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REVIEW ARTICLE

Factors influencing informal carers' acceptance of assistive telecare systems in the pre- and post-implementation phase: A scoping study

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Abstract

Assistive telecare systems (ATSs) have great potential to be beneficial for informal carers (ICs) providing long-term care to older people (OP). However, little is known about ATS acceptance among ICs. This scoping study aims to investigate various factors that influence the ICs' acceptance of ATSs over time in the pre- and post-implementation phases. A five-stage scoping study was conducted. A systematic search of five bibliographic databases (Science Direct, Scopus, CINAHL, PubMED and Proquest Social Sciences Database) was conducted in September 2020, supplemented by a round of grey literature searches. Using the established selection criteria, 37 publications published between 2000 and September 2020 were included. The data were analysed with Atlas.ti 8 using content-based analysis and a combination of deductive and inductive approaches. The results show that work on understanding acceptance of ATS only gained wider attention after 2010. Seven key factors of ATS acceptance were identified: benefits and concerns about ATS, care situation, the influence of the OP, carer characteristics, perceived need to use and social influence. Several subfactors were also found. The post-intervention acceptance factors were found to be more nuanced than the pre-implementation factors, indicating that first-hand experience with ATSs enabled study participants to provide a more tangible, extensive and in-depth overview of the various ATS acceptance factors. This scoping review is useful for ATS developers, providers, health and social care scholars and practitioners, policy makers and commissioners, all of whom seek to improve and facilitate the provision of long-term care in the community.

KEYWORDS
carers, conceptual framework, information technology, older people, scoping review, technology acceptance, telecare

1 | INTRODUCTION

Recent decades have been marked by a shift in the balance of care provision towards the home environment. This prevailing paradigm for successful ageing (Normie, 2011) has increased pressure on informal carers (ICs) who provide long-term care for older people (OP). However, in many European countries, insufficient policy measures are taken to address the needs of these carers (Eurocarers, 2018; Spasova et al., 2018; World Health Organization Regional Office for Europe, 2012). European policy

increasingly recognises the role of assistive telecare systems (ATSs) in supporting ageing in place (Eurocarers, 2019; European Ageing Network, 2019; European Commission, 2021), which can be beneficial for ICs (Andersson et al., 2017; Smole-Orehek et al., 2019). ATS is a term used to describe preventive technologies, including electronics, telecommunications and information systems (Doughty et al., 2008). It covers a wide range of telecare devices (Karlsen et al., 2019; Robertson et al., 2012), such as personal alarm systems (e.g. pendant alarm, fall detector), environmental monitors (e.g. gas, light, smoke, temperature sensors, video surveillance), mobility-related devices (e.g. falls monitors, bed sensors, door sensors, motion sensors, GPS tracking) and reminder systems (e.g. medication reminders).

While scholars have focused on the role of ATSs among OP as care receivers and primary users of ATSs, little is known about ATSs' role among ICs as secondary users of ATSs. Since care-related decisions, including the use of ATSs, also depend on ICs (Cook et al., 2017; Jaschinski & Allouch, 2019), we need to learn more about the relevant factors that affect ATS acceptance from the ICs' perspective, which has been insufficiently studied so far. In particular, we should examine how OP's perceived benefits and concerns about ATSs shape ICs' acceptance of ATSs. Attention should also be paid to issues related to the perceived trade-off between independence/autonomy and safety in relation to ATS use, also taking into account the temporal dimension of the study (i.e. whether the factors were identified in the pre- or post-adoption period) to develop and deploy appropriate ATSs. In this scoping study, we aim to provide a comprehensive analysis of factors that influence ICs' acceptance of ATSs in the pre- and post-implementation phases to inform future research and action.

1.1 | Theoretical background

Several conceptual frameworks are available for studying the general acceptance of ATSs among OP. The most widely applied model is the technology acceptance model (TAM; Davis et al., 1989) and its variations (TAM2, TAM3, STAM, HITAM, the unified theory of acceptance and use of technology [UTAUT and UTAUT2]; Chen & Chan, 2014; Middlemass et al., 2017; Venkatesh et al., 2003, 2012). Other conceptual frameworks used are for example the cycle of technology acquirement by independent-living seniors (C-TAILS) model (Peek et al., 2017), the ecological model (Sixsmith et al., 2007), the accelerating diffusion of proven technologies (ADOPT) model (Wang et al., 2011), the subjective technology adaptivity inventory (STAI) model (Kamin & Lang, 2013) and the Jaschinski et al. (2021) model. They provide a sound basis for identifying and refining the key factors that influence the acceptability of ATSs in the context of family care. However, none of these frameworks was specifically designed to study the acceptance of ATSs among ICs of OP.

Some authors have identified factors that influence the acceptance of ATSs among older adults by conducting systematic literature reviews (Liu et al., 2016; Peek et al., 2014; Weegh & Kampel, 2015; Yusif et al., 2016). As Peek et al. (2014) noted, widely used technology acceptance models are too narrow and lack a broader approach. Tsertsidis et al. (2019), basing their study on the findings of the aforementioned literature reviews, identified 36 factors that influenced the OP's acceptance of digital technologies for ageing in place, and, similarly to Peek et al. (2014), categorised them into seven themes of acceptance factors in the post-implementation phase. In their scoping review, Woo et al. (2019) mapped evidence on the decision-making factors associated with technology adoption and use by caregivers of patients receiving care at home. Factors were categorised into three main domains: the caregiver, the patient and the technology.

As we focus on ICs, it is important to consider the acceptance of technologies in the context of specific home caring situations and the physical and emotional experiences of caregiving (Milligan & Wiles, 2010). The *caringscapes/carescape* framework has been proposed (Bowlby, 2012). The *caringscapes* framework deals with multidimensional informal care exchanges, while the term *carescapes* refers to the resource and service context that characterises the care sector. To analyse care situations of ICs, Bowlby (2012) proposed eight propositions of *caringscapes*, which relate to the social and ethical relationships and understandings involved in care, aspects of the time–space organisation of care and the role of time (i.e. anticipation).

Following Peek et al. (2014), we define the **pre-implementation phase** as a phase in which a technology has not yet been used, and the **post-implementation phase** as acceptance that is determined when a technology is actually used (Davis, 1989).

What is known about this topic?

- There is a lack of technology acceptance frameworks or models that focus on informal carers.
- There is a lack of systematic research on the acceptance of assistive telecare systems from the perspective of informal carers of older people.

What this paper adds?

- Develops a framework of acceptance factors of assistive telecare systems used by informal carers of older people.
- Uncovers differences between pre- and post-implementation acceptance factors of assistive telecare systems by informal carers of older people.
- Identifies specific acceptance factors of assistive telecare systems used by informal carers.

2 | METHODS

We followed the framework for conducting a scoping study originally developed by Arksey and O'Malley (2005), refined by Levac et al. (2010) and further updated by Tricco et al. (2018). Scoping studies are designed to identify all relevant evidence independent of

the study design and gaps in the existing research literature (Arksey & O'Malley, 2005; Peters et al., 2015).

2.1 | Identifying the research question

Our scoping study addresses the following research question: What factors influence the acceptance of assistive telecare systems (ATSs) by informal carers (ICs) of older people (OP) in the pre- and post-implementation phases?

2.2 | Identifying relevant studies and study selection

The process of identifying relevant studies began with the preparation of a search strategy (see Appendix A1 for details) based on the operationalised concepts identified. A search strategy was created by combining three sets of related keywords:

> {ALL ((“family care*” OR “informal care*” OR “family caregive*”) AND (telecare OR ecare OR telehomecare OR telesurveillance) AND (“acceptance factor*” OR “acceptability factor*” OR acceptance)) AND (LIMIT-TO (LANGUAGE “English”)}.

Between 18 and 20 September 2020, a thorough systematic search of five selected bibliographic databases (Science Direct, Scopus, CINAHL, PubMED and Proquest Social Sciences Database) was conducted, yielding a total of 1016 search results of articles published between the year 2000 and September 2020. In addition, a grey literature search (review of reference lists and relevant organisational websites) provided 18 articles that were included in the review process. Prior to publication, on 3 January 2022, an update of the search strategy was performed on units published in 2020 and 2021, which resulted in three additional articles being included in the analysis. The process of identifying relevant studies and study selection is shown in the PRISMA diagram and explained in detail in the PRISMA-ScR Checklist (Appendix A2), with the update included in the last step of the diagram (Figure 1).

