Integrating Artificial Intelligence in Long-Term Care and Informal Care: A Meta-Review of Existing Literature

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Aim

The aim of this review is to synthesize recent **reviews** on the application of artificial intelligence (AI) in formal and informal long-term care (LTC), thereby enriching the understanding of this emerging field, laying the groundwork for future systematic reviews and guide future policy frameworks.

Research questions

- What is the current "state of the art" concerning the application of AI for both formal and informal LTC?

- Within what types of services are the AI-applications tested and used?

- What are the ethical considerations when developing and deploying AI-based services in LTC?

Search strategy

		Search term
Setting 1	Informal care	"caregiver" OR "family care"* OR "unpaid care"* OR "working carer" OR "unpaid carer" OR "family care support" OR "family carer" OR "municipal care" OR "family caregiver" OR caregiver OR "next of kin" OR "carer" OR "informal care"*
Setting 2	Long term care	"Long term care" OR "long-term care" OR "home care" OR "LTC" OR "municipal care" OR "residential care" OR "geriatrics" OR "long-term care facilities" OR "eldercare"
Intervention	Services using Artificial intelligence technologies	"artificial intelligence" OR "AI" OR "machine learning" OR "natural language processing" OR "neural networks" OR "deep learning" OR "activity recognition" OR "smart homes" OR "smart home care" OR "Augmented Intelligence" OR "Reinforcement Learning" OR "Unsupervised Machine Learning" OR "Supervised Machine Learning" OR "Symbolic Artificial Intelligence" OR "Symbolic AI"

30 review articles from 2019-2023
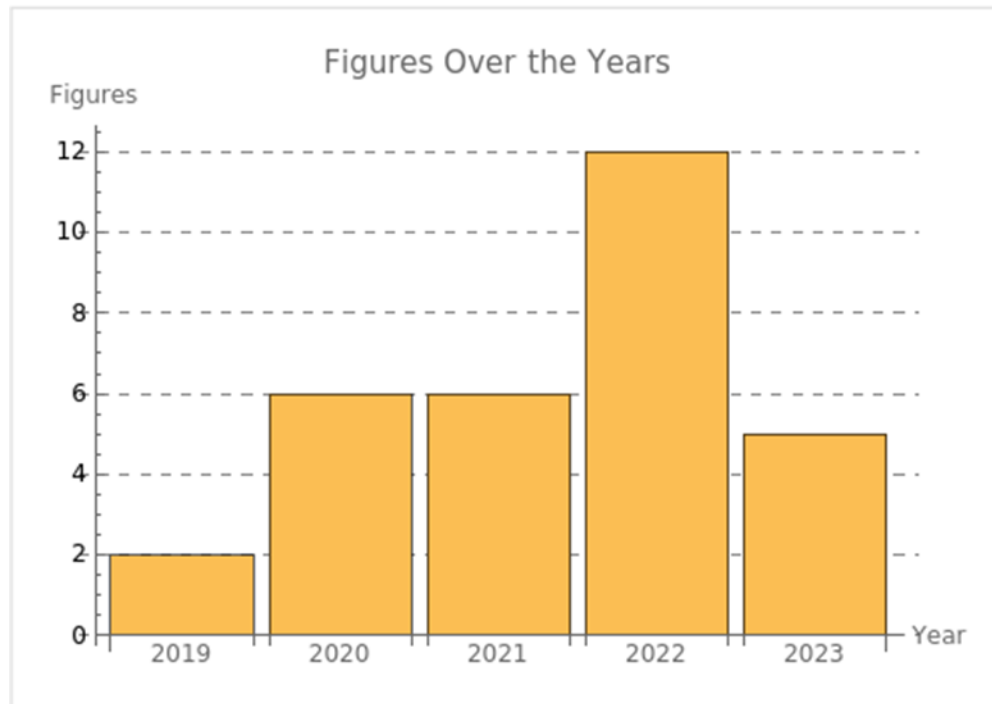
Thematic Clusters

