Barriers and Benefits of Information Communication Technologies Used by Health Care Aides

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Abstract

Background Although information and communication technologies (ICT) are becoming more common among health care providers, there is little evidence on how ICT can support health care aides. Health care aides, also known as personal care workers, are unlicensed service providers who encompass the second largest workforce, next to nurses, that provide care to older adults in Canada.

Objective The purpose of this literature review is to examine the range and extent of barriers and benefits of ICT used by health care workers to manage and coordinate the care-delivery workflow for their clients.

Methods We conducted a literature review to examine the range and extent of ICT used by health care aides to manage and coordinate their care delivery, workflow, and activities. We identified 8,958 studies of which 40 were included for descriptive analyses.

Results We distinguished the following five different purposes for the use and implementation of ICT by health care aides: (1) improve everyday work, (2) access electronic health records for home care, (3) facilitate client assessment and care planning, (4) enhance communication, and (5) provide care remotely. We identified 128 barriers and 130 benefits related to adopting ICT. Most of the barriers referred to incomplete hardware and software features, time-consuming ICT adoption, heavy or increased workloads, perceived lack of usefulness of ICT, cost or budget restrictions, security and privacy concerns, and lack of integration with technologies. The benefits for health care aides' adoption of ICT were improvements in communication, support to workflows and processes, improvements in resource planning and health care aides' services, and improvements in access to information and documentation.

Conclusion Health care aides are an essential part of the health care system. They provide one-on-one care to their clients in everyday tasks. Despite the scarce information related to health care aides, we identified many benefits of ICT adoption.

Keywords
- information technology
- delivery of health care
- health personnel
- workflow
- aged

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Background and Significance

The world's aging population is growing at a significant rate.[1] Globally, a higher increase is noted among individuals aged 65 years and older compared with other age groups.[2] In addition, with advancing age, the risk of developing chronic diseases, such as depression and dementia, becomes higher.[3] All of these combined represent significant challenges for health care systems and providers.

In Canada, health care providers, such as health care aides and personal support workers, provide direct care for the elderly, ill, or persons who require assistance with their activities of daily living and multiple tasks in different settings.[4–7] These tasks may include self-care, medication management, social interactions,[8,9] emotional support, meal preparation, companionship, socialization, and housekeeping,[10] all while under the supervision of regulated nursing staff or other health professionals.[11,12]

Although health care aides are unlicensed support personnel, they comprise the second largest workforce within the health care sector,[13] next to nurses, providing 80% of the direct care to Canadian seniors.[8,9] The situation regarding professional regulation for this group of health care workers is similar between the United States,[14] Canada,[15] and Europe, such that the regulation may vary from one country to another.[16] Depending on the location, this workforce is recognized by different names,[8] including personal support workers, personal care attendants, long-term care aides, resident care workers, nursing aides, nursing assistants, health care assistants, and care aides.[8,9,11,16–18] For this study, we will refer to them as health care aides.

The population of health care aides is difficult to estimate.[19] The exact size of the health care aide workforce in Canada is unknown since many are on a contractually, part-time or on-call basis. Most of these workers are women.[18,20,21] The shortage of health care aides in Canada and several high-income countries around the world will continue to grow as the world's senior population is expected to increase in the upcoming years.[8,16,22–26] The necessity for more health care providers is a concern, not unique to Canada. Health care aides are an essential component for the health care sector.[8,16,27,28]

These workers are vital for high quality care in continuing care facilities,[12,29] including home care, supportive living, and long-term care.[11,12,29] However, they do not work under a standardized scope of practice.[7,18] Instead, their duties are assigned depending on the employer, work setting, and client needs.[5,9–11]

Information and communication technologies (ICT) has created numerous avenues for advocating and promoting health care delivery among various age groups. ICT represent an enormous opportunity to improve health care by providing quality, accessibility, and affordability for multiple users.[30–32] Current technologies within the scope of practice of nurses[33] and unlicensed health care aides, include telemonitoring and care delivering mobile application.[15,34,35]

ICT implementation and adoption are key and beneficial to assist health care aides' workflows and activities.[36,37] Existing supporting health care tools can potentially provide a range of applications and platforms to facilitate health care aides' assignments,[38] transmit observations, and enhance communication between families, clients, and health care providers within the ecosystem of care.[39] ICT can help to deliver real-time support and keep clients' information confidential and available,[40,41] and ultimately improve caring activities and health care delivery.[37]

Despite the various technology-based interventions that exist, none have been designed with health care aides in mind or intended to support their workflows.[37] For example, Steele Gray et al[42] found that ICT for health care aides are inefficient and often do not fit their workflows. Also, Sterling et al[37] described how health care aides consistently identified existing ICT as outdated and ineffective; and not convenient for their needs, they suggested that current technologies exacerbate health care aides' existing communication challenges by not allowing real-time communication with different health care provides.

The existing evidence suggests that health care aides face multiple challenges to access and share patient information[15,37] and communicate with other health care providers.[43] This has a negative impact on their ability to care for their clients.[15] Saari et al[15] identified technology as having the ability to facilitate effective communication and address information gaps for health care aides. Consequently, opportunities for ICT intended for health care aides include features of portability,[44] ubiquity,[45] interoperability,[46] communication tools to assist care plans,[43] and integration with remote care, telemonitoring, and assistive technologies.[36]

To our knowledge, no comprehensive review has studied the range and extent of ICT used by health care aides to support their workflows and practice. Likewise, it is important to understand the barriers and benefits of implementation and adoption of ICT by health care aides. This understanding can inform the design, implementation, and adoption of future technologies and tools, since the role of health care aides is becoming more important, as they provide direct care to clients.

Objectives

To date, there is little evidence on how ICT can support health care aides' workflow and practice as the barriers and benefits of ICT use and adoption remain unknown. The purpose of this literature review is to examine the range and extent of barriers and benefits of ICT used by health care aides to manage and coordinate the care-delivery workflow for their clients.

