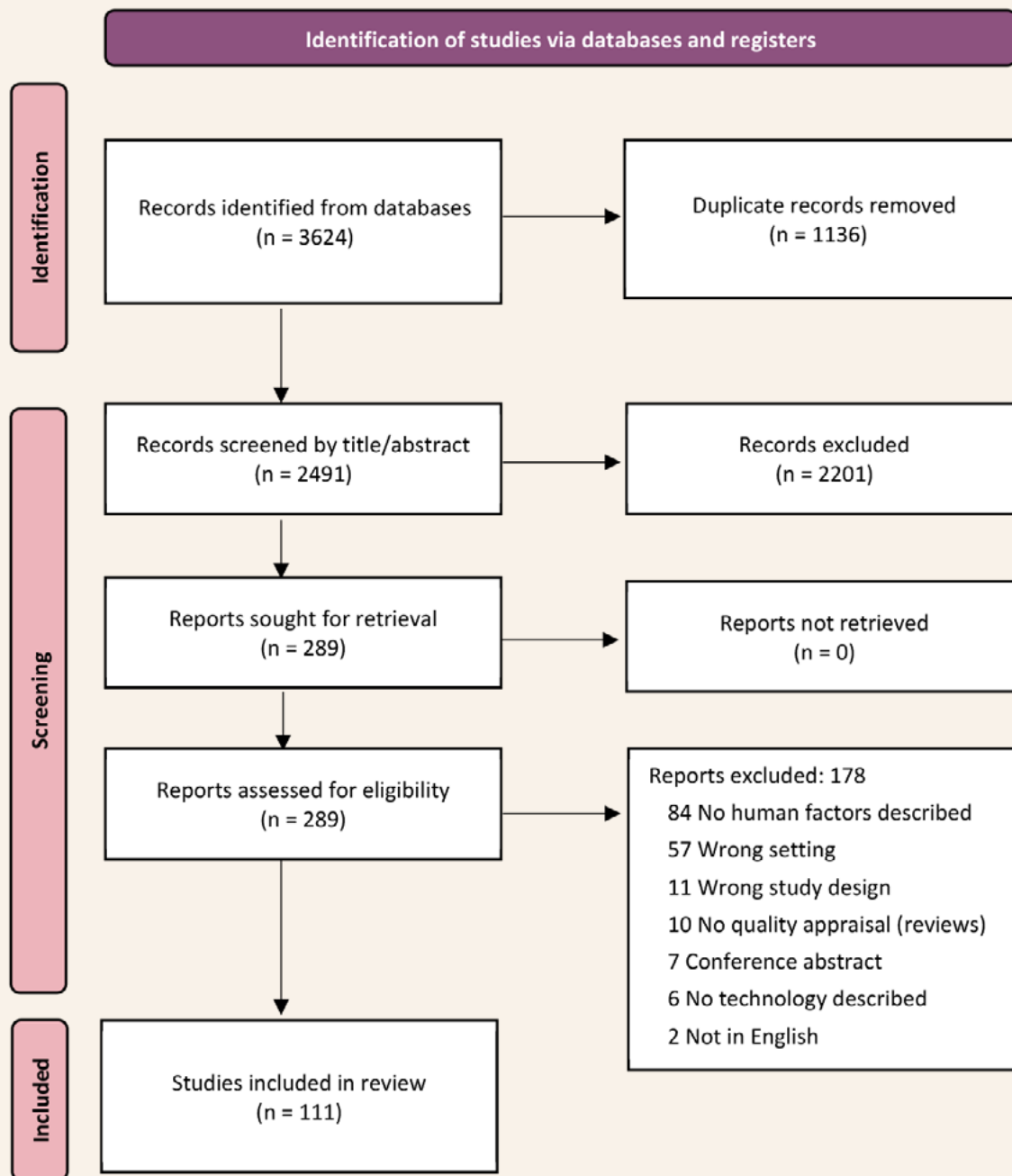
Ovid Medline search strategy

1. Home care services/ or Home health aides/
2. (Home care or homecare or home help or community aged care).ti,ab.
3. Nursing homes/ or Homes for the aged/ or skilled nursing facilities/
4. (Aged care or nursing home* or long term care or longterm care or skilled nursing facilit* or elder care).ti,ab.
5. or/1-4
6. Aged/ or "Aged, 80 and over"/
7. (Older or Elder* or aged 65*).ti,ab.
8. or/6-7
9. 5 and 8
10. Technology/ or educational technology/ or information technology/ or disruptive technology/ or technology transfer/ or culturally appropriate technology/
11. (Technolog* or gerotechnolog* or gerontechnolog*).tw.
12. Haptic technology/
13. Eye-tracking technology/
14. Digital technology/
15. Digital*.tw.
16. Biomedical technology/
17. Wireless technology/
18. Video recording/
19. "Internet use"/ or Internet/ or "internet of things"/ or Internet-based intervention/
20. (Internet or web-based).ti.
21. Self-help devices/ or assistive device*.tw.
22. Mobile Applications/
23. (Mobile health or mhealth or m?health or m-health or apps or app or mobile applications).tw.
24. Automation/ or automat*.tw.
25. Robotics/ or robot*.tw.
26. Artificial intelligence/ or (artificial intelligence or AI).tw.
27. Virtual reality/ or augmented reality/ or virtual reality.tw.
28. Inventions/ or (invention* or innovation*).tw.
29. Social media/
30. Geographic Information Systems/ or GPS.tw.
31. Biosensing Techniques/
32. Wearable electronic devices/ or fitness trackers/ or hearing aids/ or smart glasses/ or electronic surveillance.tw.
33. (Wearable* or tracker* or sensor or sensors or alarm?).tw.
34. Smart*.tw.
35. (Detect* adj2 (fall or falls)).tw.
36. Video games/ or (video game* or gamification or gaming or gamify*).tw.
37. Telecommunications/ or Computer communication networks/ or Cloud computing/ or Computer Simulation/
38. (Telecommunication* or computer network* or cloud).tw.
39. Computers/ or Computers, Handheld/ or Smartphone/ or Software/ or Cell Phone/ or Text Messaging/
40. Software.ti.
41. (Computer or computers or tablet* or ipad or ipads or laptop*).tw.
42. Automated Facial Recognition/
43. Facial recognition.tw.
44. Point-of-Care Systems/ or "point of care".ti.
45. Speech recognition software/
46. Telemedicine/ or telerehabilitation/ or telemetry/ or monitoring, ambulatory/ or monitoring, physiologic/
47. Remote Sensing Technology/ or remote monitoring.ti.
48. (Telehealth or telecare or telemedicine or video conferenc* or telerehabilitation).tw.
49. Videoconferencing/
50. (E-health or ehealth or electronic health).tw.
51. Electronic health records/ or medical records systems, computerized/ or reminder systems/ or "information storage and retrieval"/
