

A systematic review of discrete choice experiments in stroke rehabilitation

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ABSTRACT

Objectives: Existing research qualitatively explores consumer preferences for stroke rehabilitation interventions. However, it remains unclear which intervention characteristics are most important to consumers, and how these preferences may influence uptake and participation. Discrete choice experiments (DCE) provide a unique way to quantitatively measure preferences for health and health care. This study aims to explore how DCEs have been used in stroke rehabilitation and to identify reported consumer preferences for rehabilitation interventions.

Material and Methods: A systematic review of published stroke rehabilitation DCEs was completed (PROSPERO registration: CRD42021282578). Six databases (including CINAHL, MEDLINE, EconLIT) were searched from January 2000–March 2023. Data extracted included topic area, sample size, aim, attributes, design process, and preference outcomes. Descriptive and thematic analyses were conducted, and two methodological checklists applied to review quality.

Results: Of 2,446 studies screened, five were eligible. Studies focused on exercise preference ($n = 3$), the structure and delivery of community services ($n = 1$), and self-management programs ($n = 1$). All had small sample sizes (range 50–146) and were of moderate quality (average score of 77%). Results indicated people have strong preferences for one-to-one therapy (over group-based), light-moderate intensity of exercise, and delivery by qualified therapists (over volunteers).

Conclusions: Few DCEs have been conducted in stroke rehabilitation, suggesting consumer preferences could be more rigorously explored. Included studies were narrow in the scope of attributes included, limiting their application to practice and policy. Further research is needed to assess the impact of differing service delivery models on uptake and participation.

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Introduction

Shared decision-making is defined as a partnership between consumers (and/or carers) and healthcare professionals that considers the consumers values and preferences alongside medical evidence to make healthcare decisions.^{1,2} Shared decision-making has been argued as the “hallmark” of consumer-centered healthcare,³ with increased attention and emphasis on consumer's values, preferences and experiences in healthcare.⁴ Research suggests that shared decision-making improves consumer understanding, satisfaction, trust, and adherence to treatments.^{5,6} For stroke care, research on shared-decision making has

mostly focused on acute care treatments^{7,8} despite the benefits being recognized across the continuum of stroke care⁹ and shared decision-making recommended internationally.¹⁰

Stroke survivors' experiences of receiving rehabilitation interventions and the factors that influenced their adherence to a particular program or intervention have often been explored through qualitative research methods such as interviews or focus groups.¹¹ While these studies provide us with data on the barriers and enablers that influence participation, it is often difficult for us to know how these factors are prioritized by stroke survivors and what trade-

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offs people would be willing to make between factors. For example, if people say they value both the service being close to home and receiving specialist care, would they be willing to travel further to a service if it meant they were more likely to receive specialist intervention? By measuring preferences for how rehabilitation services are provided, and the trade-offs consumers are willing to make, healthcare providers can plan and deliver services that enhance engagement and participation, ultimately improving consumer outcomes.

Increasingly popular in healthcare, the economic method of Discrete Choice Experiments (DCEs) provides a unique way to quantitatively measure consumer preferences for health and healthcare.¹² DCEs have previously been used in healthcare to quantify consumer preferences, value health outcomes, investigate health workforce issues, and develop priority setting frameworks.^{13,14} Delivered most often in a survey format, the DCE respondent is presented with repeated hypothetical choices between two (or more) different healthcare scenarios and asked to select their preferred option, with each scenario varying in the levels of a set of attributes or characteristics. Analyses of these repeated choices enable calculation of the strength of preferences for and relative importance of the levels and attributes. Trade-offs participants are willing to make, can be quantified through calculation of “willingness to pay” estimates,¹⁵ and by estimating uptake of proposed service delivery models.¹² For example, a DCE exploring the preferences of people with cancer for healthcare appointments found expertise and familiarity of doctors with patients’ medical history were most important to patients.¹⁶ Patients were willing to pay \$680 for an appointment with a cancer specialist rather than a nurse or GP, and \$301 to have an appointment within 30 minutes of home rather than traveling 2–3 hours.¹⁶ Although qualitative research exploring consumer preferences for stroke rehabilitation has been done in the past,¹⁷ the DCE method is a valuable and unique approach for providing a quantitative analysis of preferences.¹⁵ To date, little is known about the use and application of DCEs in stroke rehabilitation, with limited understanding of the specific consumer preferences they reveal.