Populations and settings

- Older people with long term care needs/chronic conditions
- Mixed both young and older people with LTC needs
- Based on diagnosis/es
- Carers both formal and informal

- Services and technological systems are being developed to work in the home environment (though not yet implemented in real life settings)
- Reviews focusing on AI solutions related to a specific medical diagnosis were proposed to work in various settings (homes, nursing homes, hospitals)
- Some of the reviews were not bound to a specific context, for example virtual coaches, which are intended to follow the user where s/he is via use of their mobile phone

Technology intervention themes

Monitoring, positioning and human activity recognition

Clinical decision support systems for early prevention/identification/detection

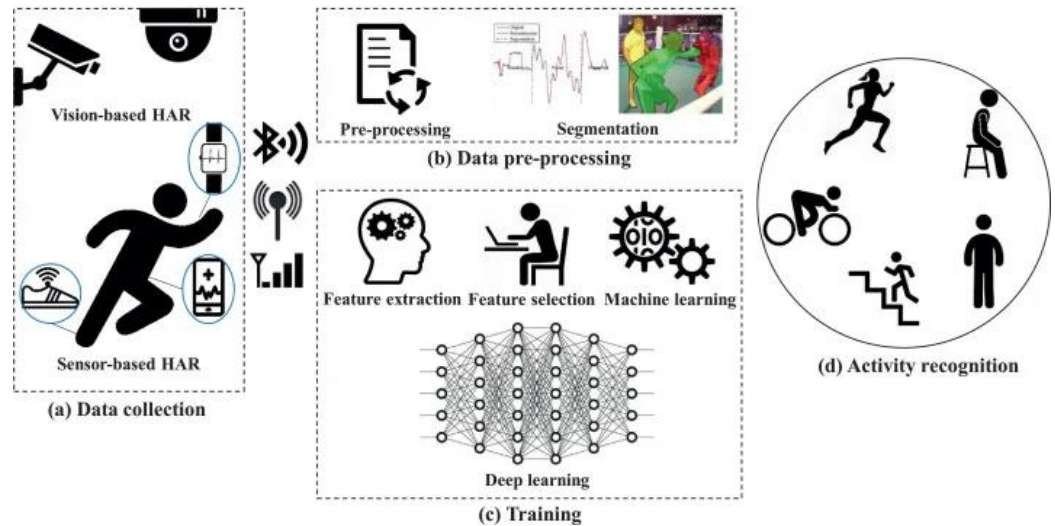Preventive treatment or support for other treatments for chronic disease