The screening process first included the removal of duplicates and reviewing for English-language criteria. The remaining articles were all reviewed for eligibility by two researchers using the established selection criteria (see Table 1).

2.3 | Charting the data

Relevant data on the studies examined were extracted using a developed charting form, where three researchers contributed to the classification of acceptance factors in the conceptual framework. Table 2 (see Section 3.1) provides a description of the studies, which are the result of an iterative process between two researchers. Both researchers collected the data and checked the table for consistency.

The search aimed to identify all relevant work from 2000 to 2020. The results show that work on understanding acceptance of ATS gained wider attention only after 2010; only three papers predated 2010, while more than half of the publications (21 units or 57%) were published after 2015.

Quality assessment is generally not conducted for scoping studies (Arksey & O'Malley, 2005; Peters et al., 2015) as they are designed “to provide an overview of the existing evidence base, regardless of its quality” (Peters et al., 2015, p. 142). Thus, we chose not to execute a quality appraisal in our study. However, as all but two of the included studies were scientific papers published in peer-reviewed journals, we assume acceptable validity and reliability of the research summarised in the analysis. The two exceptions were a research report and a dissertation, which we also found to meet the quality standards of peer-reviewed research.

2.4 | Collating, summarising and reporting the results

We used a qualitative descriptive approach to analyse the data from the publications. Data were analysed using content-based analysis and a combination of deductive and inductive approaches. We followed standard procedures for qualitative studies and were inspired by Saldaña (2013) and Braun and Clarke (2013). Analysis was supported by the qualitative data analysis software programme ATLAS.ti Scientific Software Development GmbH, 2021. We took a systematic coding approach to the data (Saldaña, 2013). As our coding scheme aimed at incorporating numerous technology acceptance factors, a set of predetermined codes ($n = 88$) was prepared based on the components from different technology acceptance models, research evidence and the caringscapes/carescape framework described in the Theoretical Background chapter. Two authors were involved in this coding: a lead coder and a second coder who systematically cross-checked the coding. Disagreements about the coding were discussed and promptly resolved. Deductive coding was used for the first three papers. This approach proved inadequate because it did not capture everything the coders saw in the data. Therefore, in the second step, coders returned to the earlier data, refined some codes and introduced inductive codes derived from the data. In the final step, the coded segments were grouped into categories in collaboration between all three authors. Finally, based on theory and data, seven groups of acceptance factors were developed to which the 228 codes and 28 categories were assigned.

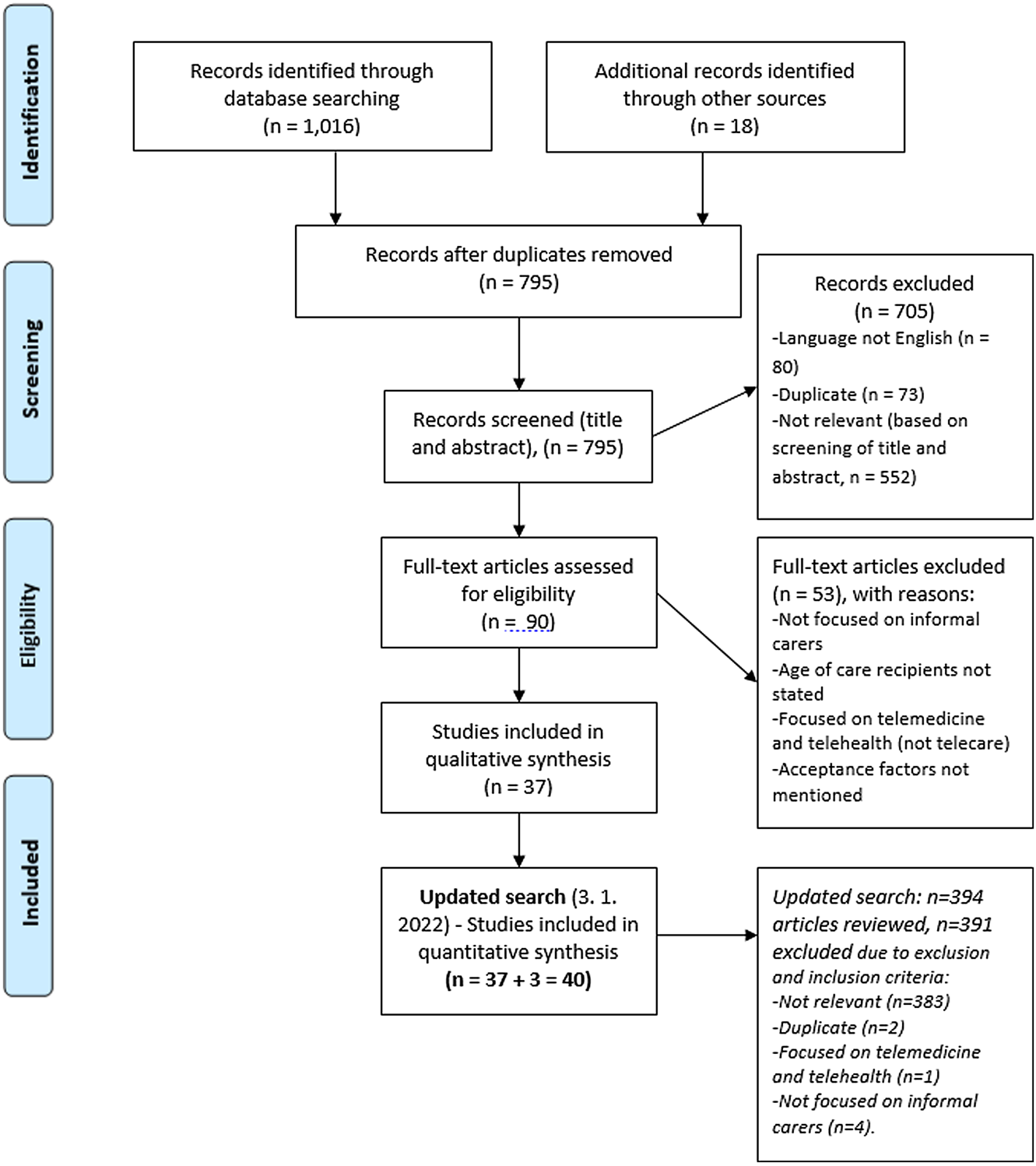

FIGURE 1 PRISMA flow diagram with search results

3 | RESULTS

3.1 | General study characteristics

The papers came from a variety of fields and disciplines. Nearly half of the papers were published in academic publications covering a broad range of ageing and gerontology issues (18 papers or 45%), in addition to five papers in journals on ageing and technology (14%), five papers in journals on technology (general), four papers in nursing journals, four in medical and sociology journals and one in the field of psychology.

As seen in Table 2, the sample consisted of 40 units, of which 6 were literature reviews (scoping or systematic reviews) and 34 were original research articles. The majority of the latter used qualitative

TABLE 1 Operationalised concepts and corresponding inclusion and exclusion criteria

Concept	Explanation
Informal carer (IC)	*An informal carer is a person who provides mostly unpaid care to someone with a long-term illness, disability or other long-lasting health or care need, outside a professional or formal framework*[a]
Included	• Focus on the ICs (i.e. family members, relatives, friends and neighbours) providing unpaid care to the OP. ICs have no formal training in care provision. • Focus on several groups of people (i.e. OP, ICs, formal service providers), with clear identification of findings that focus on ICs.
Excluded	• Focus on formal service providers who have received formal training and provide paid assistance, with no clear identification of findings that focus on ICs. • Focus on the OP, with no clear identification of findings that focus on ICs.
Care for OP	*ICs provide care for OP. There is some agreement in the literature that old age begins at 60 or 65, with WHO, Age International and Eurostat using 6O as the starting age, while the United Nations refers to those over 65 as OP*[b]
Included	• Providing informal care for OP aged 60 and over. • Providing informal care for adults of different ages; however, in the results section, the results in relation to OP aged 60 and over are clearly visible. • Providing informal care for people with disabilities of different ages, with an average age of 70 years or more and the majority of people cared for being over 60 years.
Excluded	• The age of care receivers was not clearly defined; it was not possible to obtain information on whether care receivers are OP. • The cared-for persons were of different ages and were analysed as a homogeneous group.
Assistive telecare systems (ATSs)	Assistive telecare systems *is a term used for preventive technologies which include electronic, telecommunications and information systems use*[c]*. It includes a wide range of telecare devices*[d] *such as personal alarms systems (e.g. pendant alarm, fall detector), environmental monitors (gas, light, smoke, temperature sensors, video surveillance), mobility-related devices (falls monitors, bed sensors, door sensors, motion sensors, GPS tracking) and reminder systems (e.g. medication reminders)*
Included	• Publications with a focus on one or more ATSs mentioned in our definition.
Excluded	• Publications with the main focus on telehealth or/and telemedicine. Telehealth is a broad term covering all health services provided using telecommunications technology; telemedicine refers specifically to clinical services (i.e. remote care of patients, remote medical education, patient consultation via video conferencing). • Publications with a focus on internet platforms that offer support to ICs. • Publications with a focus on psychological counselling, training or education via the internet or telephone.
Technology acceptance	According to the technology acceptance lifecycle[e], technology acceptance consists of two stages: acceptability (pre-use) and acceptance (initial use). Technology acceptability is one's perception of a system before use, while technology acceptance is one's perception of the system after initial use. Our working definition of technology acceptance includes both stages, acceptability (pre-use) and acceptance (initial use). *In the definition of technology acceptance, we also follow the lead of authors who have studied technology acceptance by identifying various acceptance factors that lead to technology acceptance*[f]
Included	• Technology acceptance and acceptance factors were examined in the study.
Excluded	• No technology acceptance or acceptance factors were mentioned in the study.