This study aims to address this gap by exploring how DCEs have been used to establish consumer preferences within stroke rehabilitation. The specific research questions of this systematic review were to identify:

- (1) How many DCE studies have been conducted in stroke rehabilitation?
- (2) What DCE methods have been used and what is the quality of included studies?
- (3) What attributes and levels are used in the DCE studies of stroke rehabilitation?
- (4) What are people’s preferences for stroke rehabilitation identified in the DCE studies?

Materials and methods

Design

A systematic review of all DCE studies published in stroke rehabilitation was conducted to answer the research questions. The protocol for the review was registered in the international database of prospectively registered systematic reviews in health and social care (PROSPERO), Centre for Reviews and Dissemination, University of York (CRD42021282578).

Search strategy

In order to identify the relevant published literature, six electronic databases were searched: CINAHL, MEDLINE, Embase, OTSeeker, Pedro, and EconLIT. The selected studies were restricted to English language, and those published from 2000 onwards. This time period corresponds with advances in stroke rehabilitation service delivery and the period in which use of DCE methods in healthcare has become more common.¹² This year limit is also consistent with DCE systematic reviews conducted in other healthcare areas.^{18,19}

Terminology for the search terms was discussed extensively with the research team members including a health economist (AP) and research librarian (JW). The main search terms were related to commonly used DCE terminology,¹² stroke rehabilitation, and consumer preference. A full description of the search strategy can be found in supplementary file 1.

Studies were included if they met the following broad inclusion criteria: use a discrete choice experiment (DCE) or best-worst type three scaling study method delivered in any mode (e.g. online, in person, phone-based), adult (>18 years old) stroke survivor population, and, asked about consumer preferences for any intervention type (allied health, medical, nursing) completed in a stroke rehabilitation context. Studies were excluded if: only a published abstract was available (i.e. no full text), the primary setting was acute care, consumer preferences were only obtained using qualitative methods (i.e. no DCE was conducted), stroke survivors were not included as responders or studies were not available in English.

Study selection and quality assessment

JW completed the database search, and all studies retrieved were stored in an EndNote Library, and uploaded to Covidence (management software for systematic reviews).²⁰ Searches were completed in October 2021 and repeated in March 2023. Following duplicate removal (managed via Covidence), two researchers (LJ and LC) independently reviewed all titles and abstracts to screen for eligibility. Conflicts were resolved independently by a third reviewer (AP). LJ and LC then independently reviewed full text of the remaining studies and decided on final inclusion. Discrepancies were resolved through discussion with a third reviewer (AP). Proportion of reviews with agreement between reviewers and Cohen's Kappa statistic for inter rater reliability were calculated within Covidence.

Unlike other study designs (such as randomized controlled trials) there are no "gold standard" checklists to assess for quality or risk of bias for discrete choice experiment methodology. Two available checklists are the *International Society for Pharmacoeconomics and Outcomes Research (IPSOR) Conjoint Analysis reporting checklist*²¹; an assessment for risk of bias, and the *checklist to assess validity of DCE studies*²²; an assessment of study quality. Both have been applied in previous research to assess design quality and validity in DCEs^{13,23} and we applied both to assess study quality in this systematic review. Each checklist item was scored as either *yes*, *no*, *partially* or

unsure. For each study, a percentage score of reported items was calculated (*yes* was scored as 1 and *no*, *partially* or *unsure* as 0). Two of LJ, LC and NF independently rated each included study for quality, and AP resolved conflicts and advised on the analysis items.

Data extraction and analysis

Data were extracted from included studies using a predefined data extraction template (as per PROSPERO registration). Extracted variables spanned five key categories¹: study characteristics, including publication year, topic area and study aim²; sample characteristics (e.g. sample size)³; study design (including number of attributes, number of levels, number of choice-sets)⁴; study process (e.g. design and pilot process)⁵; study outcomes and results. Data were extracted by RL, MN, LC, and NF under the supervision of AP.

Two studies (of five; 40%) were extracted as a pilot by all researchers (RL, MN, LC, NF) and outputs were reviewed by a senior researcher (AP) for accuracy and consistency in extraction content. Updates to the extraction approach were agreed upon after the pilot and the remaining studies were divided between researchers for the full extraction. Regular meetings between reviewers and the senior researcher were held to discuss any queries or issues arising during the extraction and to ensure consistency with interpretation of the extraction template.

