The use of conversational agents in rehabilitation following brain injury, disease, or stroke: a scoping review protocol

Judith Hocking1 • Candice Oster2 • Anthony Maeder1

1Flinders Digital Health Research Centre, College of Nursing and Health Sciences, Flinders University, Adelaide, SA, Australia, 2College of Medicine and Public Health, Flinders University, Adelaide, SA, Australia

ABSTRACT

Background: Rehabilitation for adults with brain injury or disease or stroke provides goal-directed care to overcome functional impairments and reduced independence. However, recovery can be impacted due to rehabilitation being time limited. New therapy approaches supporting rehabilitation and self-management are warranted. Conversational agents provide personal computer-based dialogues that can be designed to meet the specific needs of clients. Interacting with a conversational agent may support rehabilitation for clients with brain injury, disease or stroke.

Objective: The objective of the review is to identify peer-reviewed literature reporting the design and use of conversational agents in rehabilitation for adults with brain injury, disease, or stroke.

Inclusion criteria: Studies, written in English, that report the design and/or use of conversational agents in rehabilitation for adults aged over 18 years with brain injury, disease, or stroke will be considered for inclusion. Research settings may include hospitals, community settings, and homes. Eligible study types are peer-reviewed research protocols, prototype development papers, and pilot and clinical trials.

Methods: Primary sourcing databases (MEDLINE [Ovid], Scopus, ProQuest, Web of Science) and gray literature sources will be searched with no data range limitations. Only studies published in English will be considered due to feasibility limitations. The JBI System for the Unified Management, Assessment and Review of Information (JBI SUMARI) will be used. Two independent reviewers will screen the retrieved papers by title and abstract, and the selected papers by full-text review. Any disagreements will be resolved by an objective arbitrator. Data to be extracted and analyzed from included papers will include details of participants, concept, context, and the study design. Results will be presented narratively and in tabular format.

Keywords brain injury; conversational agent; dementia; Parkinson Disease; stroke


Introduction

Rehabilitation for adults with brain injury or disease or stroke enables recovery from symptoms including cognitive and/or physical impairments and reduced functional independence. Causes of brain injury include aneurysmal bleed, trauma, and surgery.1 Brain diseases include Parkinson’s Disease (PD), dementia, and mild cognitive impairment (MCI). Stroke (or cerebro-vascular accident) is a brain insult due to interruption of its blood supply from blockage or bleeding.2 Multi-disciplinary care teams provide rehabilitation to help clients achieve improved functional ability and well-being. Recovery varies between individuals due to the severity and location of the brain insult, and can range from significant, to minimal, or not possible. Recovery occurs due to neuroplasticity (a lifelong process of the brain forming new neural connections), which enables relearning of lost functions and/or compensatory skills.3

Functional outcomes following brain injury, disease, or stroke are optimized in rehabilitation when therapy is directed towards goals that are
meaningful and motivating for the client. Goals should address physical symptoms, language and communication, and functional independence, in addition to addressing cognitive and neuropsychiatric needs. Client motivation is central for supporting rehabilitation success as low motivation can impede recovery. Conventional rehabilitation incorporating therapist-driven care is time- and resource-limited despite clients’ potential for ongoing recovery. New, innovative approaches to support rehabilitation and self-management are needed. Digital health technology has been proposed as an innovation option.

Conversational agents (CAs), or chatbots, are computer automation systems incorporating decision logic programming to enable interactive human-computer conversation. In CA conversations, human-user responses are entered either as typed or spoken dialogues, and can be displayed as typed text. The quality of user engagement with a CA influences how well the CA achieves its intended purpose. The CA may enable the user to respond with natural and unconstrained dialogue, and/or by choosing from pre-determined options. Client needs should be identified prior to using a CA; for example, the client may be able to speak rather than type a response. Conversational agents may include a human-like avatar that embodies the conversation by speaking the CA dialogues and by incorporating non-verbal communication. This type of CA is called an embodied CA (ECA). Safety risks present in CA use include the user being misunderstood by the CA, and the CA providing (at best) annoying or irrelevant replies, or (at worst) dangerous replies. The CA design, content, intended clinical outcomes, and potential risks need to be carefully assessed.