Methods

We conducted a literature review based on Daudt et al,[47] modifications of the methodology by Arksey and O'Malley.[47,48] This methodology followed six steps: (1) determine the research questions following the PICOS (population, intervention, comparison, outcome, and study design)

framework, (2) identify the relevant studies, (3) study selection, (4) chart data, (5) collect and summarize, and (6) report the results. Modification made by Daudt et al[47] of this methodology includes an interprofessional team in step (2) and use a three-tiered approach to cross-check and select the articles in step (3).[47,49]

Data Sources and Search Strategy

We examined peer-reviewed literature published between January 2010 and March 2020, considering the past 10 years of technology development. We searched three academic databases: Medline, EMBASE, and CINAHL. We defined the search strategy in collaboration with an expert subject expert librarian. Then, we formulated and followed two main concepts to extract relevant studies from the electronic databases (N.N. and S.M.):

1. Health care professionals providing care to people who require health-related personal care.
2. Use of technologies within care.

We combined keywords for the above concepts, thesaurus terms including subject headings and the Medical Subject Headings (MeSH) terms, and free-text words using the Boolean operators of "AND" and "OR" (N.N., S.M., and A.M.C.). In addition, we customized search terms, strategies, and limits for each database (N.N., S.M., and A.M.C). For more details about the search strategy, see ►**Supplementary Table S1** (available in the online version).

Study Selection Process

We exported all studies to EndNote, a reference management software, and removed duplicates (N.N., S.M., and H.P.). Then, we transferred the remaining studies to Covidence, a primary screening and data extraction tool (N.N., S.M., and H.P.). Following, we removed additional duplicates using Covidence or manually as we progressed in the review process (N.N., S.M., H.P., and S.P.). Then, two researchers engaged in the title and abstract screening independently (N.N. and S.M.) where we compared studies with the inclusion and exclusion criteria. We resolved conflicts between the researchers through a discussion where consensus was reached (N.N., S.M., A.M.C., S.P., and H.P.). If a disagreement persisted after the discussion, one senior researcher or domain expert researcher resolved the conflict (N.N., A.M.C., and L.L.).

Next, two researchers assessed the full texts (N.N. and S.M.). A third rater decided if those studies should be included in the data extraction phase if disagreement occurred (A.M.C.). All researchers were thoroughly calibrated and trained on applying the inclusion and exclusion criteria before evaluating studies.

Inclusion Criteria

We included papers that:

- Examined the use of ICT primarily by healthcare workers, including health care aides and home care nurses.
- Reported ICT intended to assist in providing caregiving services at home.
- Were published and available in full text in peer-reviewed journals, doctoral or master's theses, and conference proceedings.
- Were published in English.

Exclusion Criteria

We excluded papers that:

- Did not report the use of ICT.
- Were related to care providers with a professional designation or regulated scope of practice.
- Reported ICT that were not intended for caregiving services at home.
- Described primary ICT use by someone other than health care aides or home care nurses.
- Did not provide enough information to categorize or extract information from.
- Were beyond the scope of this literature review.
- Were not available in full text or published in peer-reviewed journals, doctoral or master's theses, or conference proceedings.

Data Extraction Process

Three researchers (N.N., S.M., and A.M.C.) extracted data from the selected studies in an Excel spreadsheet file where we operationalized the variables. We reviewed each study in full and extracted data for the areas of interest for this review (N.N., S.M., S.P., H.P., and A.M.C.). Finally, two researchers met regularly during the study extraction phase to discuss differences and reach a consensus (S.M. and N.N.).

Data Analysis

Four researchers conducted the data analysis (S.M., N.N., A.M.C., and H.P.). Due to the diversity of the included articles, we decided to use a qualitative approach, and conducted content analysis on the extracted data. We categorized the studies into the following five main groups according to the purpose of each study. In addition, we calculated descriptive statistics for population, study characteristics, ICT features, barriers, and benefits of ICT. Finally, after several rounds of discussions between the research team, we classified the barriers and benefits that were identified in this review. In ►**Table 1**, we present a detail description of the selected studies including characteristics and ICT features.

Results

Study Selection

►**Fig. 1** shows the scholarly literature article search results. In the initial search, we identified 8,958 studies from academic databases. After the removal of 1,065 duplicates, 7,893 publications entered in the selection process. The agreement level between raters[50] during the title and abstract phase and the full-text screening phase was high, with a 95.57% level of agreement for the abstracts and 84.71% for the full papers.

Most selected studies were conducted in the United States (30%, 12/40), Sweden (12.5%, 5/40), and Norway (12.5%, 5/40). The remaining studies were conducted across nine

Table 1 Characteristics of selected studies classified by study purpose

Study purpose	Authors	Age of participants (range)	Gender of participants	Study design	Data collection method	Hardware used	Software used
Improve everyday work	Stroulia et al[54]	Not reported	Not reported	Multiple methods	Interviews, focus groups, survey Questionnaire	Tablet	Application
Improve everyday work	Sassen et al[55]	Intervention group mean: 38.6, control group mean: 39.7	Both genders (mostly female)	Quantitative	Survey Questionnaire	Laptop	Web based
Improve everyday work	Nilsson and Fagerström[56]	Not reported	Not reported	Qualitative	Focus groups	Not reported	Not reported
Improve everyday work	Lexis et al[61]	Not reported	Female	Quantitative	Survey Questionnaire	Desk computer	Web based
Improve everyday work	Kaunda-Khangamwa et al[52]	Not reported	Not reported	Qualitative	Interviews	Phone	Text messaging
Improve everyday work	Gund et al[57]	38–56; mean = 48	Not reported	Multiple methods	Interviews	Desk computer	Web based
Improve everyday work	Gars and Skov[53]	Not reported	Not reported	Qualitative	Focus groups, observations	Tablet	Application
Improve everyday work	Danilovich et al[60]	Not reported	Female	Qualitative	Interviews, Focus groups	Tablet	Application
Improve everyday work	Brown et al[51]	Mean of case managers = 36.4	Both genders	Multiple methods	Focus groups, survey Questionnaire	Tablet and computer	Web based and application
Improve everyday work	Andersen et al[58]	High strain mean: 47.9, low and moderate strain mean: 37.9	Both genders (90% female)	Quantitative	Survey Questionnaire	Phone	Web based
Improve everyday work	Alhuwail and Koru[59]	30– > 51	Not reported	Qualitative	Interviews, Focus groups	Tablet	Application
Improve everyday work	Alhuwail and Koru[46]	30– > 52	Not reported	Qualitative	Interviews, Focus groups, observations	Not reported	Not reported
Access electronic health records for home care	Yang et al[63]	25–47	Both genders (mostly female)	Qualitative	Observations	Laptop	Web based
Access electronic health records for home care	Westra et al[62]	Not reported	Not reported	Quantitative	Not reported	Not reported	Web based
Access electronic health records for home care	Tapper et al[64]	Not reported	Not reported	Quantitative	Survey Questionnaire	Tablet	Web based
Access electronic health records for home care	Sockolow et al[65]	Median age = 49 years	Both genders (88% female)	Mixed methods	Retrospective	Laptop	Application