Data were analyzed using descriptive and content analysis approaches.²⁴ Descriptive analysis was conducted for data pertaining to study and sample characteristics (e.g. country, publication year), while the attributes and levels included in each DCE along with the preference results were analyzed thematically using content analysis.²⁴ Qualitative content analysis, inductive in approach, allows researchers to identify meanings, patterns and themes from text.^{24,25} Themes were developed through iterative team discussion of patterns in the attributes and levels across the studies, as well as the preference results relating to what was and was not important to participants. For example, studies that included attributes of waiting times, travel time and location, were given the theme of "convenience."

Results

Included studies

After database searches were completed, a total of 2,446 studies were identified. Following duplicate removal and screening of title and abstracts, 13 studies were identified as potentially meeting the inclusion criteria. After full text review, five studies were included. Refer to Figure 1 for the Preferred Reporting for Systematic Reviews and Meta-Analyses (PRISMA) flowchart²⁶ and online supplementary file 2 for the PRISMA checklist.²⁶ The proportion of reviewer agreement ranged from 98% to 100% in the title and abstract screening phase, and from 70% to 100% in the full text review phase. Cohen's kappa results found inter rater reliability ranged from 0.39 (fair) to 0.41 (moderate) during the title and abstract screening, and 0.4 (moderate) to 1.0 (perfect) during full text review.

Descriptive analyses

The five included DCE studies explored stroke survivors' preferences for the format of community

services,²⁷ exercise preferences,²⁸ acceptability of therapy intensity and virtual reality^{29,30} and preferences for self-management programs.³¹ The mean sample size was $n = 87$ (range 50 to 146). The pooled mean age and standard deviation (SD) of responders was 67¹² years, and most were male (pooled 58%). Only two studies reported stroke type of responders^{27,28} within which most responders sustained ischemic stroke (pooled 83%) or hemorrhagic stroke (pooled 8%).²⁷ Studies were completed in Australia ($n = 2$),^{29,30} Germany ($n = 1$),²⁸ Singapore ($n = 1$)³¹ and Wales ($n = 1$).²⁷ Full details of the study characteristics are outlined in Table 1.

Quality assessment

The majority of the studies scored moderately against both checklists,^{21,22} with an average quality score of 77% against the *Criteria Used to Assess the Validity of DCEs Checklist*²² (range: 54% to 85%) and 66% on the *Conjoint Analysis Application in Health Checklist*²¹ (range: 53% to 73%). The lack of an opt out option (or justification) was frequently unmet, despite all studies investigating interventions that are effectively optional. For example,