Conversational agents have been implemented for varied clinical contexts and have shown to achieve positive outcomes and good user acceptability. These contexts include mental health care and health behavior change. Clients with cognitive impairment may prefer to use a CA that is presented simply and meets their needs for entering responses (e.g., typing or voice recognition). Conversational agents have also been applied for brain injury and disease: to help families support veterans to seek health care for issues arising from brain injury or PTSD, for speech training in PD, or in both PD and dementia, and for providing clinical information to support coping with PD. Conversational agents have been researched for memory rehabilitation in older adults through reminiscence therapy and supporting recall of daily activities, and for cognitive rehabilitation and social conversation in adults with MCI.

The use of CAs in health care has been reported in a number of previous synthesis reviews. Systematic reviews have been conducted on the use of CAs in mental health and in health care more generally, and a scoping review of the use of CAs in psychology has also been conducted. No review has yet been conducted that investigates the use of CAs for brain injury, disease, or stroke.

A scoping review methodology was deemed necessary due to its exploratory nature incorporating a wide range of publication types and multiple clinical contexts. The types of literature in the field of CAs for health care include design and development papers and early pilot trials, and a paucity of effectiveness studies. This is indicative of this being a newer field of study. The planned review will include these varied publication types. The choice to include multiple clinical contexts (brain injury, disease, and stroke) in this review is due to there being limited literature regarding the use of CAs in any of these contexts separately.

A preliminary search of PROSPERO, MEDLINE (Ovid), the Cochrane Database of Systematic Reviews and the JBI Database of Systematic Reviews and Implementation Reports was conducted (4 May 2020), and no current or in-progress scoping reviews or systematic reviews on the topic were identified. This primary objective of the review is to identify the peer-reviewed literature reporting the design and use of CAs in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke.

**Review questions**

How are CAs designed for and used in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke?

**Secondary questions**

a) What types of CAs are used in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke?

b) For what purposes are CAs used in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke?
c) How are the needs of adult clients aged 18 years and older with brain injury, disease, or stroke integrated into the design of CAs used in rehabilitation care for this population?

d) How are CAs implemented in rehabilitation for adults aged 18 years and older brain injury, disease, or stroke?

e) What outcomes are used to assess the use of CAs in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke?

f) What safety issues have been identified with the use of CAs in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke?

g) What are the barriers to using CAs in adults aged 18 years or older with brain injury, disease, or stroke?

h) What are the facilitators to using CAs in adults aged 18 years or older with brain injury, disease, or stroke?

Methods

The JBI methodology for conducting scoping reviews will be employed.27 The number of extracted, screened, excluded and included studies will be reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analysis for Scoping Reviews (PRISMA-ScR) recommendations.28

Inclusion criteria

Inclusion criteria encompass the key areas of study Participants, Concept, and Context (PCC). Eligible studies must report how participants were recruited and may or may not include a comparator group. Outcome measurement processes must be reported in detail that enables replication, and utilize tools validated for the study purpose or, alternatively, are the best available. Outcome measures may include assessments for user engagement, feasibility and acceptability, client and/or clinician perspectives, and clinical outcomes.

Participants

Papers that include participants adults aged 18 years or older, including geriatric populations, will be considered for this review.

Participants diagnosed with brain injury of any severity (mild, moderate, and severe), acquired brain injury (ABI) (including but not limited to concussion, traumatic brain injury [TBI], aneurysm bleed, or brain surgery, which may inadvertently cause disruption and injury to brain tissue at/near the surgical site), any brain disease including but not limited to PD, multiple sclerosis, dementia, MCI, and stroke will be considered for inclusion. Study participants must have sustained their brain injury, disease, or stroke at age 18 years or older.