(*Continued*)

Table 1 (*Continued*)

Study purpose	Authors	Age of participants (range)	Gender of participants	Study design	Data collection method	Hardware used	Software used
Access electronic health records for home care	Han et al[66]	Not reported	Not reported	Qualitative	Interviews	Not reported	Not reported
Access electronic health records for home care	Gjevjon and Hellesø[67]	Not reported	Not reported	Quantitative	Secondary analysis	Desk computer	Web based
Access electronic health records for home care	De Vliegher et al[69]	Not reported	Not reported	Qualitative	Interviews, focus groups	Desk computer	Web based
Access electronic health records for home care	Bercovitz et al[68]	Not reported	Not reported	Not applicable	Not applicable	Desk computer	Web based
Access electronic health records for home care	Alhuwail et al[70]	30–51	Not reported	Quantitative	Interviews, Focus groups, observations	Desk computer	Web based
Facilitate client assessment and care planning	Vasalampi[71]	28–63	Female	Quantitative	Survey Questionnaire	Tablet	Web based
Facilitate client assessment and care planning	Stutzel et al[75]	Not reported	Not reported	Multiple methods	Focus groups, observations, survey Questionnaire	Phone and tablet	Application and web based
Facilitate client assessment and care planning	Santi et al[72]	Not reported	Not reported	Multiple methods	Survey Questionnaire	Not reported	Not reported
Facilitate client assessment and care planning	Göransson et al[73]	28–59; mean = 47	Female	Qualitative	Interviews, focus groups	Phone and tablet	Web based
Facilitate client assessment and care planning	Farsjø et al[76]	23–65; mean = 43	Both genders (mostly female)	Qualitative	Interviews	Tablet	Application
Facilitate client assessment and care planning	Dowding et al[79]	29–66; mean = 48	Both genders (mostly female)	Qualitative	Focus groups	Tablet	Web based
Facilitate client assessment and care planning	Dean et al., 2016[74]	Not reported	Not reported	Quantitative	Secondary analysis	Phone	Web based
Facilitate client assessment and care planning	Bastide et al[77]	Not reported	Not reported	Not applicable	Not applicable	Desk computer	Web based
Facilitate client assessment and care planning	Arbaje et al[78]	Not reported	Not reported	Qualitative	Interviews, observations	Desk computer	Web based
Enhance communication	Petersen et al[40]	Not reported	Both genders (mostly female)	Qualitative	Focus groups, observations	Desk computer	Web based

Table 1 (*Continued*)

Study purpose	Authors	Age of participants (range)	Gender of participants	Study design	Data collection method	Hardware used	Software used
Enhance communication	Lyngstad et al[81]	Intervention group: 38.6–40.5 (mean = 39.6) Control group: 38.4–40.4 (mean = 39.4)	Both genders (mostly female)	Quantitative	Survey Questionnaire	Desk computer	Web based
Enhance communication	Lyngstad and Hellesø[80]	Intervention group: 38.6–40.5 (mean = 39.6) Control group: 38.4–40.4 (mean = 39.4)	Both genders (mostly female)	Quantitative	Survey Questionnaire	Desk computer	Web based
Enhance communication	Lindberg et al[101]	Not reported	Not reported	Systematic review	Not applicable	Tablet and laptop	Web based and application
Enhance communication	Gentles et al[82]	Not reported	Not reported	Scoping review	Not applicable	Computer and phone	Web based and phone based
Enhance communication	Chiang and Wang[2]	27–54	Female	Qualitative	Interviews	Phone	Application
Enhance communication	Bossen et al[83]	30–75	Both genders	Qualitative	Interviews, observations, focus groups	Tablet and computer	Web based
Provide care remotely	Mangwi Ayiasi et al[84]	Not reported	Not reported	Quantitative	Survey Questionnaire	Phone	Application
Provide care remotely	Little et al[85]	Not reported	Not reported	Qualitative	Observations	Phone	Application
Provide care remotely	Katalinic et al[35]	Not reported	Not reported	Quantitative	Survey Questionnaire	Tablet	Application