[a]Eurocarers (2018);
[b]Kydd et al. (2020);
[c]Doughty et al. (2008);
[d]Karlsen et al. (2019); Robertson et al. (2012);
[e]Nadal et al. (2020);
[f]Liu et al. (2016); Peek et al. (2014); Tsertsidis et al. (2019).

research methods (17 articles or 42.5%), followed by mixed-methods research (10 articles or 25%) and quantitative research (7 articles or 17.5%). A total of 3577 individuals were included in the studies reviewed here, with sample sizes reflecting the research method used. The age of ICs, stated in 19 papers, varied considerably, ranging from an average age of 45 to 73 years.

In terms of location, 20 studies (50%) were conducted in European countries, 12 (30%) in the USA and one in Canada, Australia and Asia. Only three included data from more than one country.

In terms of ATSs tested or featured (Karlsen et al., 2019; Roberts et al., 2012), mobility-related devices were the most commonly assessed technology (n = 38 or 95%), followed by environmental monitors (n = 33 or 82.5%), reminder systems (e.g. medication reminders; n = 20 or 50%) and personal alarm systems (n = 18 or 45%). Nearly two-thirds of the studies reviewed (65% or 26 studies)

TABLE 2 Characteristics of studies

Author, year	Country	Study type (data collection method)	Study cases[a]	Age of ICs	Telecare devices within ATSs[b]	Acceptance factors in implementation phase: PRE / POST	Dementia (YES/NO)	Identified acceptance factors[c]
Bledsoe et al. (2010)[a]	/	Literature review	18 studies (11 of them dealing with technology)	/	Mobility-related devices Environmental monitors	POST	YES	Care situation (2) Benefits of technology (1)
Burstein et al. (2015)	Germany	Mixed-mode (in-depth interviews and closed-ended questionnaire)	34	Range: 43–76 Median: 61	Personal alarm systems Environmental monitors Mobility-related devices Reminder systems	PRE	YES	Characteristics of ICs (2) Care situation (1) Benefits of technology (3) Concerns regarding technology (1)
Carretero et al. (2015)[a]	European union	Qualitative case study method (mapping)	n.a.	/	Personal alarms system Environmental monitors Mobility-related devices (*Only findings from three ICT-based initiatives, which offered telecare, were taken into consideration.*)	POST	NO	Benefits of technology (3) Concerns regarding technology (2)
Chou et al. (2012)	Taiwan	Qualitative (in-depth interviews within an intervention study)	30	Average: 59.2	Personal alarms system Mobility-related devices	POST	YES	Care situation (1) Influence of OP (1) Benefits of technology (4) Concerns regarding technology (1)
Cook et al. (2017)	United Kingdom	Qualitative (semi-structured interviews)	14	n.a.	Personal alarms system Environmental monitors Mobility-related devices Reminder systems	POST	YES	Characteristics of ICs (3) Care situation (2) Influence of OP (1) Perceived need to use Social influence (2) Benefits of technology (4)
Czaja (2016)	USA	Literature reviews (Expert opinion based on evidence from the studies)	/	/	Environmental monitors Mobility-related devices Reminder systems	PRE	NO	Characteristics of ICs (1) Influence of OP (1) Benefits of technology (1) Concerns regarding technology (4)
Dolničar et al. (2017)[a]	Slovenia	Mixed-mode (intervention study including a baseline and follow-up telephone survey and semi-structured interviews)	baseline: $n = 22$; follow-up survey: $n = 17$; interviews: $n = 7$	Survey: 27–72, Average = 45 Interviews: 27–57, Average = 45	Personal alarms system Mobility-related devices	PRE & POST	NO	Care situation (3) Influence of OP (1) Social influence (1) Benefits of technology (5) Concerns regarding technology (3)
Epstein et al. (2016)[a]	Canada	Qualitative (focus groups, semi-structured interviews)	$n = 37$: focus group with 4 dyads; interviews in pairs with 17 older adults and 16 family carers	Range: 33–83	Environmental monitors	PRE & POST	YES	**PRE** Influence of OP (1) Benefits of technology (2) **POST** Care situation (1) Influence of OP (2) Benefits of technology (3) Concerns regarding technology (3)

(Continues)

TABLE 2 (Continued)

Author, year	Country	Study type (data collection method)	Study cases[a]	Age of ICs	Telecare devices within ATSs[b]	Acceptance factors in implementation phase: PRE / POST	Dementia (YES/NO)	Identified acceptance factors[c]
Gaugler et al. (2021)	USA	Mixed-mode (RCT, bi-annual surveys, open-ended qualitative information, semi-structured interviews)	*n* = 179 (intervention); *n* = 30 (interviews)	Average: 62.7	Environmental monitors Mobility-related devices	POST	YES	Characteristics of ICs (2) Care situation (2) Influence of OP (2) Perceived need to use (1) Benefits of technology (2) Concerns regarding technology (3)
Gaugler et al. (2019)[a]	USA	Mixed-mode (experiment, survey and open-ended qualitative information)	132 dyads (*n* = 64 in RAM treatment group; *n* = 68 to usual care control)	Average: 61.71	Environmental monitors	POST	YES	Care situation (3) Benefits of technology (1) Concerns regarding technology (3)
Gibson et al. (2019)[a]	North-East England	Qualitative (semi-structured interviews)	*n* = 26	Range: 49–82 Average: 61	Environmental monitors Mobility-related devices Reminder systems	POST	YES	Characteristics of ICs (2) Care situation (3) Influence of OP (2) Perceived need to use Social influence (2) Benefits of technology (4) Concerns regarding technology (3)
Guisado-Fernández et al. (2019)	/	Scoping study	*109 papers*	/	Environmental monitors Mobility-related devices Reminder systems	POST	YES	Characteristics of ICs (3) Care situation (2) Influence of OP (2) Perceived need to use Benefits of technology (5) Concerns regarding technology (6)
Hassan (2020)	/	Scoping study	*31 studies*	/	Personal alarms system Environmental monitors Mobility-related devices Reminder systems	PRE & POST	NO	**PRE** Characteristics of ICs (2) Care situation (1) Benefits of technology (1) Concerns regarding technology (5) **POST** Characteristics of ICs (2) Care situation (1) Influence of OP (1) Social influence (1) Benefits of technology (1) Concerns regarding technology (4)
Huber et al. (2013)[a]	USA	Qualitative (exploratory in situ study - prototype testing; interviews)	*n* = 4	n.a.	Environmental monitors Mobility-related devices	POST	NO	Characteristics of ICs (1) Influence of OP (1) Benefits of technology (4) Concerns regarding technology (1)

TABLE 2 (Continued)