52. Information systems/ or big data/
53. (Electronic health record* or reminder system* or data or machine learning).ti.

- 
54. Medical informatics applications/ or decision making, computer-assisted/ or health information systems/ or integrated advanced information management systems/ or online systems/ or medical informatics computing/
 55. Decision support system*.tw.
 56. Systems Integration/ or Health Information Interoperability/
 57. (Interoperability or (system* adj1 integrat*)).tw.
 58. Attitude to Computers/ or User-Computer Interface/
 59. (Technology acceptance or technical knowledge).tw.
 60. or/10-59
 61. 9 and 60
 62. Workforce/ or health workforce/ or Patient Satisfaction/
 63. Health personnel/ or allied health personnel/ or community health workers/ or licensed practical nurses/ or nursing assistants/ or physical therapist assistants/ or caregivers/ or case managers/ or infection control practitioners/ or medical staff / or nurses/ or nursing staff/ or nutritionists / or occupational therapists/ or pharmacists/ or physical therapists/ or physicians/ or general practitioners/ or physicians, family/ or physicians, primary care/ or social workers/
 64. (Worker* or workforce or staff or personnel or human or nurse or nurses or assistant* or aide* or carer* or caregiver* or manager* or practitioner* or professional* or therapist* or nutritionist* or dietician* or pharmacist* or physician* or doctor* or clinician* or provider* or client* or consumer* or human factor*).tw.
 65. or/62-64
 66. 61 and 65
 67. limit 66 to (English language and yr="2018 - Current")

Notes: Standard search operators used in MEDLINE:

- / = Search in database 'subject heading' field
- tw = Search in 'all fields' in database
- ti,ab = Search in 'title and abstract' fields
- ti = Search in 'title' field only
- adj = Search terms in 'proximity' to each other
- * = Truncation more than one word or a variety
- ? = Include one letter search variant



Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart of study selection. (Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71.)

Cite as: ARIIA Knowledge & Implementation Hub. A review summary: Human Factors: Technology in Aged Care. Adelaide, SA: ARIIA; 2023.

www.ariia.org.au

For more information email ariia@ariia.org.au or call 08 7421 9134

ARIIA - Level 2, Tonsley Hub, South Rd, Tonsley SA 5042

ARIIA was established as an independent, not-for-profit organisation, set up to lead the advancement of the aged care workforce capability by promoting and facilitating innovation and research to improve the quality of aged care for all Australians.

ariia Aged Care Research & Industry Innovation Australia

Flinders University

Australian Government Department of Health and Aged Care