Studies that include a cohort of healthy participants will also be considered if the purpose of the study is to develop and test a novel CA, prior to the CA being trialed with a clinical cohort, and if it is clearly reported how the design and development of the CA has specifically attempted to meet the intended cohort’s clinical needs regarding acquired brain pathology. In the final review, data from such studies will be annotated separately to data from studies in which the CA was tested on a clinical cohort.

Concept

The concept is the use of CAs in rehabilitation for adults with brain injury, disease, or stroke. For the purposes of this review, the type of therapeutic focus will be goal-directed care, recovery, or rehabilitation. Other types of focus, such as companionship, will be excluded unless the study includes outcome assessment of a rehabilitation goal.

Any type of CA design will be included, for example, CA design incorporating a humanoid avatar (ECA) or a simple interface with text only. The CA intervention may be standalone or used alongside usual care. The CA may have been designed specifically for the study, or it may be a more general or previously developed CA that has been integrated for use in a specific clinical setting.

Any type of clinical rehabilitation purpose for use of the CA will be considered; for example, motivation, achievement of therapy goals, adherence to therapy programs, and for improving health and well-being. All interventions must be intended to support the specific needs of the study cohort in relation to participants’ brain diagnoses.

Context

The clinical setting can be either a hospital, outpatient, community-based, and/or home environment. Rehabilitation interventions can be provided by a multi-disciplinary team or single discipline service, with or without family/carer involvement.
Papers reporting research conducted in a non-clinical setting may be included if the research concerns the design, development, and/or early pilot-testing of a CA prior to intended testing in a clinical setting with participants with brain injury, disease, or stroke.

Any geographical setting is eligible for inclusion. Studies with any publication date will be considered as the review is intended to be broad-reaching in order to increase the number of papers identified.

**Exclusion criteria**
Studies that provide insufficient detail to enable inclusion criteria confirmation will be excluded. Additional reasons for exclusion include research that addresses a clinical purpose for the CA other than recovery of function through goal-directed activity, such as memory prompts, social conversational support, or comfort care; or does not include planning for or actual assessment of the use of the CA in a clinical setting.

**Types of sources**
Types of studies considered eligible for this review are peer-reviewed publications, or academically reviewed and passed postgraduate research theses (excluding honors theses). Types of eligible peer-reviewed publications include quantitative and/or qualitative studies: research protocols, peer-reviewed expert-opinion papers, clinical studies including pilot trials, systematic or scoping reviews, and full, reviewed conference papers (but not abstracts). For any included review, the list of papers for that review will be searched for publications relevant for inclusion in this planned review. Research reports describing the design and development of a prototype CA intended for use in this review’s target population, including papers that do not report any outcome results, will also be considered. Gray literature sources of conference proceedings and development papers will be considered for inclusion when the same research has not been presented as a peer-reviewed publication. Only studies published in English will be considered due to feasibility and time limitations.

**Search strategy**
A MEDLINE (Ovid) search strategy has been developed through the following steps. An initial database search was conducted to locate a small number of relevant articles from which listed keywords and indexing terms were sourced for use in constructing a more comprehensive search. Additional synonyms for chatbot were included. The final constructed search for MEDLINE (Ovid) is presented at Appendix I. This constructed search strategy will be reformulated for each electronic database used. Reference lists of included papers will be searched for additional papers eligible for inclusion.

**Sourcing databases**
Primary sourcing databases (MEDLINE [Ovid], Scopus, ProQuest, Web of Science) will be searched for relevant peer-reviewed papers, conference proceedings, and theses. If there is missing data for any included paper, the paper’s corresponding author will be contacted with a request to provide the specific information. Gray literature sources including International Conference Proceedings Series and ProQuest Dissertations & Theses Global will also be searched.