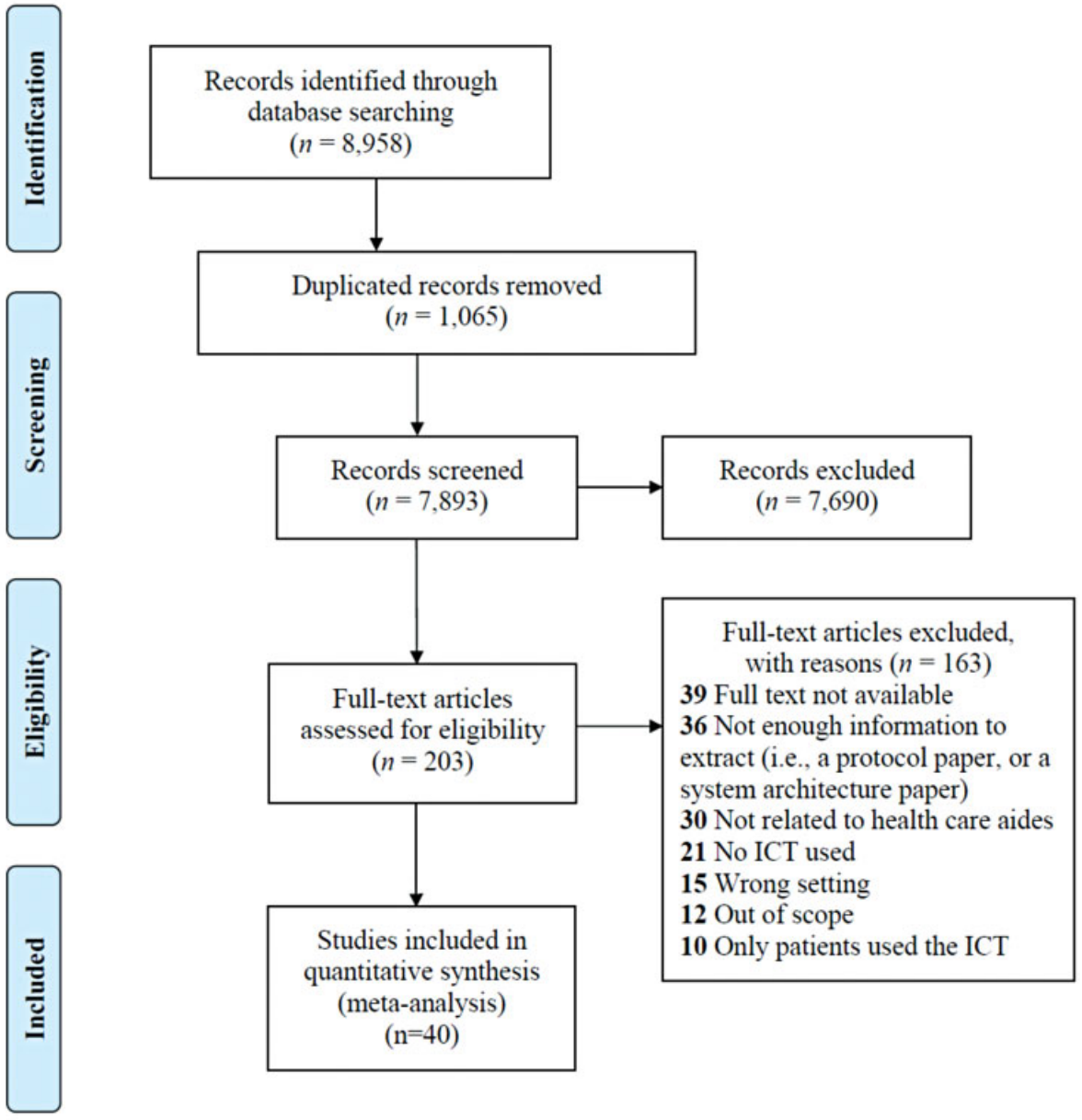

Fig. 1 Scholarly literature article search results. ICT, information and communication technologies.

other countries. Half of the studies were published from 2010 to 2015 and a half after 2015 (►**Supplementary Figs. S1** and **S2**, available in the online version).

Characteristics of the Research Conducted

Population

Of the total included studies, 38 (97.5%) did not use the term "health care aide" or "personal support worker" to refer to the health care workers. However, we considered these studies as they were conducted within samples with a similar scope of practice. Also, most studies did not report the age of their participants. For that reason, it was not possible to extract this information. Also, 24 (60%) studies did not report participant gender or sex. Only 11 (27.5%) studies reported male and female participants, and 5 (12.5%) reported only female participants.

Study Design

Most studies were qualitative ($n = 17$, 42.5%) and quantitative ($n = 13$, 32.5%), with a smaller proportion of studies that included multiple ($n = 5$, 12.5%) or mixed-method designs ($n = 1$, 2.5%). One systematic review and one literature review were also included. Two studies did not report their study designs. We extracted 53 data collection methods from the selected studies, as some authors used multiple methods. For that reason, this denominator is not adding up to the total number of selected studies.