Smart homes/Ambient Assistive Living

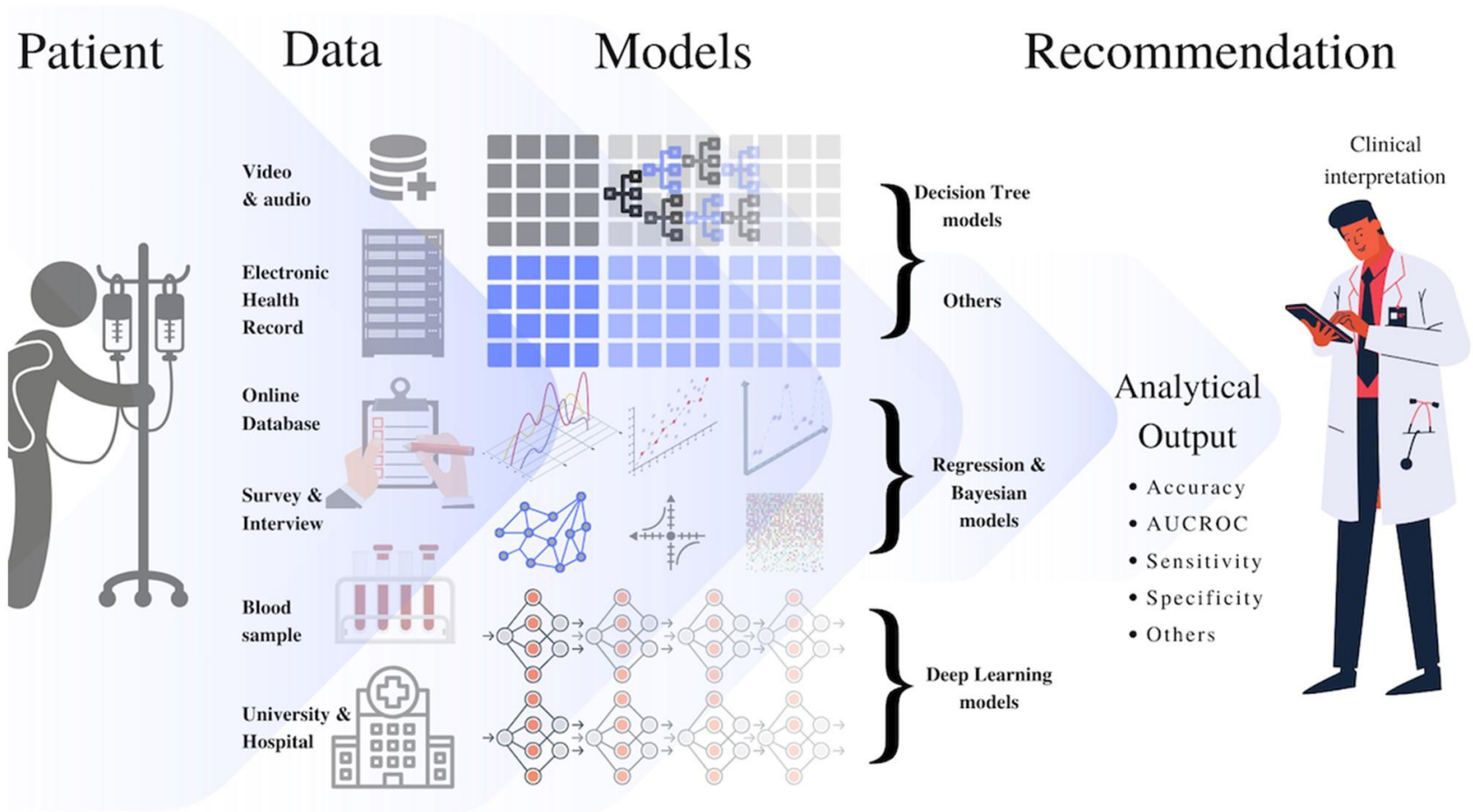# Monitoring, positioning and human activity recognition

Environmental sensors and wearable sensors.

Tracking devices for indoor and outdoor positioning

Purpose: activity recognition, fall detection, health-related events, reviewing vital signs, behavioral monitoring (wandering for example).

(a) Data collection

(b) Data pre-processing
Pre-processing   Segmentation

(c) Training
Feature extraction   Feature selection   Machine learning
Deep learning