Author, year	Country	Study type (data collection method)	Study cases[a]	Age of ICs	Telecare devices within ATSs[b]	Acceptance factors in implementation phase: PRE / POST	Dementia (YES/NO)	Identified acceptance factors[c]
Hvalič-Touzery et al. (2021)	Slovenia	Qualitative (semi-structured interviews)	$n = 22$	Range: 35–67, Average: 53.9	Personal alarms system Environmental monitors Mobility-related devices	POST	NO	Characteristics of ICs (1) Care situation (1) Influence of OP (2) Benefits of technology (1) Concerns regarding technology (2)
Jaschinski and Allouch (2019)[a]	The Netherlands	Qualitative (semi-structured interviews)	(1) $n = 20$ (2) $n = 9$	(1) Range 45–56, Average: 53.3 (2) Range: 42–72, Average: 59.6	Environmental monitors Mobility-related devices	(1) PRE & (2) POST	NO	Characteristics of ICs (2) Care situation (4) Influence of OP (2) Perceived need to use Benefits of technology (4) Concerns regarding technology (7)
Karlsen et al. (2019)[a]	Norway	Qualitative (semi-structured interviews)	$n = 7$	Range: 43–86, Average: 63.9	Personal alarms system Environmental monitors Mobility-related devices Reminder systems	POST	NO	Characteristics of ICs (3) Care situation (5) Perceived need to use Benefits of technology (2) Concerns regarding technology (3)
Kinney et al. (2004)[a]	USA	Qualitative (structured interviews)	$n = 19$	Range: 36–82, Average: 54.86	Environmental monitors Mobility-related devices	POST	YES	Care situation (3) Influence of OP (1) Benefits of technology (1) Concerns regarding technology (4)
Kramer (2014)	Germany	Qualitative (in-depth interviews)	$n = 105$	Range: 34–89, Average: 62	Environmental monitors Mobility-related devices	PRE	YES	Characteristics of ICs (2) Benefits of technology (3)
Mahoney (2011)[a]	USA	Meta-synthesis of mixed-mode research, 2 relevant studies: (1) discussion group, survey, (2) focus groups	(1) $n = 27$ (2) $n = 29$ (*end-users—the management staff, elders, family and affiliated nurse practitioners*)	n.a.	Environmental monitors Mobility-related devices	PRE & POST	NO	**PRE** Characteristics of ICs (1) Influence of OP (1) Social influence (1) Benefits of technology (1) Concerns regarding technology (3) **POST** Care situation (1) Influence of OP (2) Perceived need to use Benefits of technology (3) Concerns regarding technology (4)
Mehrabian et al. (2014)[a]	France	Mixed-mode (semi-structured interviews, survey)	$n = 30$	Average: 64.1	Environmental monitors Mobility-related devices Reminder systems	PRE	YES	Care situation (1) Influence of OP (1) Perceived need to use Benefits of technology (3) Concerns regarding technology (4)

TABLE 2 (Continued)

Author, year	Country	Study type (data collection method)	Study cases[a]	Age of ICs	Telecare devices within ATSs[b]	Acceptance factors in implementation phase: PRE / POST	Dementia (YES/NO)	Identified acceptance factors[c]
Meiland et al. (2012)[a]	The Netherlands, Sweden	Mixed-mode (field testing: interviews, observations, questionnaires, logging and diaries)	(1) $n = 16$ (2) $n = 14$ (3) $n = 12$	Range: 23–79, Average > 59	Environmental monitors Mobility-related devices Reminder systems	POST	YES	Influence of OP (1) Perceived need to use Benefits of technology (2) Concerns regarding technology (3)
Mitchell et al. (2020)[a]	USA	Mixed-mode (survey, interview)	$n = 30$	Average: 60.79	Environmental monitors Mobility-related devices	POST	YES	Characteristics of ICs (1) Care situation (3) Influence of OP (2) Benefits of technology (3) Concerns regarding technology (3)
Mitseva et al. (2012)[a]	Finland, Denmark, Greece, Northern Ireland (UK)	Quantitative (survey questionnaire)	$n = 71$	(1) Average: 54.89 (2) Control group, Average: 62.23	Environmental monitors Mobility-related devices Reminder systems	POST	YES	Characteristics of ICs (1) Care situation (1) Influence of OP (2) Social influence (1) Benefits of technology (4) Concerns regarding technology (1)
National Alliance for Caregiving (2011)	USA	Quantitative (survey questionnaire)	$n = 1000$	18+ (53% under the age of 50, 29% are 50 to 64 and 18% are 65 or older)	Mobility-related devices Reminder systems	PRE & POST	NO	**PRE** Characteristics of ICs (2) Care situation (5) Influence of OP (1) Perceived need to use Social influence (2) Benefits of technology (2) Concerns regarding technology (4) **POST** Benefits of technology (2)
Olsson et al. (2012)	Sweden	Qualitative (interviews)	$n = 14$	Range: 62–89, Average: 73	Environmental monitors Mobility-related devices Reminder systems	PRE & POST	YES	**PRE** Characteristics of ICs (3) Care situation (3) Influence of OP (2) Perceived need to use Social influence (2) Benefits of technology (3) Concerns regarding technology (4) **POST** Characteristics of ICs (2) Care situation (2) Influence of OP (2) Perceived need to use Social influence (3) Benefits of technology (3) Concerns regarding technology (3)

TABLE 2 (Continued)

Author, year	Country	Study type (data collection method)	Study cases[a]	Age of ICs	Telecare devices within ATSs[b]	Acceptance factors in implementation phase: PRE / POST	Dementia (YES/NO)	Identified acceptance factors[c]
Percival and Hanson (2006)[a]	UK	Qualitative (focus groups)	$n = 55$	n.a.	Personal alarms system Environmental monitors Mobility-related devices Reminder systems	PRE	NO	Care situation (1) Influence of OP (2) Benefits of technology (2) Concerns regarding technology (2)
Pot et al. (2012)[a]	Netherlands	Quantitative (survey questionnaire)	$n = 28$	Average: 63	Mobility-related devices	PRE & POST	YES	**PRE** Care situation (1) **POST** Care situation (3) Influence of OP (1) Benefits of technology (3) Concerns regarding technology (1)
Rialle et al. (2008)	France	Quantitative (survey questionnaire)	$n = 270$	Range: 31–92, Average: 64	Personal alarms system Mobility-related devices	PRE	YES	Characteristics of ICs (1) Care situation (2) Perceived need to use Benefits of technology (2)
Riikonen et al. (2013)[a]	Finland	Mixed-mode (ethnographic approach: open interviews, notes on observations, field notes, a structured questionnaire)	$n = 25$	21 ICs were < 65, 4 ICs were > 65	Personal alarms system Environmental monitors Mobility-related devices Reminder systems	POST	YES	Care situation (2) Influence of OP (1) Benefits of technology (2) Concerns regarding technology (1)
Rosenberg et al. (2012)	Sweden	Qualitative (interviews, focus groups)	(1) interviews, $n = 8$ (2) focus groups, $n = 16$	(1) Range: 55–78, Median: 59; (2) Focus groups: Range: 45–78	Environmental monitors Mobility-related devices Reminder systems	PRE	YES	Characteristics of ICs (2) Care situation (3) Influence of OP (1) Perceived need to use Social influence (2) Benefits of technology (2) Concerns regarding technology (2)
Schulz et al. (2016)	USA	Quantitative (web survey)	$n = 512$	Range: 18–64	Personal alarms system Environmental monitors Mobility-related devices	PRE	YES	Characteristics of ICs (2) Care situation (3) Influence of OP (1) Perceived need to use Benefits of technology (3)
Sriram et al., (2019)	/	Systematic literature review	*55 papers*	/	Personal alarms system Environmental monitors Mobility-related devices Reminder systems	POST	YES	Characteristics of ICs (2) Care situation (2) Influence of OP (2) Perceived need to use Social influence (1) Benefits of technology (4) Concerns regarding technology (6)

TABLE 2 (Continued)