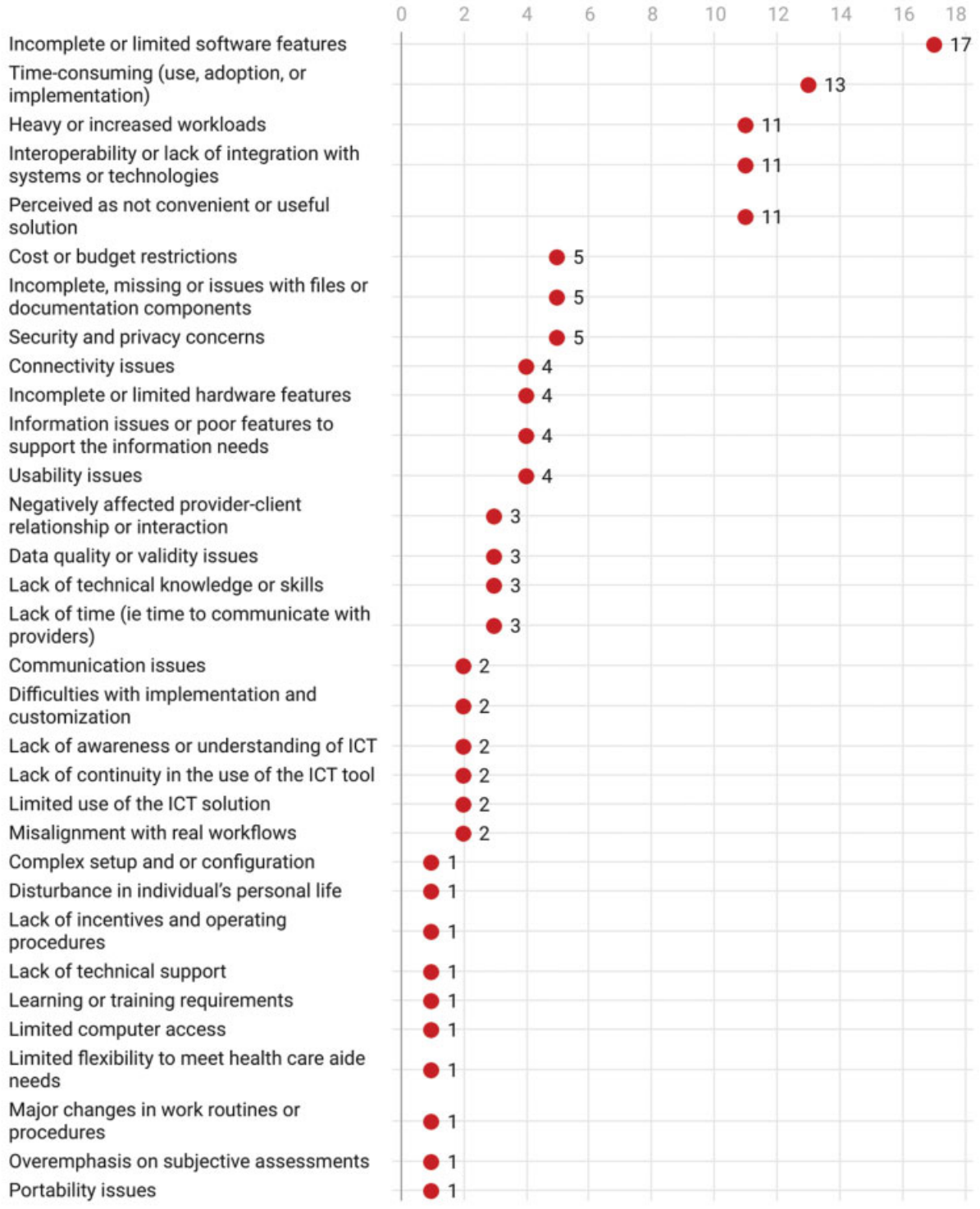

Fig. 2 Distribution of barriers reported in the selected studies.

We found five different types of data collection techniques: interviews ($n = 14$, 26.4%), focus groups ($n = 13$, 24.5%), survey/questionnaires ($n = 12$, 24.5%), observation ($n = 9$, 17%) and one for workshops; and two different types of data analyses: secondary analysis ($n = 3$, 5.6%) and retrospective analysis ($n = 1$, 1.8%). We present a summary of study designs and data collection methods in ►**Supplementary Table S2** (available in the online version).

Study Purpose

We classified the selected studies in five groups, according to the main purpose of ICT use by health care aides: (1) improve everyday work ($n = 12$, 30%),[46,51–61] (2) access electronic health records for home care ($n = 9$, 22.5%),[62–70] (3) facilitate client assessment and care planning ($n = 9$, 22.5%),[71–79] (4) enhance communication ($n = 7$, 17.5%),[2,40,80–83] and (5) provide care remotely ($n = 3$, 7.5%).[35,84,85]

Features of the Reported Information and Communication Technologies

In ►Table 1, we report our findings regarding the hardware and software used in the ICT referred in the selected studies. Desk computers were the most used form of hardware ($n = 11$, 27.5%), followed by electronic tablets ($n = 9$, 22.5%), mobile phones ($n = 6$, 15%), and laptops ($n = 3$, 7.5%). Some studies reported a combination of hardware between tablets and desk computers ($n = 2$, 5%), tablets and mobile phones ($n = 2$, 5%), tablets and laptops ($n = 1$, 2.5%), or desk computers and mobile phones ($n = 1$, 2.5%). Five studies (12.5%) did not report the type of hardware used.

Regarding software, most studies used a web-based platform ($n = 21$, 52.5%), followed by mobile applications ($n = 10$, 25%). A few studies used mobile applications and a web-based platform ($n = 4$, 10%). One study (2.5%) reported a text messaging technology, and four studies (10%) did not report the type of software.

Barriers and Benefits Identified in Adopting Information and Communication Technologies by Health Care Aides

In this section, we present the information regarding barriers and benefits of ICT used by health care aides.

Barriers

Several studies have explored the barriers of ICT implementation and adoption for various health care professionals.[45,86–95] Still, the evidence of ICT related barriers for health care aides is limited. The concept of barriers is associated with attitudes, education, training, and limitations for the adoption and use of ICT.[92] Barriers vary, and there is a need to address them to implement ICT.[86] In the literature, the evidence reports that barriers could be related but not limited to inadequate access to useful, relevant, and appropriate hardware and software when implementing ICT.[94] ICT barriers have been observed from the technology, organizational, socioeconomic, and ethical perspectives.[96]

In ►Fig. 2, we present a list of the barriers we identified for the adoption and implementation of ICT for health care aides. In ►Supplementary Table S3 (available in the online version), we include an entire list of barriers category, frequency, and the corresponding studies.

In this review, we found 128 barriers related to the adoption and use of ICT by health care aides. The overarching categories were as follows: (1) incomplete hardware and software features, (2) time-consuming ICT adoption, (3) heavy or increased workloads, (4) perceived lack of usefulness of the ICT, (5) cost or budget restrictions, (6) security and privacy concerns, (7) lack of collaboration and integration with current technologies, (8) data quality or validity and communication issues, (9) technical support, and (10) related to the provider–client relationship.

In the group of barriers related to hardware and software, we found that users reported system malfunctions, poor design, and issues regarding software configuration.[35,40,46,63,66,67,70,71,85] In these studies, the software did not reflect users' needs and expectations or did not support their information needs.[70] Some studies described the lack of documentation features.[35,46,65,70,72] In addition to usability issues,[59] we found connectivity issues, as a significant hardware barrier in this group.[56,64,71,84] Some studies reported incomplete hardware features as a significant barrier to adopting and implementing ICT.[56,65,77,86]

Time-consuming adoption and implementation was another significant barrier for health care aides,[2,35,40,51,53,55,56,59,63–65,85] This further amplifies the need for communication with ICT providers in order for an effective ICT solution.[71,72,76] In some studies, users reported the ICT implementation process as time consuming.[40,52,53,63–65,85] A few studies described the lack of time for documentation between clients and providers as a significant barrier.[53] These groups of studies reported that ICT required more time from health care aides.[2,51,56] Likewise, we found that users referred to ICT as a waste of time, particularly during the documentation process.