(d) Activity recognition

Vision-based HAR

Sensor-based HAR

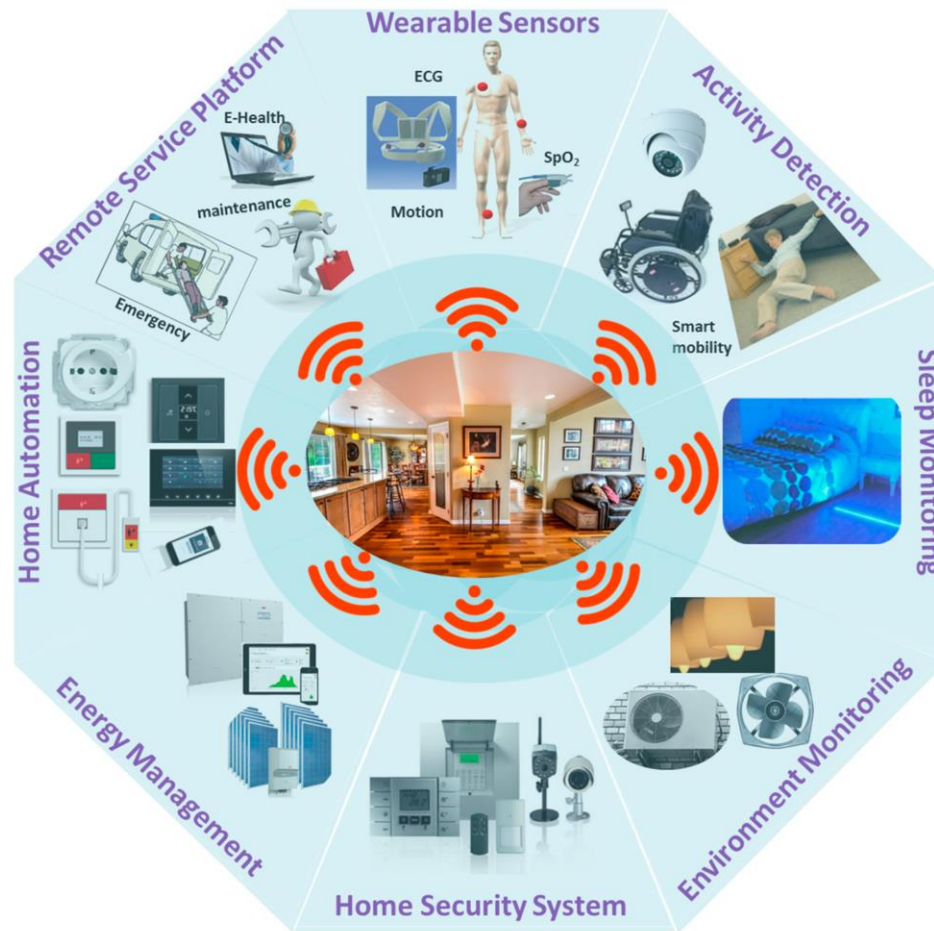# Clinical decision support systems for early prevention/identification/detection

Preventive treatment or supporting treatments for chronic disease

Virtual carers or virtual coaches Conversational agents

Smart homes/Ambient Assistive Living

Outcomes: System performance and optimisation

- A clear focus on technology (system accuracy, capability), rather than care

- Momin et al. (2022) showed high levels of accuracy in predicting events (falls), identified the challenges and showed the latest solutions for in-home care systems.