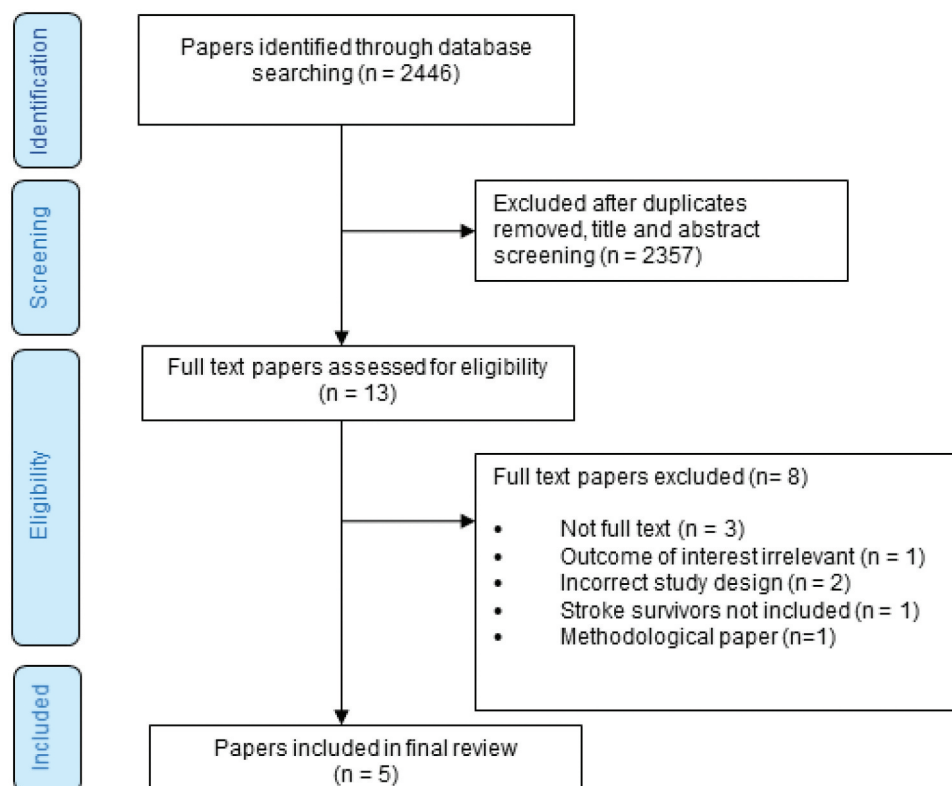


Figure 1. Preferred reporting for systematic reviews and meta-analyses (PRISMA) diagram; flow of studies through the review.

Table 1. Characteristics of included studies.

| Study | Topic area | Country | Year of data collection | Mode of delivery | Sample size and type of respondents |
|-------------|---|----------------------------|-------------------------|-----------------------------------|---|
| Doshi 2023 | Self-management | Singapore | 2020–2021 | Online | 146 stroke/TIA survivors |
| Geidl 2018 | Exercise preference | Germany | 2015 | In-person | 104 stroke survivors |
| Burton 2014 | Patient and carer preferences for community services post-stroke | Wales, United Kingdom | 2011–2012 | Paper (at home/remote) | 80 stroke survivors 34 family carers |
| Laver 2013 | Acceptability of high intensity therapy and virtual reality programs for rehabilitation | South Australia, Australia | 2009–2010 | In-person Paper (face to face) | 106 patients receiving rehabilitation (including 53 stroke survivors) 23 occupational therapists 91 other rehabilitation clinicians |
| Laver 2011 | Therapy intensity and use of technology in first few weeks of rehabilitation | South Australia, Australia | 2009–2010 | In-person | 50 stroke survivors |

Geidl²⁸ investigated preferences for exercise among stroke survivors, but did not include an option for participants to choose not to participate, despite this being a very common preference clinically. In contrast, the item related to “level of burden considered for data collection” was always addressed, primarily through the justification of the number of attributes and/or choice tasks within the DCE. For example, “To reduce cognitive burden, the total number of choice tasks were then divided into four blocks and respondents were randomly allocated to one of the blocks. Each respondent was asked to answer a total of eight choice tasks.”³¹ Refer to [Tables 2 and 3](#) for full quality assessment results.

DCE methods, design and analysis

All five studies identified attributes and levels through reviews of the literature,^{28–31} clinical guidelines²⁸ or relevant policy documents.²⁷ Four studies^{27,29–31} also conducted interviews or qualitative research with stroke survivors to assist the development of the attributes and levels.

The mean number of attributes used within the included DCEs was 5 (range 4–6), and all studies had between 2–4 levels for each attribute. All studies presented participants with 6–9 choice-sets and cited level of participant fatigue or cognitive burden as the main considerations for this. Refer to [Table 4](#) for further details. All studies used fractional factorial designs, with two using orthogonal main effects plans,^{27,28} two using Street and Burgess designs,^{29,30} and one using SAS to generate an optimal D-efficient design.³¹ No studies reported using informative priors within the

experimental design to improve efficiency. One study included an opt-out option in their design,³¹ the others all used forced choice sets.

Three studies used conditional (fixed effects) logistic regression,^{28–30} while the other two used a mixed (random effects) logit model.^{27,31} Where stated, all studies used effects coding.^{27,29–31} In reporting their results, all studies reported coefficients, and four of the five presented the relative importance of each attribute.^{27–29,31} Two studies^{27,30} presented marginal rates of substitution, using travel time²⁷ or cost³⁰ to calculate willingness to pay. Four of the five studies included a sub-group analysis: Burton et al.²⁷ compared patients and carers; Laver et al.³⁰ compared patients, occupational therapists and other clinicians; Laver et al.²⁹ compared younger and older respondents; and Doshi et al.³¹ investigated the likelihood of opting out by various sociodemographic characteristics such as age, gender and ethnicity.