Studies presenting barriers related to heavy or increased workloads[40,52,55,59,69,71–73,83] argued that users perceived a growth in daily workloads due to the use and implementation of ICT. For example, Petersen et al[40] reported problematic ICT use due to report writing taking precedence over the care of their patients. Heavy workload of health care aides was referred as a major barrier of adoption and implementation of new ICT.[71,72]

Other studies on the usefulness of ICT,[55,57,58,64,70,71,74] suggesting that ICT did not meet health care aides' needs[64] or represent an immediate advantage.[55] Another significant barrier we found was the associated cost or budget restriction.[35,52,57,64,76] A few studies referred to concerns such as return on investment,[64] licensing and purchasing costs,[35] and financial restrictions to implement or accept the ICT solution.[76]

Security and privacy concerns were also highlighted as significant barriers to ICT adoption by health care aides.[2,40,60,72,77] In some studies, users perceived risk regarding their information being leaked, stolen,[2,60] or tracked by malicious users.[77] Other studies highlighted the privacy of information on the devices as an issue.[40]

We found barriers associated with the lack of collaboration and integration with current technologies[57,59,68,71] and existing systems.[35,72,76] Such barriers included lack of technical knowledge or skills for implementing and effectively using ICT,[53,83] concerns about interoperability issues,[64,66,69] validity of information (i.e., incompleteness, errors, and inaccurate information),[73,78] lack of continuity in the use of the ICT solution,[40,76] and limitations in software features and system designs.[57,59]

Data quality and validity[40,62,72] and communication issues were also reported[40,81] as barriers. A few studies reported technical support as a major barrier.[56,70] Other ICT were reported as not aligned with actual workflows[56] or posed difficulty for scaled or customized implementation.[35] The lack of technical support and learning or training requirements, as well as limited flexibility, were also described as barriers.[40] Finally, some studies indicated that the provider-client relationship was negatively affected by the implementation of ICT.[63,64,71]

In summary, the most predominant barriers related to the ICT for health care aides were related to incomplete or limited software features,[35,40,46,52,63,66,67,70,71,85] time-consuming ICT (i.e., in use, adoption, or implementation),[2,35,40,51,53,55,56,59,63 64,65,85] heavy or increased workloads,[40,52,55,59,69,71–73,83] and health care aides perceived ICT as not convenient or a useful solution.[55,57,58,64,70,71,74,83]

Benefits

Several authors have documented the benefits of ICT for health care providers.[66,78,85,87,95,97] However, there is little evidence on the benefits of technology for health care aides. Benefits of ICT are described as tangible or perceived outcomes derived from the implementation or adaptation of ICT.[98,99] The benefits of using new ICT are usually described with great positivity. A clear description of the benefits of ICT for health care aides can inform the decision-making process regarding the implementation and adoption of new technologies for health care aides.[36] The evidence suggested that benefits related to ICT for health care aides are consistent between different health care professionals. These benefits are related to improvements in documentation, monitoring, and quality of care, and support to existing workflows and information exchange, and enhancement in communications.[100]

In ►Fig. 3, we report the distribution of benefits identified for ICT used by health care aides. In ►Supplementary Table S4 (available in the online version), we present an entire list of the benefits we found.

The main benefits we found in this review were related to (1) improvements in communication, (2) support to workflows and processes, (3) improvements in resource planning and health care aides services associated cost and time, (4) improve access to information and documentation, (5) improve documentation quality and efficiency, and (6) improvements in the coordination of care and patient's care follow-up at home, extending care for patients in the community.

Improvements in communication compared with conventional methods, such as fax, traditional mailing, and telephone,[2,80,81,101] was a consistently reported benefit of ICT for health care aides. In these studies, users reported that ICT improved communication between caregivers, patients,[51,54,72] and staff[64,65] by introducing tools such as video calls and telehealth.[35,57] Several studies reported the

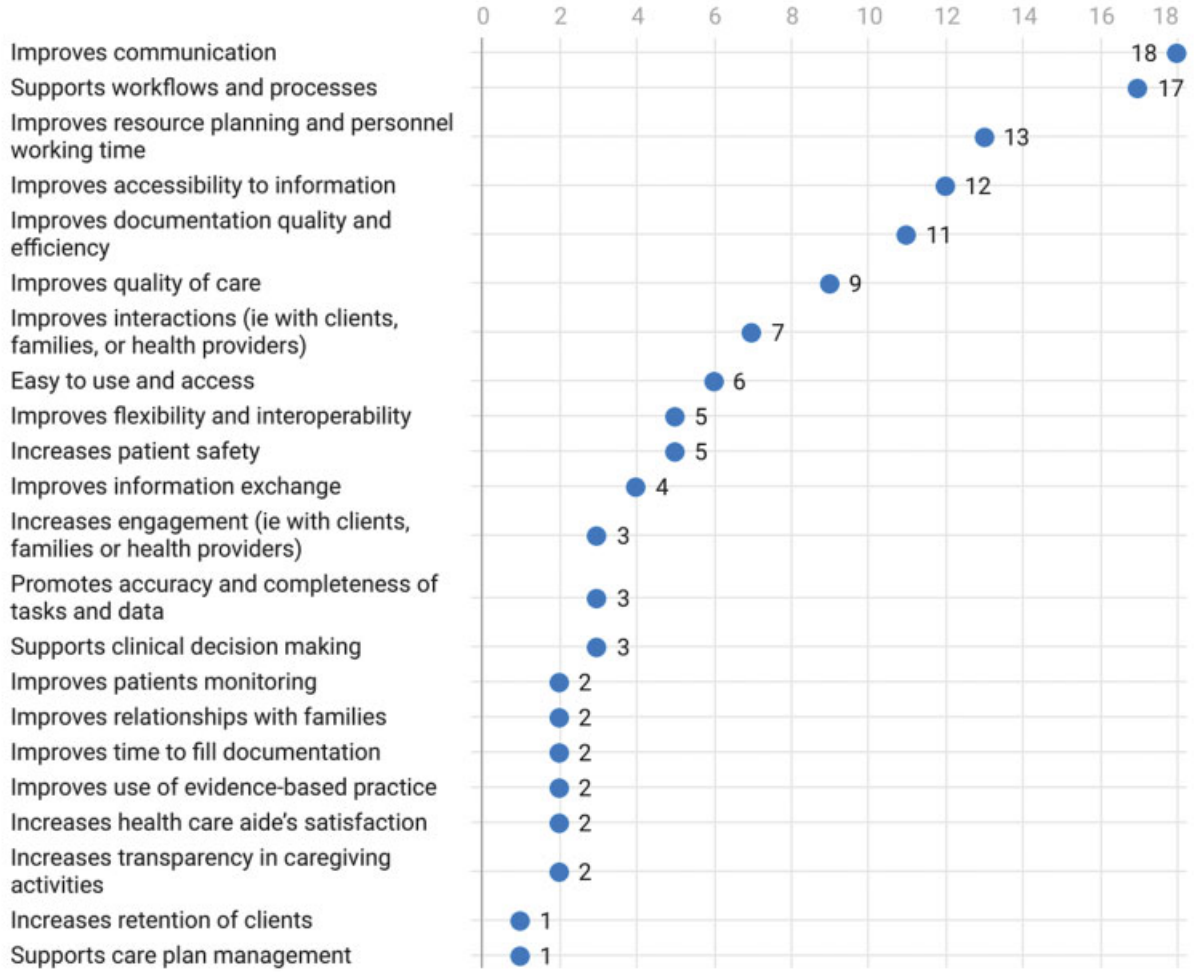

Fig. 3 Distribution of benefits reported in the selected studies.