Author, year	Country	Study type (data collection method)	Study cases[a]	Age of ICs	Telecare devices within ATSs[b]	Acceptance factors in implementation phase: PRE / POST	Dementia (YES/NO)	Identified acceptance factors[c]
Thordardottir et al. (2019)	/	Literature review	*30 studies* including 1655 participants (2007–2017)	/	Personal alarms system Environmental monitors Mobility-related devices Reminder systems	POST	YES	Characteristics of ICs (2) Care situation (2) Benefits of technology (4) Concerns regarding technology (4)
Verloo et al. (2020)[a]	France, Switzerland	Qualitative (personal interviews, focus groups, photo-elicitation interviews)	$n = 21$	Average: 68.4, Median: 68	Personal alarms system Environmental monitors Mobility-related devices Reminder systems	PRE	NOT	Characteristics of ICs (4) Care situation (2) Influence of OP (2) Benefits of technology (3) Concerns regarding technology (4)
Zmora et al. (2021)	USA	Mixed-mode (RCT, surveys, open-ended qualitative information)	$n = 36$ (treatment group)	Range: 31–92 Average: 59.7	Mobility-related devices Environmental monitors	POST	YES	Characteristics of ICs (2) Care situation (1) Influence of OP (1) Benefits of technology (3) Concerns regarding technology (4)
White et al. (2020)	United Kingdom	Quantitative (survey)	$n = 128$	Range: 21–80	Personal alarms system Environmental monitors Mobility-related devices	POST	NO	Care situation (1) Influence of OP (1) Social influence (1) Concerns regarding technology (2)
Williamson (2015)	USA	Qualitative (semi-structured interviews)	$n = 10$	n.a.	Mobility-related devices Reminder systems	PRE	NO	Care situation (4) Influence of OP (2) Social influence (1) Benefits of technology (2) Concerns regarding technology (1)
Williamson et al. (2017)[a]	Australia	Quantitative (questionnaire)	$n = 6$	Range: 47–68	Personal alarms system Mobility-related devices	PRE & POST	NO	**PRE** Care situation (1) Influence of OP (1) Benefits of technology (4) **POST** Care situation (1) Influence of OP (2) Social influence (1) Benefits of technology (4) Concerns regarding technology (3)
Xiong et al. (2020)	North America	Quantitative (survey questionnaire)	$n = 381$	Range: 20–94, Average: 62.6	Personal alarms system Environmental monitors Mobility-related devices Reminder systems	PRE	YES	Characteristics of ICs (1) Benefits of technology (2) Concerns regarding technology (2)

[a]Some studies have examined multiple target groups (e.g. ICs, OP, professional carers, etc.). Our analysis focuses only on ICs, so the number of study cases refers only to this target group.

[b]In the analysis, we mapped the telecare devices used in each individual study and presented them in uniform categories of ATS (Karlsen et al., 2019; Robertson et al., 2012).

[c]Acceptance factors were coded in detail for each unit, and analysis of the coded factors yielded 7 key factors with 28 subdimensions, which are presented here (along with the number of codes within each subdimension).

addressed dementia in some way. The rest of the sampled articles deal with the role of the ATS in general care for older adults, with a clear emphasis on its role in ageing in place and in enabling distant care for ICs. Half of the studies considered acceptance factors only in the post-implementation phase (n = 20), others only in the pre-implementation phase (n = 11 or 27.5%), with 9 studies (22.5%) considering both.

In the remainder of this section, we, therefore, focus on the content analysis of the identified acceptance factors. Nine selected papers contained acceptance factors related to the pre- and post-implementation phases. These articles were duplicated and coded separately for acceptance factors in the pre- or post-implementation phase. Thus, the final number of units was 20 in the pre-implementation group and 25 in the post-implementation group.

3.2 | Factors influencing the acceptance of ATSs by ICs of OP

Seven key factors were found to influence ICs' acceptance of ATS, presented graphically in Figure 2. The most frequently mentioned factors influencing acceptance were benefits and concerns about the technology, both of which relate to ICs' perceptions of ATS and experiences with it, followed by the care situation and the influence of OP. In addition, the characteristics of ICs, perceived need to use and social influence were also cited as influencing factors.

The abovementioned factors were formulated based on identified subdimensions, which are detailed in Table 3. The differences between the pre- and post-intervention factors are discussed below.

3.2.1 | Benefits of technology

ICs reported several technology-related benefits that influenced their acceptance and adoption of ATSs. Most studies (n = 34)

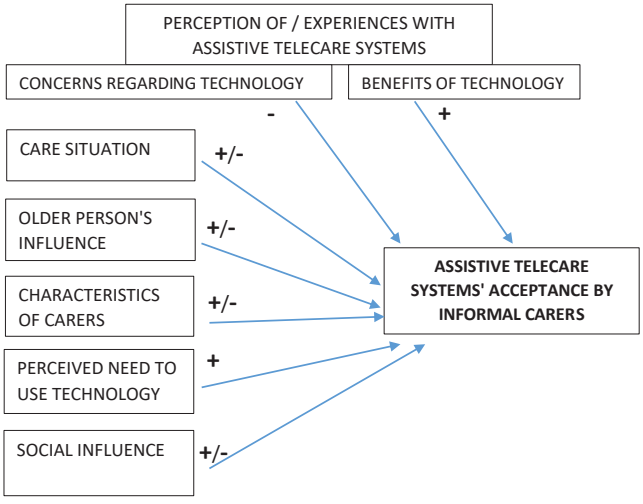

FIGURE 2 Key factors of the acceptance of assistive telecare systems by informal carers of older people

reported that **perceived usefulness** was a strong predictor of ICs' acceptance of ATSs. Verloo et al. (2020) found that ICs' perception of a technology's usefulness depended on the care recipients' current health status, their own openness to technology and the associated costs: "*If it is a technology that can help me, I will accept it*" (Verloo et al., 2020, p. 8). Multiple perspectives of the usefulness of ATSs were found: assisting with daily care routines, improving ICs' quality of life, improving social interactions and relationships, positively influencing ICs' psychological well-being and ensuring the safety of the OP. In almost all studies, ICs indicated that they would use (or already use) technology if they could see or experience how a technology could **assist them in their care tasks** and **positively impact their quality of life** by saving them time and money, giving them more freedom and personal time and allowing them to remain in employment longer. One IC who used an ATS said, "*GPS gives me rest; if my husband is outside alone, he doesn't live on my energy*" (Pot et al., 2012, p. 131). ICs mentioned that they would use (or were using) ATSs if (when) it allowed them to provide more care remotely, be alerted immediately in an emergency, complete more tasks more efficiently and if it would contribute to the prevention of accidents and relieve some of their workload (n = 36).

Some studies (n = 31) have found that **system/device functionalities, design and usability of ATSs** are important determinants of acceptance. The facilitators cited in the studies were ease of use (n = 22), reliability and stability (n = 10), user-friendliness and flexibility (n = 14), ability to personalise (n = 5) and adequate feedback for the user. For example, Burstein et al. (2015) found that ease of use, while important, was unlikely to be sufficient on its own to persuade ICs to adopt the technology. Dolničar et al. (2017), Meiland et al. (2012) and Xiong et al. (2020) found that ICs identified reliability as the most important potential feature, along with ease of use and unobtrusiveness. In addition, ICs of people with dementia mentioned greater flexibility in the design and implementation of ATSs (n = 9), which should be tailored to the changing needs of OP with dementia (n = 5).

More than half of the studies (n = 29) emphasised that ICs viewed ATSs as a **means to improve their psychological well-being** by reducing their anxiety and stress levels; easing their caregiving burden, frustration and worry; relieving some of their responsibility; and increasing their peace of mind and reassurance about the safety of the OP. The safety and security of the OP were found to be an important factor in the acceptance of an ATS (n = 18). As one IC commented, "*Having telecare is having a sense of security. The installation indeed put my mind at ease. Nothing happening is the best result*" (Chou et al., 2012, p. 177). Epstein et al. (2016) mentioned that ICs who used the monitoring system liked it because it gave them a sense of control and order in their lives.