Content analysis of attributes and levels

Thematic analysis revealed that attributes related to intervention delivery were most commonly included, with all studies investigating the attributes of mode of delivery (e.g. individual or group therapy, 5/5 studies). The intervention provider/location (4/5 studies)^{28–31} and duration of the intervention were also included in most studies (4/5 studies).^{28–31} Cost, i.e. *financial cost of therapy*, was included as an attribute in three studies.^{29–31} Attributes relating to the *amount of recovery* or *treatment effectiveness* were only included as attributes in two studies,^{29,30} as was an attribute exploring preferences for technology use^{29,30} and

Table 2. Validity assessment of included studies according to the criteria used to assess the validity of included studies²².

| Criteria | | Doshi 2023 | Geidl 2018 | Burton 2014 | Laver 2013 | Laver 2011 |
|----------------------------|---|--------------|-------------|--------------|--------------|--------------|
| Choice task design | Attributes and levels grounded in qualitative work with target population | Green | Orange | Green | Green | Green |
| | No conceptual overlap between attributes | Green | Green | Green | Green | Green |
| | Uni-dimensional attributes | Green | Green | Green | Green | Green |
| Experimental design | Opt-out/status quo option or justification of forced choice | Green | Red | Red | Red | Green |
| | Experimental design optimal or statistically efficient | Green | Green | Green | Orange | Green |
| | Piloting conducted among target population | Green | Red | Green | Red | Green |
| Conduct | Target population(s) appropriate for research objective | Green | Green | Green | Green | Green |
| | Sampling frame representative of target population | Orange | Green | Green | Green | Orange |
| | Response rate sufficient to minimise response bias | Orange | Green | Orange | Green | Orange |
| | Any pooled analysis from different subgroups appropriate | Green | Green | Green | Green | Green |
| | Econometric model appropriate for choice task design | Green | Grey | Green | Green | Green |
| | Econometric model accounts for serial correlation of choices | Green | Grey | Green | Green | Green |
| | Relative attributes effects compared using common metric | Green | Orange | Green | Green | Green |
| | | | | | | |
| | | | | | | |
| Total percentage score | | 11/13 85% | 7/13 54% | 10/13 77% | 11/13 85% | 11/13 85% |

Green= yes, orange= partially, red= no, grey=unsure.

attributes exploring frequency or intensity of the intervention.^{28,31} Attributes including the convenience of therapy (i.e. travel time to access the intervention),²⁷ information included in the intervention³¹ and the impact of rewards for completing an intervention³¹ were explored in single studies.

Content analysis of preferences

Ten key intervention features and stroke survivor preferences were identified from the thematic analyses. These were: *setting* (hospital context preferred), *frequency of therapy* (less frequent preferred), *intensity of therapy* (less intense preferred), *duration of therapy* (shorter duration preferred), *format* (individual participation over groups preferred), *amount of recovery* (as much recovery as possible preferred), *technology use* (aversion to newer technology), *cost* (lower cost preferred) and *education topics* (health education and risk management preferred).

The attributes that had the greatest influence on stroke survivor preferences were explored in four studies^{28–31} and included *amount of recovery/health outcome, intervention intensity, duration, and education topics*. Refer to Table 5 for full details.

Discussion

To our knowledge, this is the first systematic review to explore the use of DCEs in stroke rehabilitation. Only five DCE studies have been conducted in stroke rehabilitation in the past two decades, indicating very limited use of this method to understand stroke survivor rehabilitation preferences. None of the included studies focused specifically on preferences within one type of intervention (e.g. treadmill training or constraint induced movement therapy [CIMT]), but instead focused on general preferences for intervention delivery such as frequency of sessions, or personnel delivering therapy (e.g. qualified clinician or student).