**Selection of source of evidence**
Following completion of the search, all identified records will be uploaded to EndNote v.X9 (Clarivate Analytics, PA, USA) and duplicates will be removed. Two independent reviewers with expertise in brain rehabilitation and CAs will then conduct the screening process; any disagreements will be resolved by discussion or an objective arbitrator. Prior to the formal screening process commencing, a pilot screening process will be conducted as recommended in the JBI Manual of Evidence Synthesis. This process will comprise an initial screening of 25 titles/abstracts conducted by both co-reviewers independently. The screening results will then be compared and discussed: where indicated, changes will be made to the eligibility criteria to ensure both reviewers share the same understanding. This pilot process will be continued until at least 75% agreement occurs between the co-reviewers.

Following title and abstract screening, potentially relevant papers will be retrieved in full and their citation details imported into the JBI System for the Unified Management, Assessment and Review of Information (JBI SUMARI). These papers will undergo full-text review. The final review will present the full search results in a Preferred Reporting Items for Systematic Reviews and Meta-analyses extension for scoping reviews (PRISMA-ScR) flow
diagram\textsuperscript{27,28}; citations of the included papers in the reference list; and a full list of excluded studies, with reasons for exclusion, included as an appendix.

**Data extraction and charting process**

Data to be extracted from the included papers will encompass PCC study details and type of study (see Appendix II). PCC criteria will be used to appraise user experience of digital technologies.\textsuperscript{11} Data will be extracted by two independent reviewers using a modified version of the JBI data extraction instrument template (see Appendix II).\textsuperscript{27} This data extraction instrument will be pilot trialed by both reviewers, independently, on two to three included papers; and the results compared and discussed to ensure all relevant data is extracted, and that there is consistency between the reviewers. As needed, this extraction tool will be revised during the data extraction phase in response to findings. Any changes to the extraction tool will be reported in the final review. Any disagreement between the two reviewers regarding the extracted data, as well as proposed changes to the extraction template, will be resolved by an objective arbitrator. Results will be presented narratively, in a tabular format and visually (see Appendix III). Data will be categorized according to CA design, clinical contexts, participant characteristics, research design, and outcomes measures used.

**Acknowledgments**

Ms. Shannon Brown (research librarian, Flinders University) for assistance in constructing the MEDLINE search strategy.

This review will contribute to the work submitted by the first author (JH) for the degree of Doctor of Philosophy at Flinders University, Adelaide, SA, Australia.

**Funding**

JH is a PhD scholarship recipient from the Australian Research Council Industrial Transformation Research Hub for Digital Enhanced Living (IH170100013). The results of this review will not affect JH’s PhD scholarship.

**References**


© 2020 JBI. Unauthorized reproduction of this article is prohibited.
Appendix I: Search strategy

MEDLINE (Ovid). This search was conducted on April 28, 2020.

Database(s): Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Daily and Versions(R) 1946 to April 28, 2020.