Some studies (n = 9) in which ICs and OP used ATSs found improved **social interactions and relationships** to be one of the drivers of adoption of ATSs. Pot et al. (2012) mentioned less conflict between ICs and OP about being alone outdoors. Similarly, Mitseva et al. (2012) reported that ICs perceived the system as beneficial because it reduced stress and tension in the relationship between ICs

TABLE 3 Factors influencing the acceptance of ATS by ICs of OP in the pre- and post-implementation phase

	Pre-implementation acceptance factors		Post-implementation acceptance factors		Acceptance factors—total	
	Total (n = 20)	%	Total (n = 28)	%	(n = 48)	%
Benefits of technology Gr = 364	19	95	27	96.4	46	95.8
Operational support in caregiving tasks and perceived usefulness Gr = 179	19	95	26	92.9	45	93.8
Device and service characteristics Gr = 147	13	65	18	64.3	31	64.6
Positive psychological outcomes of telecare use Gr = 95	10	50	19	67.9	29	60.4
Improved social interactions and relations Gr = 14	3	15	6	21.4	9	18.8
Positive perception of telecare Gr = 11	1	5	8	28.6	9	18.8
Concerns regarding technology Gr = 283	15	75	25	89.3	40	83.3
Device and service characteristics Gr = 138	9	45	24	85.7	33	68.8
High costs Gr = 43	10	50	9	32.1	19	39.6
Ethical issues Gr = 45	9	45	10	35.7	19	39.6
Compatibility and unmet needs Gr = 28	5	25	10	35.7	15	31.3
Negative psychological outcomes of telecare use Gr = 36	6	30	10	35.7	16	33.3
Negative perception of telecare Gr = 31	6	30	8	28.6	14	29.2
Worsened social interactions and relations Gr = 7	2	10	2	7.1	4	8.3
Care situation Gr = 176	15	75	24	85.7	39	81.3
Characteristics and needs of the OP Gr = 83	11	55	19	67.9	30	62.5
Social policy for caring Gr = 31	9	45	5	17.9	14	29.2
Time–space organisation of care Gr = 20	4	20	9	32.1	13	27.1
Relationship between OP and carer Gr = 33	5	25	9	32.1	14	29.2
IC's experiences with care Gr = 13	4	20	6	21.4	10	20.8
Intensity of informal care Gr = 5	2	10	1	3.6	3	6.3
Influence of OP Gr = 186	14	70	22	78.6	6	75
Benefits of technology for the OP Gr = 74	8	40	16	57.1	24	50
Negative perceptions, concerns and experiences of OP with telecare Gr = 113	11	55	17	60.7	28	58.3
Characteristics of carers Gr = 107	14	70	15	53.6	29	60.4
Demographic characteristics of the carer Gr = 44	9	45	10	35.7	19	39.6
Prior experience with technology, knowledge, & skills Gr = 27	6	30	10	35.7	16	33.3
Awareness of telecare Gr = 33	7	35	7	25	14	29.2
General attitude towards technology Gr = 4	3	15	0	0	3	6.3
Perceived need to use Gr = 44	10	50	10	35.7	20	41.7
Perceived need of ICs to use telecare Gr = 44	7	35	9	32.1	16	33.3
Social influence Gr = 34	6	30	10	35.7	16	33.3
Influence of professionals Gr = 23	6	30	8	28.6	14	29.2
Influence of informal caregiving sources Gr = 11	2	10	3	10.7	5	10.
Influence of family and friends Gr = 4	2	10	1	3.6	3	6.3

Gr = Groundedness refers to the number of quotations associated with a code (total number of quotations = 991, total number of codes = 216);
Note: Articles that mentioned both pre-implementation and post-implementation factors were duplicated and coded separately.

and the OP, as the latter listened to the system's reminders rather than those of a family member.

A positive perception of ATSs was expressed primarily by those ICs who were already users of ATSs, particularly from the perspective of enjoyment of its use (n = 6) and their positive general attitude towards the use of technology (n = 5).

3.2.2 | Concerns regarding technology

The most common potential barriers to the use and acceptance of ATSs among ICs included the perceived or actual **high cost of the devices and services** (n = 19), the characteristics of the **system design** (e.g. the complexity of the technology and its interface, the

perception that learning to use it would be too difficult and time-consuming, fears about use and maintenance, intrusiveness, lack of interoperability or technical errors; $n = 17$) and the **characteristics of the services** (e.g. lack of instructional support and training, lack of guidance and maintenance, absence of manual, concerns about installation, unreliability, inaccuracy and unsafety; $n = 19$). In particular, some studies ($n = 7$) emphasise that the adjustment period to the ATS and ongoing support during this period lead to greater acceptance of the ATS. ICs of people with dementia also expressed that the functionality and design of an ATS should be tailored to the severity of dementia and take into account factors such as the size of the device, its complexity, its reliability and ease of use for both ICs and the person with dementia (e.g. Mitchell et al., 2020).

Ethical issues are another concern mentioned in almost half of the articles, especially the invasion of privacy by the passive movement monitoring system ($n = 17$) and the issue of data autonomy ($n = 2$). According to Jaschinski and Allouch (2019, p. 775), ICs felt "*uncomfortable to 'spy' on the care recipient and having intimate information at their disposal*." However, some studies mentioned that some ICs prioritised the privacy of the OP ($n = 12$), while others felt that the benefits of security outweighed privacy concerns ($n = 9$). In particular, ICs of people with dementia viewed the physical safety of the OP and their ability to remain in the community as more important than privacy and autonomy. On the contrary, Percival and Hanson (2006) mentioned that some ICs took a balanced view that while they would want a comprehensive safeguarding monitoring system, OP had the right to "*take the risk of living the way [they] want to*" (2006, p. 895). The study also mentioned the problem of not having control over data management. Some ICs were concerned that the data could be misused (i.e. given to commercial companies) and manipulated.

Another barrier to the acceptance of ATSs was **negative perceptions** ($n = 14$), such as lack of trust in them, fear of the technology, their impersonal nature and their time-consuming nature. The studies confirmed that if ICs did not see the benefits of an ATS, they would not be interested in adopting it. The findings also showed that nine studies concluded that an ATS **did not address ICs' needs** because, for example: (i) it was not tailored to the specific or changing needs of the IC and the OP; (ii) it did not involve the IC and the OP in all stages of the research and design process; (iii) it was not compatible with the everyday arrangements of the IC (Gibson et al., 2019). Studies mentioned that unmet needs led to frustration. Epstein et al. (2016) also found that some ICs and OP distanced themselves from using the ATS, stating that they were not at that stage yet.

In considering the use of ATSs, ICs also expressed concern about the impact of using such systems, relating to the **perceived or actual negative psychological outcomes** of using ATSs ($n = 16$) and **the deterioration of social interactions and relationships** ($n = 4$). ICs considered an ATS a potential stressor if it provided an overwhelming amount of information to which they had to respond ($n = 2$), or if it failed to meet their expectations ($n = 5$). It can also cause worry if it is not reliable. ICs who used ATSs experienced additional responsibilities. Some ICs found ATSs burdensome because they required too much of them (e.g. writing daily reminders; $n = 9$). ICs expressed concern that the use of an ATS could reduce the human touch in care ($n = 4$) and create a distance between ICs and OP, increasing social isolation and reducing the quality of relationships. Hassan (2020) found that some ICs were concerned that ATSs would replace the face-to-face component of care. Participants in Jaschinski and Allouch's (2019) study stated that contact, warmth and empathy were crucial for OP and that technology could not provide these qualities.

3.2.3 | Informal care situation

ICs are also influenced by the home care situation[1] in their acceptance of an ATS. Overall, the **characteristics and needs of the OP** ($n = 30$) were the most frequently mentioned subfactors, particularly the health status of the OP ($n = 23$), the severity of the disease (e.g. stage of dementia, $n = 21$) and the degree of dependency ($n = 9$). ICs' acceptance of ATSs increased with the progression of the disease or the (sudden) deterioration of the OP's health condition. Studies also found that for higher adherence in people with dementia, an ATS needs to be introduced early in the course of the disease, as disease progression negatively affects adherence to such technologies and the ability to interact with them (Thordardottir et al., 2019).

ICs also mentioned that they considered an ATS especially beneficial for OP living alone. The user's age and low level of social support, as well as digital skills and familiarity with the technology, seem to have an impact on ATS acceptance.

One-third ($n = 14$) of the articles also mentioned social policies for caring, time–space organisation of care and the relationship between the OP and IC as factors influencing ICs' acceptance of an ATS. Financial concerns and the unaffordability of ATSs have been cited as important barriers to acceptance and adoption. An important issue behind these costs is the likelihood of public funding being available, the need for **policy decisions** on subsidies for such solutions and the availability of less expensive alternatives. Several studies ($n = 8$; e.g. Olsson et al., 2012) considered that ATSs should be subsidised and provided as part of a community care package rather than as a stand-alone service.

With regard to the **time–space organisation of care**, remote care provision positively influences the acceptance of ATS ($n = 13$) either because they do not live near the OP or because they have to be away for several hours during the day (for work or other reasons).

Acceptance was also related to **the relationship between the OP and their ICs**. In particular, two studies found that the perception of playfulness, as opposed to the intrusiveness of the ATS, was only possible because of the close existing bond between the older adults and their ICs (Huber et al., 2013; Hvalič-Touzery et al., 2021). Olsson et al. (2012) found that the need for shared decision making and consensus was a priority for ICs even when individuals had dementia, making such discussions difficult.