benefits of telehealth and remote care provided by ICT.[32,102] We observe health care aides' opportunity to provide services in distant places.[102,103] For example, ICT can support health care aides to deliver high-quality health care in remote territories and regions in rural communities and isolated populations.[63,64,102] The need for telehealth services for older adults, especially those living with dementia, has increased over the last few years.[104] A few authors have described how telehealth can improve health care service delivery.[35,54,102,104,105]

Also, studies reported that ICT enabled a better cultural understanding by delivering information in different languages.[70] In addition, we found that ICT supported communication across locations, personnel, and families.[76] Moreover, a few studies reported that ICT improve older adults communication capacity about their health concerns.[73] Finally, ICT were found to allow health care aides to respond to issues rapidly.[83]

Another group of studies reported that ICT supported workflows and processes[2,35,53,54,66,69,71,72,74,77,81,83] by improving time management,[74,77,81] simplifying and standardizing procedures,[72] reducing repetitive actions,[2] and supporting schedule planning.[2,40,52,61,77,82,84,101] As an example, Stroulia et al[54] reported that ICT for health care aides supported automatization and adaptative scheduling which could potentially reduce travel times and missed appointments. Katalinic et al[35] reported how ICT can support health care aides' remote practice to provide caregiving services to clients in distant locations.

We found a group of studies reporting benefits related to better work and staff organization associated with ICT.[71] Lastly, ICT were observed as a factor for improving staff planning,[66,71] enable caregiving services in a timely manner,[84] and promote time savings in comparison with existing methods of communication.[40] Regarding the benefit of costs and service utilization,[2,101] Chiang et al[2] reported the reduction of medical costs and service consumptions through the use of smartphones applications to provide home care services. Also, Lindberg et al[101] identified several publications describing how ICT for health care aides can reduce cost of caregiving services compared with traditional modes of delivery.

Furthermore, a few studies described accessibility to information and documentation as an enormous benefit[40,53,54,57,59,64,80,101] by providing health care aides quick access or real-time updates to their clients information.[54,59] A significant group of studies reported that ICT improved documentation quality and efficiency,[64,65,68] by improving consistency in documentation,[72] with more precise and updated information.[54,57,59,76]

Lastly, we found another group of benefits that reported improvements in the coordination of care and patient follow-up at home. These benefits have proven to extend the care for patients in the community,[2,35,82,84,101] and improve interactions between clients and health care aides.[52,56,57,61,75] The effectiveness of ICT was described as a benefit by providing easy access to health care plans,[35,53,57,72] promoting flexibility and interoperability,[40,63,69] and assisting patient safety.[54,57,71,73]

Discussion

This review examined the range and extent of ICT used by health care aides to manage and coordinate care delivery and their workflow with clients. We included 40 studies selected from the academic literature. We organized our findings into five categories of purposes for implementing ICT among health care aides. Additionally, we found a diversity of settings and arrangements for hardware and software to deploy these technologies within health care services and organizations.

In the literature, we identified evidence suggesting that current technologies for health care aides are inefficient and often do not fit their workflows,[42] or outdated and ineffective.[37] From a benefits perspective, ICT is presented as a facilitator of effective communication for health care aides.[15] In this review, we shared additional knowledge about the range and extent of ICT used by health care aides, as well as enhanced our understanding of the barriers and benefits associated with the use, adoption, and implementation of ICT by health care aides.

The literature suggests that across the health care sector, the barriers and benefits of ICT are common for health care professionals.[87,95] Overall, we identified 128 barriers and 130 benefits associated with ICT used by health care aides. Even though ICT can face significant barriers in implementation, we found positive information regarding their benefits. Our findings are consistent with the academic literature that exposed the barriers and benefits of use and implemention of ICT in the health care sector for other providers.[15,35,42,45,66,89,97,106,107]

Several authors acknowledge the difficulties related to implementing technologies in health care settings.[45] The common barriers for the adoption and implementation of ICT within this sector are related to resource requirements and costs,[108,109] technological limitations, and lack of global standards and privacy concerns.[110–112] These barriers are aside from the previously established structural organizational barriers.[86]

In the academic literature, there are several examples describing the barriers related to the adoption and implementation of ICT in health care settings that can be analyzed under the lens of technology acceptance models.[45,113–115] Furthermore, the expected benefits of using ICT could inform future implementations.[116] Benefits of good-quality software, compatibility and interoperability with other information systems[117] would promote the adoption of these technologies among health care aides.[118]

In this review, our findings suggested that health care aides could experience multiple barriers to use and adopt new ICT in their workflows and practice. The main barriers we found were related to incomplete hardware and software features, time-consuming ICT adoption, and heavy or increased workloads. In past studies, authors have described the financial, organizational, structural, cultural, and technical difficulties to adopting ICT[89] and additional barriers to ICT use and adoption by health care aides, such as professional skills[102] and digital health education and literacy.[119] To overcome these barriers, authors have recommended a

more comprehensive[120] and participatory design process involving health care aides' needs and experiences.[60,121,122]

Likewise, we observed that health care aides could adopt and use ICT to support new models of care, such as telehealth for client follow-up, and consultation. However, traditional work practices have shaped health care aides' current workflows and procedures. As a result, health care aides face multiple barriers to adopt and use ICT in their practice. One significant barrier is the organizational and provider infrastructure,[42] as providers generally use ICT-specific electronic patient information systems. By increasing their own awareness about the use, capabilities, and benefits of integrating ICT in critical activities of integrated care, health care aides could take advantage of the potential of these technologies to improve activities, such as prevention,[42] collaboration, and delivery of care in innovative ways using ICT.