<table>
<thead>
<tr>
<th>#</th>
<th>Searches</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>((“Text based” or “text-based” or virtual or relational or intelligent or synchronous or asynchronous or user-computer or “user computer” or human-computer or “human computer” or “computer assisted”) adj2 (assistant or human or agent or coach or chat or person or people or interface or therapy)).ti,ab,kw.</td>
<td>3116</td>
</tr>
<tr>
<td>2</td>
<td>(Chatbot or avatar).tw,kw.</td>
<td>1326</td>
</tr>
<tr>
<td>3</td>
<td>((Conversational or “embodied conversational” or artificial or “natural language”) adj1 (agent or intelligence or processing)).tw,kw.</td>
<td>9139</td>
</tr>
<tr>
<td>4</td>
<td>(Dialogue systems or Artificial Conversational Entity or Dialogue systems).tw,kw.</td>
<td>26</td>
</tr>
<tr>
<td>5</td>
<td>(“automated question answering system” or “3D human” or “AI agent” or “believable agent” or “conversive agent” or “cyber individual” or “desktop mate” or “digital animated avatar” or “electronic virtual interactive entity” or “language bot” or “lifelike animated character” or “natural language system” or “online chat agent” or “language bot” or “lifelike animated character” or “natural language system” or “online chat agent” or “relational agent” or “smart virtual assistant” or “synthetic agent” or “teachable agent” or avatar or bot or buddy or character or chatbot or chatterbot or chatterbox or ECA or intellitar or IVA or IVR or smartbot or VDA or ((anthropomorphic or automated or embodied or intelligent or pedagogic or talk” or virtual) adj3 (advisor or agent or assistant or coach or consultant or expert or head or human or interface or machine or person or persona or people or representative or robot or specialist or teacher or tutor)) or ((animated or artificial or asynchronous or automated or chat or computerized or computerised or conversation” or “dialog” or “intelligent or interact” or relational or synchronous or “text based” or “text-based” or “virtual”) adj3 (agent or assistant or attendant or chat or coach or computer or entity or human or interface or person or people or person or program or response or robot or system or “talking head”)).tw,kf.</td>
<td>172,121</td>
</tr>
<tr>
<td>6</td>
<td>1 or 2 or 3 or 4 or 5</td>
<td>181,561</td>
</tr>
<tr>
<td>7</td>
<td>exp brain injuries/ or exp brain diseases/</td>
<td>1,202,820</td>
</tr>
<tr>
<td>8</td>
<td>(“acquired brain injury” or “ABI” or “traumatic brain injury” or “TBI”).tw,kw.</td>
<td>47,556</td>
</tr>
<tr>
<td>9</td>
<td>((brain or cerebr) adj4 (injur or hypoxi or damage or trauma or neoplasm or lesion or tumor or cancer or infection)).tw.</td>
<td>202,879</td>
</tr>
<tr>
<td>10</td>
<td>(MTBI or “mild traumatic brain injury” or TBI or “traumatic brain injury” or “ABI” or “acquired brain injury” or “brain injury” or concuss or “post concuss” or “post-concuss” or PCS).tw,kf.</td>
<td>93,717</td>
</tr>
<tr>
<td>11</td>
<td>((brain or cerebr) or cerebell$ or intracerebral or intracran$ or parenchymal or intraparenchymal or intraventricular or infratentorial or supratentorial or basal gangli or putaminal or putamen or posterior fossa or hemispher or subarachnoid) adj5 (h?emorrhag or h?ematoma or bleed)).tw.</td>
<td>75,937</td>
</tr>
</tbody>
</table>
(Continued)

<table>
<thead>
<tr>
<th>#</th>
<th>Searches</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>((brain or cerebr” or cerebell” or vertebrobasil” or hemispher” or intracran” or intracerebral or infratentorial or supratentorial or middle cerebr” or mca” or anterior circulation or basilar artery or vertebral artery) adj5 (isch?emi” or infarct” or thrombo” or emboli” or occlus” or hypoxi’)).tw.</td>
<td>115,022</td>
</tr>
<tr>
<td>13</td>
<td>(stroke” or “post stroke” or poststroke or “post-stroke” or apoplex” or “cerebral vasc’” or cerebrovasc” or cva or SAH).tw.</td>
<td>301,738</td>
</tr>
<tr>
<td>14</td>
<td>7 or 8 or 9 or 10 or 11 or 12 or 13</td>
<td>1,457,718</td>
</tr>
<tr>
<td>15</td>
<td>exp Dementia/</td>
<td>163,326</td>
</tr>
<tr>
<td>16</td>
<td>(dementia or alzheimer” or “mild cognitive impairment” or “cognitive impairment”” or neurodegen” or parkinson”).tw,kw.</td>
<td>397,148</td>
</tr>
<tr>
<td>17</td>
<td>15 or 16</td>
<td>429,973</td>
</tr>
<tr>
<td>18</td>
<td>14 or 17</td>
<td>1,625,798</td>
</tr>
<tr>
<td>19</td>
<td>6 and 18</td>
<td>9243</td>
</tr>
<tr>
<td>20</td>
<td>exp animals/ not humans/</td>
<td>4,694,207</td>
</tr>
<tr>
<td>21</td>
<td>19 not 20</td>
<td>7937</td>
</tr>
</tbody>
</table>
Appendix II: Data extraction instrument