Three studies reported that ICs' interest in ATSs increased when ICs experienced moderate to high care burdens. Intense, demanding

and stressful **experiences with care**, especially in situations where OP are completely dependent on their support, influence ICs' acceptance of ATSs. Schulz et al. (2016) found the effects of time spent caring on acceptance of ATSs. ICs providing 9–39 h of care were willing to pay more than those providing less than 9 h of care per week.

3.2.4 | Influence of OP

Our study found that while most ICs had a strong influence on care decisions, their ATS acceptance decisions depended heavily on OP's perceptions, experiences, attitudes and desires in relation to ATSs and the benefits they perceived for the OP. As one study stressed, telecare perception is dyadically interdependent (Hvalič-Touzery et al., 2021). The most frequently cited **benefits** of ATSs for OP, perceived either by OP themselves or by their ICs, were the independence, mobility and ability of OP to remain in the community ($n = 13$), as well as their sense of safety and security ($n = 7$). The importance of OP's independence is vividly expressed in one IC's statement, "*I am an advocate of staying independent for as long as possible; and if you use these technologies, you stay independent*" (Jaschinski & Allouch, 2019, p. 768). Independence is also perceived to be important because it increases the freedom of the OP and therefore their sense of self-worth ($n = 4$). ICs mentioned that it enabled OP to stay in touch with their families and friends and higher quality of life and peace of mind for the OP were mentioned as possible benefits ($n = 4$). Some ICs expressed that OP was interested in using ATSs ($n = 4$). OP's **negative perceptions**, experiences, attitudes and concerns about ATS were cited as barriers to ICs' acceptance of ATSs. Specifically, the OP in the studies mentioned their inability to use the ATS ($n = 13$), their concerns about privacy ($n = 17$) and intrusiveness ($n = 8$), their loss of independence or pride ($n = 2$) and a reduction in social interaction ($n = 4$). OP's rejection of this technology was due to the sudden introduction of an ATS and the stigma attached to it ($n = 8$), their resistance to change ($n = 5$) and lack of trust in the reliability of the ATS ($n = 5$), their fear of losing it ($n = 4$), their unrealistic expectations of an ATS ($n = 5$), the feeling they did not need support, a lack of necessary experience and skills ($n = 13$) and the perception that it did not meet their needs ($n = 6$). One IC mentioned their mother's fear of being controlled by the machine (Mehrabian et al., 2014). Some ICs also mentioned the OP's negative experiences of using ATSs, such as the system being disruptive, confusing, unclear or having too many false alarms ($n = 11$).

3.2.5 | Characteristics of the ICs

Several characteristics of ICs can positively or negatively influence the acceptance of an ATS. Two salient factors were the ICs' digital literacy ($n = 13$) and their awareness of ATSs ($n = 14$). Some ICs explained that their lack of acceptance was due to **their lack of experience with care technology and technology in general, limited knowledge and skills** related to ATSs and **lack of awareness** of the existence of ATSs. Knowledge and awareness of ATSs relate to ICs' understanding of these systems, as they are often unaware of what the technology can do for them and how it can help them with their daily activities (Cook et al., 2017; Hassan, 2020). According to Burstein et al. (2015), high awareness of ATSs was reflected in high levels of use and was not affected by the age of the IC. A lack of awareness of the availability of these systems meant that ICs were unlikely to have access to them (e.g. Hassan, 2020). Two studies mentioned the impact of ICs' life circumstances on their ATS acceptance.

Other factors included the demographic characteristics of the ICs and their **general attitude towards technology** (i.e. fear of using advanced technology vs. openness to it) ($n = 3$). **The demographic characteristics** of ICs, particularly age ($n = 8$) and gender ($n = 4$), were mentioned as influencing the acceptance of ATSs. Gender was mentioned in relation to the ICs' own interest in technology, general knowledge and previous profession. For example, Olsson et al. (2012) found that some women had difficulty using technology because their husbands had previously dealt with technological issues, yet some women had the necessary knowledge and skills because of their own interests or previous profession. The age of the ICs was mentioned in relation to their competence and familiarity with ATSs (Sriram et al., 2019). Older ICs were less likely to perceive technology as useful and were more concerned about their familiarity with the systems.

3.2.6 | Perceived need to use

The acceptance of ATSs is also influenced by ICs' perceived need to use this technology ($n = 20$). For example, one IC, whose mother was reluctant to wear a pendant alarm, told her, "*You may not want to wear it, but please wear it for me because it stops me worrying about you*" (Sriram et al., 2019, p. 21). Some studies ($n = 5$) also found that ICs were more likely to use ATSs in the future than in the present because they did not see a need for assistance in the current care situation because the person they cared for was still independent and healthy enough, or because they lived nearby. As one IC said, "*We do not need such a system now. I can still manage my husband's difficulties on my own*" (Mehrabian et al., 2014, p. 26).

3.2.7 | Social influence

In deciding whether or not to use an ATS, ICs are influenced not only by OP but also by significant others. **The influence of health and social care professionals** was the most important expressed factor of IC acceptance in this dimension ($n = 14$). An American study (National Alliance for Caregiving, 2011) of 1000 technology-using ICs found that the most important influencing factor encouraging ICs to try new technologies to support care was a healthcare professional explaining directly or via an official medical website that the technology would be helpful (88% would be more likely to try it). **Caregiving organisations and various caregiving resources** (e.g. IC

magazines, websites, carer forums on the internet, or demonstration events) were the next most likely to be listened to ($n = 5$). ICs' **family members and friends** can positively or negatively influence acceptance, although they appear to be less influential than the other two groups ($n = 3$). Rosenberg et al. (2012) found that it was important to consider societal pressures. Lack of knowledge and awareness about ATSs among professionals, policy makers and other stakeholders should also be addressed. As Gibson et al. (2019) found, ICs received little advice and support on ATSs from social care professionals, leading them to seek advice and support elsewhere.

3.3 | Specifics of the pre- and post-implementation acceptance factors

Our analysis revealed some differences between pre- and post-implementation acceptance factors, particularly when considering the subdimensions of these factors. For example, **ICs' concerns about device and service features** were present in both phases. However, this factor was particularly important in the post-implementation phase, as some users reported negative experiences of using the ATS (i.e. technical errors, design problems, unreliability, instability and inaccuracy of the system) ($n = 11$). On the contrary, **ethical issues** were more likely to be mentioned in the studies that focused on the pre-implementation phase ($n = 9$).

In relation to the care situation, the importance of **social policy for care** was mainly expressed in the pre-implementation phase ($n = 9$), where ICs indicated the need for subsidised ATSs ($n = 6$) and the lack of social provision for OP and their ICs ($n = 4$). The more pronounced factors in the post-implementation phase were the **characteristics and needs of the OP** ($n = 19$) **and the time–space organisation of care** ($n = 9$). For the latter, ICs endorsed the use of an ATS as an attempt to bridge the **geographical distance** created by being away from home for several hours a day, or because they did live in close proximity to each other. The greater prevalence of the factor related to the characteristics and needs of the OP in the post-implementation phase might be the result of a high number of studies with dementia in which the IC's acceptance was associated with the OP's phase of dementia. The **demographic characteristics** of ICs ($n = 9$), particularly their age and gender, were an important acceptance factor only in the pre-implementation phase.

Greater differences between the two phases within the **benefits of technology** factor were observed in psychological outcomes of ATS use and positive perceptions of ATSs. Studies that focused on the post-implementation phase reported actual psychological benefits of using ATSs (e.g. decreased anxiety, burden and frustration; increased peace of mind, reassurance and sense of safety; $n = 19$), such that these benefits were more pronounced among ICs and had a greater impact on their ATS acceptance than in the pre-implementation phase when ICs only imagined how helpful an ATS could be ($n = 10$). In the post-implementation phase, ICs mostly expressed their perceptions as enjoyment in use and a generally positive attitude towards ATSs ($n = 8$). We also observed some minor differences between the two phases in the factors of **social influence** and **influence of OP**, as well as in some other subdimensions of the main factors.