Table 3. Validity assessment of included studies according to the conjoint analysis application in health checklist²¹.

| Criteria | | Doshi 2023 | Geidl 2018 | Burton 2014 | Laver 2013 | Laver 2011 |
|--------------------------------------|--|--------------|--------------|--------------|--------------|--------------|
| Research question and method | Were a well-defined research question and a testable hypothesis articulated? | Orange | Green | Orange | Green | Green |
| | Was the study perspective described, and was the study placed in a particular decision-making or policy context? | Green | Orange | Green | Green | Green |
| | Is the rationale for using conjoint analysis to answer the research question given? | Green | Green | Green | Green | Green |
| Attributes and Levels | Was attribute identification supported by evidence? | Green | Orange | Green | Green | Green |
| | Was attribute selection justified and consistent with theory? | Green | Orange | Green | Green | Green |
| | Was level selection for each attribute justified by the evidence and consistent with the study perspective and hypothesis? | Orange | Green | Green | Orange | Green |
| Construction of tasks | Was the number of attributes in each conjoint task justified (that is, full or partial profile)? | Grey | Red | Grey | Green | Green |
| | Was the number of profiles in each conjoint task justified? | Green | Green | Orange | Green | Green |
| | Was (should) an opt-out or a status-quo alternative (be) included? | Green | Red | Red | Red | Red |
| Choice of experimental design | Was the choice of experimental design justified? Were alternative experimental designs considered? | Orange | Green | Green | Green | Green |
| | Were the properties of the experimental design evaluated? | Red | Red | Green | Red | Orange |
| | Was the number of conjoint tasks included in the data-collection instrument appropriate? | Green | Orange | Green | Green | Green |
| Preference elicited | Was there sufficient motivation and explanation of conjoint tasks? | Green | Orange | Grey | Grey | Green |
| | Was an appropriate elicitation format (that is, rating, ranking, or choice) used? Did (should) the elicitation format allow for indifference? | Green | Orange | Green | Green | Green |
| | In addition to preference elicitation, did the conjoint tasks include other qualifying questions (for example, strength of preference, confidence in response, and other methods)? | Red | Red | Red | Red | Green |
| Data collection | Was appropriate respondent information collected (such as sociodemographic, attitudinal, health history or status, and treatment experience)? | Green | Green | Green | Green | Green |
| | Were the attributes and levels defined, and was any contextual information provided? | Green | Green | Green | Green | Orange |
| | Was the level of burden of the data-collection instrument appropriate? Were respondents encouraged and motivated? | Green | Green | Green | Green | Green |
| Data collection plan | Was the sampling strategy justified (for example, sample size, stratification, and recruitment)? | Orange | Green | Green | Red | Red |
| | Was the mode of administration justified and appropriate (for example, face-to-face, pen-and-paper, web-based)? | Orange | Green | Green | Green | Green |
| | Were ethical considerations addressed (for example, recruitment, information and/or consent, compensation)? | Green | Green | Green | Green | Green |
| Statistical analysis | Were respondent characteristics examined and tested? | Green | Red | Orange | Orange | Orange |
| | Was the quality of the responses examined (for example, rationality, validity, reliability)? | Orange | Red | Orange | Orange | Orange |
| | Was model estimation conducted appropriately? Were issues of clustering and subgroups handled appropriately? | Green | Grey | Green | Green | Orange |
| Results | Did study results reflect testable hypotheses and account for statistical uncertainty? | Orange | Green | Green | Green | Green |
| | Were study conclusions supported by the evidence and compared with existing findings in the literature? | Green | Green | Green | Green | Green |
| | Were study limitations and generalizability adequately discussed? | Green | Green | Orange | Green | Green |
| Presentation | Was study importance and research context adequately motivated? | Green | Green | Green | Green | Green |
| | Were the study data-collection instrument and methods described? | Orange | Red | Green | Green | Orange |
| | Were the study implications clearly stated and understandable to a wide audience? | Green | Green | Green | Green | Green |
| Total percentage score | | 19/30 63% | 16/30 53% | 21/30 70% | 22/30 73% | 22/30 73% |

Green= yes, orange= partially, red= no, grey=unsure.

Our review found that stroke survivor preferences are consistent with DCE studies conducted in other areas of healthcare, in which the attributes such as health outcomes¹⁹ and one-to-one therapy (over groups) for treatment of depression³² and for cardiac rehabilitation³³ are preferred. Programs offered by specialists rather than generalists have been preferred in DCEs

completed in the contexts of cancer,³⁴ telehealth,³⁵ emergency departments³⁶ and Parkinson's disease.³⁷ In contrast to our review in which consumers preferred hospital-based rehabilitation programs over home-based rehabilitation programs, DCEs completed in dialysis³⁸ and healthcare for older adults³⁹ found home-based treatments were preferred, but in some clinical