This data extraction instrument is based upon the JBI Data Extraction Instrument template.27

<table>
<thead>
<tr>
<th>Scoping review details</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Scoping review title:</td>
<td>The use of conversational agents in rehabilitation following brain injury and disease or stroke: a scoping review protocol</td>
</tr>
<tr>
<td>Review objective/s:</td>
<td>This review's primary objective is to identify the peer-reviewed literature reporting the design and use of CAs in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke.</td>
</tr>
<tr>
<td>Review question/s:</td>
<td>Primary question: How are CAs designed for and used in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke? Additional review sub-questions: a) What types of CAs are used in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke? b) For what purposes are CAs used in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke? c) How are the needs of adult clients aged 18 years and older with brain injury, disease, or stroke integrated into the design of CAs used in rehabilitation care for this population? d) How are CAs implemented in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke? e) What outcomes are used to assess the use of CAs in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke? f) What safety issues have been identified with the use of CAs in rehabilitation for adults aged 18 years and older with brain injury, disease, or stroke? g) What are the barriers to using CAs in adults aged 18 years or older with brain injury, disease, or stroke? h) What are the facilitators to using CAs in adults aged 18 years or older with brain injury, disease, or stroke?</td>
</tr>
<tr>
<td>Inclusion/exclusion criteria</td>
<td>Population: Participants’ age: Adults aged 18 years or older, including geriatric populations. Participants’ diagnoses: Brain injury including any severity (mild, moderate and severe): ABI; concussion; TBI; aneurysm bleed or surgery; brain disease including PD, dementia, and MCI; and stroke. Study participants must have sustained their brain injury, disease or stroke at age 18 years or older. Studies that include a cohort of healthy participants will also be considered for inclusion if the purpose of the study is to develop and/or conduct early testing of a novel CA, prior to the CA being trialed with a target clinical populations of adults with brain injury, disease or stroke; and it is clearly reported how the design and development of the CA has specifically attempted to meet the brain-related needs of the target clinical population.</td>
</tr>
</tbody>
</table>
**Scoping review details**

<table>
<thead>
<tr>
<th>Concept</th>
<th>The concept under review is the design and use of CAs for rehabilitation for adults with brain injury, disease or stroke. <strong>Type of conversational agent:</strong> Any type of CA design will be included, for example, utilizing either natural language processing and/or a humanoid avatar. The CA intervention may be standalone or used alongside usual care. The CA may have been designed specifically for the study; or it may be a more general, previously developed CA which has been integrated for use in a specific clinical setting. <strong>Type of rehabilitation clinical purpose:</strong> Any type of clinical rehabilitation purpose for use of the CA will be considered; for example, motivation, achievement of therapy goals, adherence to therapy programs, and for improving health and wellness. All interventions must be intended to support the specific needs of the study cohort, in relation to the brain diagnosis/es. Include other details if relevant; for example, comparator group, participant retention and attrition.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context</td>
<td><strong>Clinical setting:</strong> Rehabilitation settings can include hospital, outpatient, community-based, and home environments providing rehabilitation care to adults with brain injury, disease or stroke. Rehabilitation interventions can be provided by a multi-disciplinary team or single discipline service, with or without family/carer involvement. Other intervention contexts (eg, social and care settings) will also be considered for this review, in order to optimize the number of papers identified. <strong>Non-clinical setting:</strong> Papers reporting research conducted in a non-clinical setting may be included if the research concerns the design, development, and/or early pilot-testing of a CA prior to intended testing in a clinical setting with participants with brain injury, disease, or stroke. <strong>Time and place:</strong> Any date of publication and any geographical setting is eligible for inclusion.</td>
</tr>
<tr>
<td>Types of evidence source</td>
<td>Types of studies considered eligible for this review must be peer-reviewed publications, or academically reviewed and passed postgraduate research degree theses (excluding honors theses). Types of eligible peer-reviewed publications include quantitative and/or qualitative studies; research protocols; peer-reviewed expert-opinion papers; clinical studies including pilot trials; systematic or scoping reviews; and reviewed full conference papers (but not abstracts).</td>
</tr>
</tbody>
</table>