- Li et al 2022: most systems focused on algorithms, there is a need to determine effects on patients' security, mental health, and QoL.
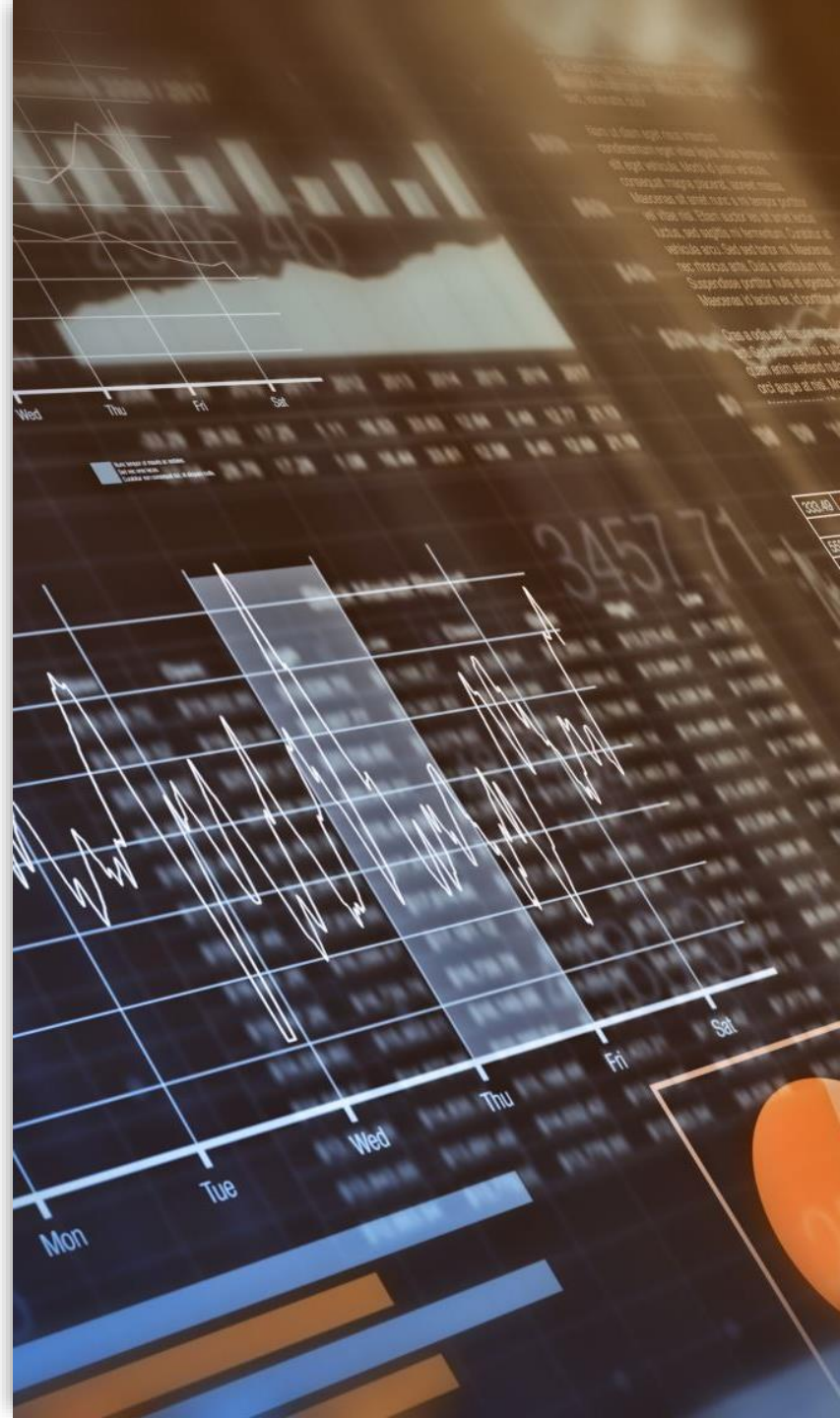
Health-related outcomes

7 reviews reported health outcomes for the supported person. Diagnostic accuracy, symptom reduction.

Loveys et al., 2022 noted that the long list of health-related outcomes for older people in nursing homes, with small sample sizes made it difficult to synthesize in a meaningful way and made a meta-analysis impossible.

The technology focused mainly on assisting ADL or remote monitoring, few of the included articles were able to provide robust evidence for effectiveness (Lee-Cheong et al., 2022)

The state of the art

Research is conducted in laboratory settings, real-life settings should be considered (Oyibo et al., 2023)

Only a few studies went beyond proof-of-concept (Seibert et al., 2021)

A lack of reliable and comparable evidence in the field of conversational agents (Bin Sawad et al., 2022)

AI technology is an assistant and support to the multi-disciplinary dementia team, not a replacement. (Dashwood et al., 2021),

A lack of research focusing on informal care

Maresova et al. (2020) points to how smart home solutions are **primarily targeting older people** and secondarily caregivers, and that LTC is the most frequently used case for smart solutions.

There is arguably a need for AI-enhanced services that target the needs of the person with LTC needs, informal and formal carers and the wider informal care support network.

A lack of QoL-, daily functioning and social participation outcomes

- lack of data on how older people could maintain social relationships and become more proactive (Turjamaa et al., 2019)

- Cisek and Kelleher (2023) point to a gap for systems and devices supporting ADL and social participation.

- Monitoring systems were targeted towards daily functioning, but far from doing evaluations in real-life settings

What would be required of AI-based services for informal carers and LTC-workers?