Table 4. Attributes and levels of included studies.

| Study | Number of choice sets | Number of attributes | Number of levels | Attribute (levels) | | | | | |
|-------------|-----------------------|----------------------|------------------|--|--|--|---|--|--|
| | | | | Mode of intervention | Effectiveness of intervention | Intervention provider/location | Dose of intervention | Cost of intervention | Other attributes |
| Doshi 2023 | 8 | 6 | 4 | 2,4,8 or 15 stroke survivor participants | - | - | Duration 3 hours or 2 hours per session Frequency 1, 4, 6 or 8 sessions Duration [^] 20–30 or 45–60 mins/ session Frequency 1–2, 3 or 4–5 sessions/week Intensity [^] Light, moderate or vigorous | \$50 SGD [^] \$100 SGD \$200 SGD \$300 SGD | Topics covered [^] Rewards for completion Schedule |
| Geidl 2018 | 8 | 6 | 2–4 | Alone, with a partner, in a group with healthy people or in a group with people with similar health issues | - | At home or local | - | - | Type of exercise |
| Burton 2014 | 9 | 4 | 2–3 | Group or individual support | - | Hospital stroke team, community health team or voluntary organisation | - | - | Time to plan & make journey Social & leisure activities |
| Laver 2013 | 6 | 5 | 3 | Group, individual therapy or computer therapy | Amount of recovery/ health outcome [^] 70%, 80% or 90% recovery | Community based Dr & physio, same specialist therapy team all phases or different specialist team each phase | Duration 30 mins/day 3 hrs/day 6 hrs/day | No cost \$50 AUD/week \$100 AUD/ week | - |
| Laver 2011 | 6 | 5 | 3 | Group, individual or computer therapy | Amount of recovery/ health outcome [^] 70%, 80% or 90% recovery | Community based team, same specialist therapy team all phases or different specialist team each phase | Duration 30 mins/day 3 hrs/day 6 hrs/day | No cost \$50 AUD/week \$100 AUD/ week | - |

[^]attributes that had the greatest influence on consumer preferences, - Attribute not included in DCE. Mins= minutes, hrs= hours, AUD= Australian dollars, SGD= Singapore dollars.

contexts such as cardiac rehabilitation, preferences for location of treatment were variable.³³

Unlike other areas of healthcare, DCEs in stroke rehabilitation have not focused on specific interventions; for example in cancer care, 26 DCEs have been conducted in colorectal cancer screening alone.⁴⁰ Although the included studies of our review provided important insights into the general preferences of stroke survivors (such as one-to-one therapy over group-based therapy), it is difficult to apply these to the design and delivery of specific interventions. Furthermore, trade-offs made by stroke survivors weighing up three important attributes “effectiveness”, “convenience” and “cost”, are difficult to appreciate, as there were no studies that measured these attributes concurrently. In the two studies with the broadest range of attributes,^{29,30} *amount of recovery* was the attribute that had the

greatest influence on preferences. In comparison, Geidl and colleagues²⁸ found the most important attribute to be *duration* and *intensity* of intervention, however the authors did not include an attribute on amount of recovery. Burton et al.²⁷ included an attribute about convenience (the time to plan and make a journey), but this study did not include attributes on effectiveness or dose of therapy. Our findings demonstrate that future DCEs should be carefully constructed to contain all key attributes (including amount of recovery, dose, convenience and cost) in order to be able to quantify true consumer trade-off related preferences.

Understanding preferences and the relative trade-offs are especially important for encouraging intervention uptake and designing health services that meet the needs of stroke survivors. Arguably at present, clinicians make assumptions about the

Table 5. Dominant stroke rehabilitation preferences reported by stroke survivors.