**Evidence source details and characteristics**

<p>| Citation details (eg, author/s, date, title, journal, volume, issue, pages) |
|---|---|
| Country |
| Context |
| Participants (details, eg, age/sex and number) |</p>
<table>
<thead>
<tr>
<th>(Continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scoping review details</strong></td>
</tr>
<tr>
<td><strong>Type of research (quantitative, qualitative, mixed methods, review, design and methodology)</strong></td>
</tr>
<tr>
<td><strong>Details/results extracted from source of evidence (in relation to the concept of the scoping review)</strong></td>
</tr>
<tr>
<td><strong>Type of research reported (eg, prototype development; usability/feasibility testing; pilot or full clinical trial)</strong></td>
</tr>
<tr>
<td><strong>Type of intervention: design of CA (how it meets clinical needs aligned to brain insult)</strong></td>
</tr>
<tr>
<td><strong>Type of intervention: mode of use; for example, who used CA; dose (including duration; frequency)</strong></td>
</tr>
<tr>
<td><strong>Outcomes measured (eg, tools assessing clinical aspects; feasibility; usability)</strong></td>
</tr>
<tr>
<td><strong>Safety (any issues; perceived risks and risk management)</strong></td>
</tr>
<tr>
<td><strong>Barriers to CA use and implementation</strong></td>
</tr>
<tr>
<td><strong>Facilitators to CA use and implementation</strong></td>
</tr>
</tbody>
</table>

ABI, acquired brain injury; CA, conversational agent; MCI, mild cognitive impairment; PD, Parkinson’s Disease; TBI, traumatic brain injury
This form may be iteratively developed and changed during the scoping review process, as evolving understanding of the literature emerges.
Appendix III: Potential approaches to be used for presenting results

The review results will be presented narratively, as well as in tabular and other visual formats. Examples of tabular formats and visual formats are presented below.

Tables
Tables will be used to present review results, including but not limited to:
- Summary data of included studies (details of publication, type of publication, type of research, participant cohort, CA design, outcome assessments)
- Aggregated findings of focus areas of importance and/or interest (eg, CA design, purpose/s for using CA; mode/s of CA implementation; acceptability, feasibility, and/or safety factors).

Visual presentation
Below are some examples of how the extracted data may be visually presented in the final review.

Figure 1: Types of conversational agents used across each diagnosis/es
Legend: † = conversational agent

Figure 2: How different types of conversational agents are used
Legend: † = conversational agent
**Clinical Trial / Pilot Trial**
- Type of CA
- How the CA is used

**Feasibility / Usability Testing**
- Type of CA
- How the CA is used

**Design & Development research**
- Type of CA
- How the CA is used

---

**Figure 3: Types of research investigating different types and uses of conversational agents**

Legend: † = conversational agent

- Alzheimer’s disease
- Vascular dementia
- Mild cognitive impairment

No. of papers for each sub-category within each main diagnosis category, eg, sub-categories for dementia-related cognitive impairment and MCI

# for eg brain injury diagnoses

Gives relevant cumulative sub-categories, eg, for each diagnosis; and for papers reporting more than one diagnosis

# for eg dementia diagnoses

**Write total #**

**Total no. of papers**

---

**Figure 4: Publication frequency according to type of conversational agent and diagnosis**