Barriers to access to data, even at regional levels, present an obstruction to deliver care by health care aides.[42] Accessing and updating information about client's observations and medical conditions are essential for health care aides to provide better caregiving services. Evidence suggests that information exchange also can improve health care aides' communication with other health professionals.[15] Thus, we support the argument that access to information can enhance the ability of health care aides to provide higher quality caregiving services[37,97,102] and make better decisions to improve the quality of care.[36]

Since health care aides face structural challenges in their profession, such as lack of regulation and standardized scope of practice, it is crucial to consider these barriers beforehand when implementing new ICT.[8,9,12,29,123] New ICT developments should consider both, the structural and the technological barriers within the health care sector.[124]

ICT can support health care aides' work by facilitating caregiving[125] and support the long-term relationship between patients and health care providers.[97] By implementing and adopting ICT in health care aides' professional practice, they could support caregiving services for numerous people. In summary, ICT could serve as a strategy to enable socially isolated people to utilize health care aides' services,[36,102,126,127] and address the lack of direct support from professionals available to provide care services[128] and leverage the shortage of skilled and well-trained health care professionals.[129]

Involving health care aides into the process of designing, implementing, and customizing new ICT is crucial to increase the rate of adoption.[36,37] As the older adult population demands more caregiver professional services, we could expect an increasing number of new ICT to support health care aides.[33,36,125] For that reason, we should consider the findings reported in this review related to barriers and benefits of ICT for health care aides.

Future Recommendations

After reviewing an extensive compilation of studies for this review, we recognize the need for more straightforward ICT aligned with health care aides' workflows. In addition, we must consider the involvement of end-users in design, training, and education, and clarity about the use of ICT. The voice of the end-user is essential for developing ICT tools. Future developments should include feedback from users in every step of development and the mindset of improving care. This could be done in participatory design methods[130] to engage users in the ICT.

The novel coronavirus disease 2019 (COVID-19) pandemic has accelerated the adoption of ICT tools,[29,105] such as telehealth applications.[105] These applications include remote consultations for seniors,[131] specifically persons living with dementia, to minimize the risk of contracting COVID-19.[132] The pandemic has impacted the role of health care aides as caregivers by limiting their interactions and communications with their clients and families,[133] as well as it has revealed limitations in their ability to provide remote services. This is considering the gaps between different health care facilities and their preparedness to provide telehealth services with patients who have no internet connection or phone service.[134]

At the same time, the pandemic revealed opportunities for the adoption and implementation of ICT tools to monitoring COVID-19 symptoms[109] and coordinating and delivering care.[135,136] In the upcoming years, we can expect a greater demand, adoption, and use of ICT to improve and enable the quality of care. Identifying the health care aides' needs and requirements for design is crucial,[121] as this will pave the road to acceptance and adoption of the ICT. We also believe that critical sociocultural factors need to be understood before developing ICT.[121] In the future, health care aides with technical training may be more receptive to ICT.[38] This could help health care aides to overcome multiple barriers identified in this study.

Finally, although the literature reporting information specific to health care aides is scarce, and there is limited research on evidence-based practices for this population, we cannot understimate the importance of health care aides to sustain the health care system. Indeed, many countries around the world face a shortage of these groups of service providers. In this review, we have seen how ICT can help health care aides in their practice. However, more research is needed to support evidence-based ICT.

Limitations of the Study

This literature review has some limitations. First, despite our efforts to conduct a comprehensive and exhaustive search, the academic literature lacks consistency concerning our search terms. We were looking for healthcare workers, such as health care aides and personal support workers. Due to the limited literature involving this population, we decided to include nurses and personal support providers in studies that referred home care services. We assumed that their experiences are similar, considering different ways of pointing health care aides across Canada and other countries. Second, it was hard to classify barriers and benefits, as some articles reported these indistinctly. For that reason, we defined meanings for each group, and after a process of

open discussion, such definitions were organized accordingly. Third, although we identified several barriers and benefits in selected studies, not all studies comprehensively reported all perceived benefits and barriers associated with ICT for health care aides.

Conclusion

Despite challenges, the literature identifies that ICT can improve health care aides' workflow and quality of care for their clients. The main issue we experienced was the scarce literature related specifically to health care aides. We achieved the aim of this literature review to understand the barriers and potential benefits of ICT adoption for health care aides. We classified this information by purpose as reported in the selected studies. Future directions should examine the impact of the ICT on workflows of health care aides.

Clinical Relevance Statement

This literature review showed the information and communication technologies (ICT) used by health care aides to manage and coordinate the care-delivery workflow for their clients. In addition, we have explored the factors that would assist in the development and adoption of electronic platforms, which could improve the overall efficiency of care provided by health care aides.

Multiple Choice Questions

1. What is the most common barrier to implement and adopt information and communication technologies (ICT) faced by health care aides?
   a. Incomplete hardware and software features
   b. Time-consuming ICT adoption
   c. Heavy or increased workloads
   d. Perceived lack of usefulness of ICT

   Correct Answer: The correct answer is option a, as health care aides reported system malfunctions, poor design, and issues regarding software configuration. In these studies, the software did not reflect users' needs and expectations or did not support their information needs. Some studies described the lack of documentation features. In addition to usability issues we found connectivity issues, as a hardware significant barrier in this group. Some studies reported incomplete hardware features as a significant barrier to adopting and implementing ICT.

2. What is the most common benefit for health care aides to implement and adopt information and communication technologies (ICT)?
   a. Improvements in communication
   b. Improvements in planning
   c. Improvement in organization staffing
   d. Increase overall productivity

   Correct Answer: The correct answer is option a. We found this benefit as the most common in this review. Improvements in communication include communication between caregivers and patients and staff, better cultural understanding. In addition, ICT can support communication across locations, personnel, and families and allow clients to inform their concerns to health care aides.

Author Contributions

All authors contributed to the study's conception and design. Data extraction, analysis, and synthesis were performed by H.P., N.N., and S.M. The first draft of the manuscript was written by H.P., N.N., S.M., and S.P., and all authors commented on previous versions of the manuscript. L.L., A.M.C., and N.N. read and approved the final manuscript.

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Conflict of Interest

None declared.

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