| Therapy/Intervention characteristic | Dominant Preferences | Supporting Papers |
|--|--|--|
| Setting | Hospital (rather than community) | Burton 2014 |
| Frequency | Less frequent therapy | Geidl 2018, Laver 2013, Laver 2011 |
| Intensity | Less intense therapy | Geidl 2018, Laver 2013, Laver 2011 |
| Duration | Shorter duration | Geidl 2018, Laver 2013, Laver 2011 |
| Format | Individual participation (rather than group) | Burton 2014, Laver 2013, Laver 2011. Partially by Geidl 2018 |
| Recovery/impact | As much recovery as possible | Laver 2013, Laver 2011 |
| Technology | Aversion to programs using newer technology (such as virtual reality programs) | Laver 2013, Laver 2011 |
| Content (Topics covered in a self-management intervention) | Health education and risk management | Doshi, 2023 |
| Cost | Lower out of pocket costs | Doshi 2023 |

willingness of stroke survivors to engage in particular rehabilitation interventions. They may also make assumptions about the stroke survivors' motivators for engaging in therapy (i.e. prioritizing optimal recovery above all else). Whilst our review found *amount of recovery* to be a consistently important attribute, it may not be the most important attribute at the expense of others. A systematic review of DCEs in healthcare, found discordance between healthcare provider and consumer preferences, with consumers placing more importance on issues of process (such as safety, route of administration and timing) than healthcare providers.⁴¹ This highlights the importance of understanding consumer preferences so that truly shared decision-making about healthcare interventions can occur. Increased awareness among clinicians of the relative importance of different characteristics of stroke rehabilitation may also improve communication and promote shared decision making. Returning to the importance of understanding nuanced preferences, the application of DCEs stands out as a key approach to uncovering the complex decision-making processes of stroke survivors. This method not only highlights the attributes consumers prioritize, but informs the design of rehabilitation programs that resonate more effectively with their personal goals and circumstances, thus fostering better engagement.

Most studies included in this review were conducted over five years ago, and there remains a large discrepancy between what people have indicated as their rehabilitation preferences and what evidence suggests about physical rehabilitation and recovery. Research indicates that high dose, massed practice, and activity-based tasks are more likely to achieve motor recovery post stroke.⁴² Our

systematic review indicates however, that while stroke survivors value amount of recovery, they also prefer less frequent, less intense and short duration therapy sessions.^{28–30} The Stroke Clinical Practice Guidelines (Australia) recommend and advocate for increased amounts of practice⁴² but clinicians may need to clearly emphasize the importance of dose and repetition to consumers in early post-stroke therapy, to aid recovery and assist with stroke survivors' expectations and engagement in rehabilitation.

This systematic review was conducted using a comprehensive search and employed evidence-based quality assessment tools. There were, however, several limitations. Firstly, there is selection bias as only papers published in English were included. Secondly, only two studies^{28,31} were published after the checklist for DCE validity was published²² thus the quality rating for the included studies may have been impacted by the absence of a method-specific checklist. Thirdly, the included studies had relatively small sample sizes which may impact on generalizability. Additionally, limited demographic details provided within the included studies (particularly time since stroke and stroke type) may also inhibit the generalizability of our review's findings. Consumer preferences for rehabilitation are likely to change over time, through various phases of post-stroke recovery. It is therefore important to understand if, when and how preferences for rehabilitation may change over this continuum. The findings regarding stroke survivors' preferences from this systematic review should be interpreted with some caution due to the age of the included studies. It is possible that stroke

survivors' preferences for stroke rehabilitation have changed given the considerable impact the COVID-19 pandemic has had on health care services and the increased availability and acceptability of services such as telehealth.⁴³ Furthermore, the studies included in this review investigated a broad spread of stroke rehabilitation interventions, therefore the generalizability of the results across settings and services is limited.

DCEs are a valuable way of measuring consumer preferences, including how they may impact uptake and participation in health services. Given the scarcity of studies conducted in stroke rehabilitation, and cardiovascular diseases more broadly,⁴⁴ there is an opportunity to raise awareness among clinicians and researchers alike about the potential use and benefits of DCEs in this clinical area,¹³ particularly in relation to implementation and consumer-engagement.⁴⁵ Our review suggests that research should focus on attributes of specific interventions and delivery modes (e.g. telehealth) so programs and healthcare services can be tailored to meet stroke survivors' preferences, and maximize uptake of evidence-based interventions. While feasibility studies outside of the stroke context have found dyadic DCE approaches to be acceptable for cohorts with cognitive impairments, additional research to ensure preference data that represents the full spectrum of stroke survivors will also be important. Our findings have relevance to clinical practice, as our team is working to design DCEs for specific post-stroke rehabilitation interventions. By understanding consumer preferences through the use of DCEs, we can begin to set stroke survivors' expectations early in the rehabilitation journey and align healthcare services with stroke survivors' preferences, values and goals.

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