- Theory-based?
- Reliability
- Easy accessible advice and support
- Focused on the health and wellbeing of the triad (care recipient, informal and formal carer)
- Attention to the amount of work required for installation, updates, maintenance of the system, not increasing the burden on any of the triad
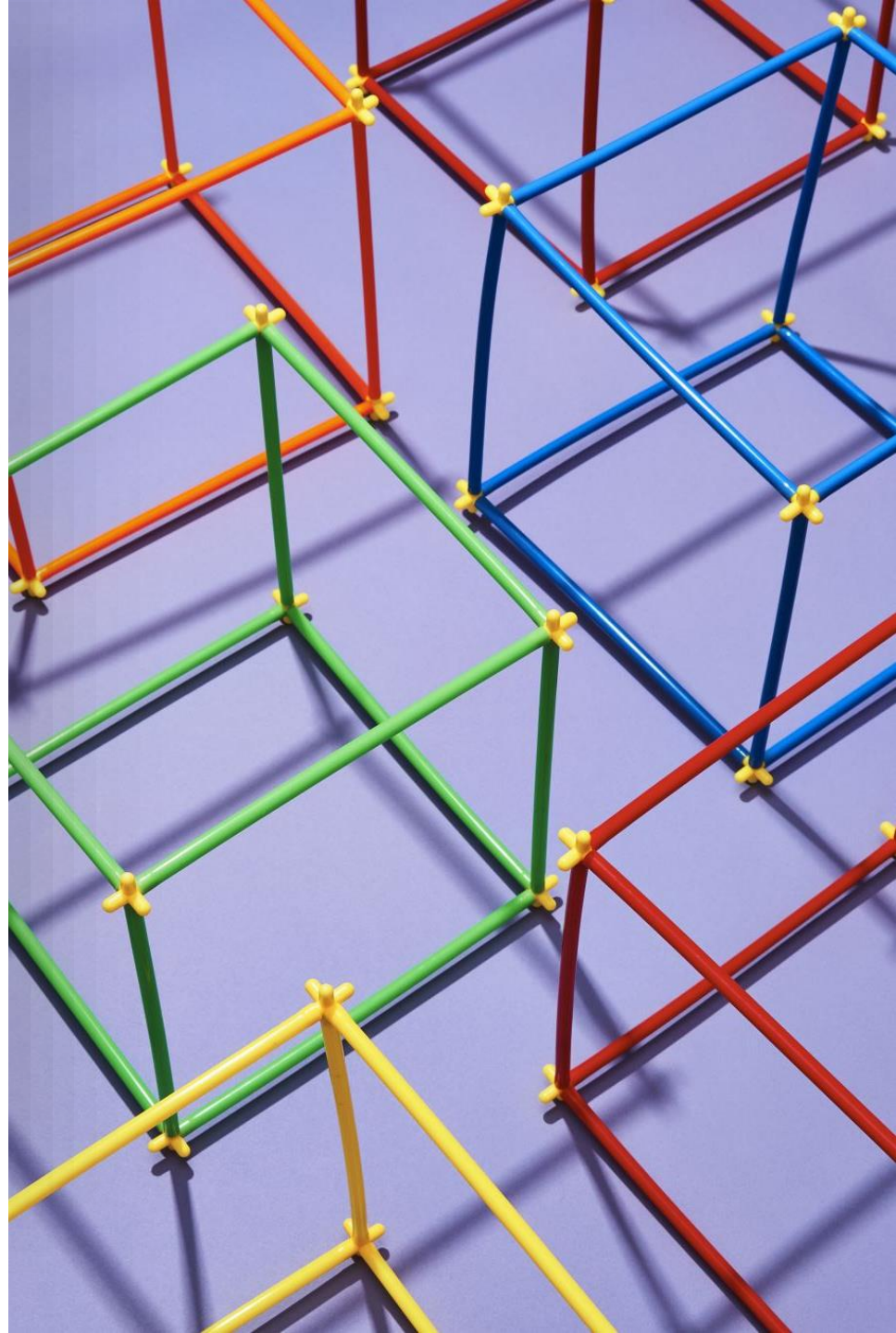
Contact and information