Since many studies ($n = 27$) focused on the ICs of OP with **dementia**, we also briefly addressed the specifics of ATS acceptance of these ICs. We recognised some subfactors in the post-implementation phase ($n = 18$) that were more pronounced with ICs of people with dementia: limited knowledge and skills of ICs regarding new technologies and digital literacy ($n = 6$); noncompatibility of ATSs to the changing needs of people with dementia and their ICs ($n = 5$); the need for features of an ATS and its ability to be personalised ($n = 4$); features of the ATS that allow ICs to see, hear and talk to the OP remotely and combine work with care ($n = 6$); the positive impact on ICs' sense of safety in relation to the OP and corresponding reduction in worries ($n = 8$); increased reassurance, peace of mind and respite from constant vigilance ($n = 10$); increased awareness of OP's health conditions ($n = 7$); increased independence of people with dementia and their ability to remain in the home environment ($n = 7$); unwillingness of people with dementia to use certain ATSs (e.g. pendant alarms) or inappropriate use of ATSs ($n = 10$); inability of people with dementia to use an ATS ($n = 6$) and expressed need by ICs to use an ATS ($n = 6$).

4 | DISCUSSION

To the best of our knowledge, this is the first literature review to systematically identify and analyse the factors that influence the acceptance of ATSs by ICs of OP, and focus on whether these factors are expressed in pre- and post-implementation phases. Our study found seven key factors that influenced acceptance and adoption. The most frequently mentioned factors were the *benefits and concerns about ATSs*, followed by the *care situation* and the *influence of the OP*. In addition, *carer characteristics*, *perceived need to use* and *social influence* were identified as influencing factors. Several subfactors were found.

Differences were found between the pre- and post-intervention acceptance factors, especially when considering subfactors. For example, *social policy for care* was a more prominent subfactor in the pre-implementation phase than in the post-implementation phase. *Psychological outcomes of ATS use*; *positive perceptions of ATS*; *concerns about equipment and service features*, *characteristics and needs of the OP*; *time–space organisation of care*; and *benefits of ATSs for OP* seemed to be more important in the post-implementation phase than in the pre-implementation phase. These findings indicate that testing ATSs in practice resulted in a rich array of first-hand and realistic user experiences, which in turn provided a more varied and detailed overview of post-implementation acceptance factors.

Our study was initially based on existing components of different variants of the TAM and UTAUT models (Chen & Chan, 2014; Davis, 1989; Venkatesh & Davis, 2000), as well as on some ATS acceptance factors of OP already defined in the literature (Peek et al., 2014; Tsertsidis et al., 2019). These models were extended to

include the *caringscapes/Carescape* framework (Bowlby, 2012). Our scoping study showed that some components of TAM and UTAUT were also found to be important ATS acceptance factors among ICs of OP, with *perceived usefulness*, included in the broader *benefits of technology* factor, being the most frequently mentioned component. There were a few other components mentioned as ATS acceptance factors among ICs, such as *facilitating conditions*, *compatibility*, *perceived ease of use* and *social influence*), but they seemed to have a less important role in ICs' adoption of ATSs. Neither *technology anxiety* nor *resistance to change* was found to be a strong ATS acceptance factor among ICs.

When considering the acceptance factors reviewed by Peek et al. (2014), Liu et al. (2016) and Tsertsidis et al. (2019), some significant differences were found within the components of their acceptance models compared to our conceptual framework. This was not unexpected, as the aforementioned authors focused on OP's acceptance of ATSs, and we focused on the acceptance of ATSs by ICs. First, new subfactors were identified within the factor of *social influence*. Health and social care professionals and, to some extent, sources of informal care were identified as key *social influence* providers, while the influence of family and friends was found to be low. Health and social care professionals were found to play an important role in the uptake of ATSs in studies from both phases, although some also mentioned that ICs sought advice on ATSs from health or social care professionals, but did not receive it or found it inadequate due to their lack of knowledge (Cook et al., 2017; Gibson et al., 2019; Olsson et al., 2012). Second, the *benefits of technology* factor were modified to focus on benefits specific to ICs (e.g. perceived usefulness, positive psychological outcomes of telecare use, improved social interactions and relationships and device and service characteristics). Third, some new subfactors were added to the *concerns regarding the technology* factors, focusing on ICs (e.g. negative psychological outcomes of using ATSs for ICs and negative perceptions of ATSs).

Finally, compared to the themes of acceptance factors among OP found in existing literature reviews, three new components were identified in our framework of acceptance of ATSs by ICs. First, the *OP's influence*, defined as the ICs' perception of the benefits of ATS use for the OP (i.e. maintenance of the OP's independence and ability to remain at home, psychological benefits of using ATSs for the OP and OP's desire to use ATSs) and the OP's perceptions, concerns and attitudes about using ATSs (e.g. the OP's technological concerns—the OP's inability to use ATSs, the OP's refusal or unwillingness to use ATSs and the intrusive nature of ATSs—and the negative effects of using ATSs on the OP's health). ICs' ATS-related decisions depended heavily on OP's perceptions, experiences, attitudes and desires in relation to ATSs. Second, the *care situation*, with the most pronounced subfactors being the characteristics and needs of OP, the caringscapes framework (i.e. time–space organisation of care and social relationships) and the Carescape framework (i.e. social policy for care). Only the latter subfactor was more prominent in the pre-implementation phase, as ICs indicated a need for subsidised ATSs. The third new set of factors found were the *characteristics of ICs*, which included their demographic characteristics, technology experience, general attitudes towards new technologies and ICs' awareness of ATSs.

4.1 | Strengths and limitations

First, it is important to appreciate the characteristics of the scoping study methodology in terms of its advantages and shortcomings. The latter lie primarily in its descriptive nature, which lacks a systematic assessment of the quality of the studies, limiting to some extent the generalisability of the findings. Nevertheless, the strength of this approach is that it provides a comprehensive overview and synthesis of available resources. Second, there is the possibility of selection bias resulting from the limitations of the databases and search engines selected, as well as the selection process. This was addressed with an iterative evaluation of the inclusion criteria by two researchers, with the aim of reaching an agreement in cases of disagreement. It is also possible that we did not include all relevant studies due to the apparently large amount of grey literature identified (alerting us to the terminological diversity of published work in this area). This may be particularly evident when reviewing work on ICs of people with dementia, which should be further explored in terms of their specific needs. The fact that only English and online studies were included may contribute to the exclusion of relevant literature. Third, due to the nature of scoping methodology, the quality of included publications was not assessed, which limits the ability to draw generalisable conclusions from this research. Fourth, although an attempt was made to include all research relevant to the objectives of the study, the inconsistent use of various terms in the literature and the lack of a universally accepted definition of ATSs may have led to the exclusion of some research. To account for this terminological diversity and inconsistency, when reviewing abstracts and full texts, we included, in the final analysis, all studies in which descriptions of devices met our inclusion criteria for ATSs, even though the terminology may not have matched ours. Finally, the vast majority of the selected studies relate to developed countries, so further research should include a broader range of countries.

5 | CONCLUSION

This work contributes to a better understanding of the acceptance factors of new technologies for ageing in place by adding the perspective of ICs to the existing knowledge on OP's acceptance of ATSs. The fact is that OP and ICs engage together in the use of ATSs and, therefore, often make joint decisions about it. Further research is needed that relates ATS acceptance factors in a 'care partnership', i.e. in the dyad between the person in need of care and the person responding to that need for care. Further research is also needed to capture the complexity of the acceptance process by ICs in the pre- and post-implementation phases. As health and social care

professionals play an important role in both the decision-making process and the actual use of ATSs, this role should be explored, including the perspective of their potential lack of knowledge of ATSs. The limitation of our framework is that some factors appear under "benefits" and "concerns" related to technologies, which makes empirical evaluation difficult. Therefore, our framework of acceptance should be extended so that eventual empirical validation of this framework will be easier. Our findings can be used by ATS developers and providers, as well as by health and social care professionals, to better understand the complex nature of the ATS acceptance process.

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CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

AUTHORS' CONTRIBUTIONS

The first author, SHT, contributed significantly to the conception and design, analysis and interpretation of the data, drafting of the manuscript and its writing. KP contributed significantly to the conception and design, acquisition of data, analysis, drafting of the manuscript and its writing. VD participated in the conception of the study, writing of the manuscript, interpretation and critical revision of the manuscript for important intellectual content. All authors have given final approval for the version to be submitted. All authors agree to be accountable for all aspects of the work and to ensure that issues regarding the accuracy or integrity of any part of the work are adequately investigated and resolved. All authors agreed on the order in which their names are listed in the manuscript.

DATA AVAILABILITY STATEMENT

The data that supports the findings of this study are either available in the supplementary material of this article or can be requested from the authors.

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ENDNOTE

[1] The 'home care situation' refers to the home-based informal care provided by informal carers.

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