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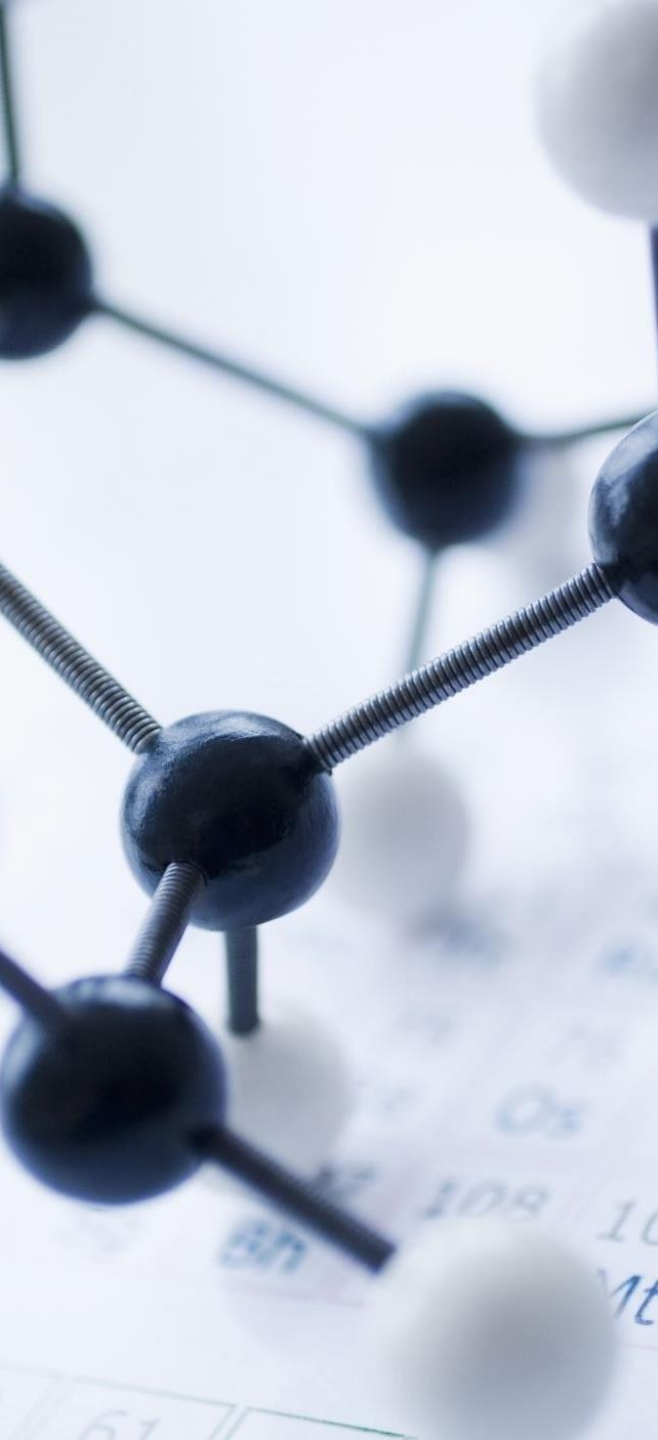Centre (Nka)
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Rationale

- In the face of ageing populations and a critical shortage of long-term care staff, the need for innovative solutions has never been more pressing. While existing research on artificial intelligence (AI) in healthcare has made contributions to theoretical discussions, it has largely focused on principles, barriers, and facilitators, leaving a significant gap in empirical evidence for practical applications (Tangi et al., 2022). Thus, there is a need to clarify where current research is situated and within which areas of LTC the research has been conducted.

Different types of reviews

Type of Review	Count
Qualitative review	I
Systematic review	I I I I I I I (7)
Systematic search of the literature	I
Lacking method description	I
Review	I I I I I (5)
Systematic scoping review	I
Overview of the literature	I I I (3)
Scoping review	I I I I I I I (7)
Rapid review	I
An integrative review	I I (2)
Narrative review	I
Retrospective review	I