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Community-Based Interventions After Acquired Brain Injury—A Systematic Review of Intervention Types and Their Effectiveness

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Objectives: Comprehensive review of existing types and effectiveness of community-based interventions delivered to adults (mean age 18-65 years) with long-lasting (≥6 months) difficulties following acquired brain injury (ABI). **Design:** Systematic review of controlled intervention studies published until February 2021. **Main Measures:** Systematic searches in databases (MEDLINE, PsycINFO, Database of Abstracts of Reviews of Effects [Cochrane Library], and Cochrane Central Register of Controlled Trials [Cochrane Library]) and inclusion of English peer-reviewed full-text articles; randomized or controlled community-based intervention studies; sample size of 20 or more participants; and 3 or more intervention sessions. Two reviewers independently extracted data for the synthesis and assessed the methodological quality. Data extraction included study characteristics, demographics of participants, content and dose of intervention, outcome measures, and findings. **Result:** The search returned 7386 publications, of which 49 eligible studies were included, revealing a diverse range of community-based interventions and a myriad of outcome measures applied for assessing functional capacities, participation, and quality of life in the chronic phase of ABI. Intervention types encompassed 14 holistic, 23 physical, and 12 specific interventions. A large heterogeneity regarding intervention frequency and intensity was found. Meta-analyses performed on the holistic, physical, and specific interventions did not indicate any significant pooled effects but showed highly variable effects between individuals, both in persons with traumatic and nontraumatic brain injuries. **Conclusions:** Because of lack of pooled effects within types of community-based interventions, specific evidence-based recommendations within holistic, physical, and specific interventions designed to mitigate long-lasting ABI problems cannot be made. This review highlights the need for future studies to address methodological issues concerning larger sample size, lack of clear description interventions and comparator, missing reports of effects in change scores, need for consistent use of recommended outcome measures, and investigating the wide variety in intervention responsiveness among participants with ABI. Systematic review registration: PROSPERO (CRD42019124949). **Key words:** *acquired brain injury*, *chronic phase*, *community-based rehabilitation*, *intervention*, *treatment outcome*

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Acquired brain injury (ABI) represents a huge global health problem and is a leading cause of disability, even in young adults.[1] Persons with ABI commonly experience a wide range of symptoms that relate to physical, communicative, cognitive, behavioral, psychosocial, as well as problems with community integration and participation.[2–11] Traumatic brain injury (TBI) and stroke are the most common ABI etiologies,[12] but the term includes all damage to the brain that is not related to congenital disorders or degenerative neurological disorders. The long-term consequences of ABI are often overlapping across etiologies. Moreover, studies have repeatedly reported unmet treatment needs for patients in the chronic phase,[13–15] including unmet family needs.[16] These studies underline gaps between service delivery and demands in the chronic phase when patients have returned to their living environment. Provision of relevant community-based interventions could mitigate the existing service gap in the chronic phase. Broad, holistic programs aiming to address the complexity of ABI symptoms and global functioning, as well as specific interventions targeting distinct functions or symptom domains, have been developed.[17,18] There is, however, a knowledge gap regarding which type of interventions are effective in mitigating long-term ABI consequences. While several systematic reviews have been conducted with the purpose of identifying effective interventions for adults with ABI,[19–21] the effectiveness of community-based interventions specifically targeting various long-lasting impairments has yet not been evaluated. The primary objective of the current review was to (1) assess types of community-based interventions delivered in the chronic phase of ABI ($\geq$6 months) and (2) investigate the effectiveness of the interventions in improving functional capacities, participation, and quality of life (QOL) in adults with ABI.

METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines formed the basis for this review.[22]

Search strategy

See Supplemental Digital Content 1 (available at: http://links.lww.com/JHTR/A519) for the search strategies. MEDLINE, PsycINFO, Database of Abstracts of Reviews of Effects (Cochrane Library), and Cochrane Register of Controlled Trials (Cochrane Library) were searched (September 31, 2019) and updated prior to submission (February 22, 2021).

Eligibility criteria

The inclusion criteria for studies were elaborated according to the PICO framework (Problem, Intervention, Comparison, Outcomes) and targeted to the community-based intervention after ABI. Community-based intervention was defined as the intervention efforts provided by human resources in a community- or home-based setting, but outside hospitals and nursing homes, for persons with ABI. Studies were eligible for inclusion if they met the following criteria: (1) peer-reviewed full-text articles in English; (2) randomized controlled or controlled studies with a sample size of 20 or more; (3) inclusion of adult participants of working age (sample mean age of 18-65 years) and diagnosed with an ABI except progressive neurological disorders; (4) interventions provided in home or in a community (health) facility by either specialized healthcare resources or primary care resources; (5) intervention performed at least 6 months after ABI and with 3 or more intervention sessions; and (6) including outcome assessment. Commentaries, conference abstracts, reviews, case reports, and qualitative studies were excluded. Studies were also excluded if invasive medical procedures and surgical or pharmaceutical interventions were applied. For the meta-analyses, only studies with sufficiently detailed data reporting (eg, mean scores and SD) on outcomes related to function, participation, or QOL were included.

Study selection

Following removal of duplicates, the first (S.L.H.) and second (I.M.H.B.) authors reviewed a sample of 50 abstracts to calibrate interpretation of the inclusion and exclusion criteria. Then they independently screened all titles and abstracts for initial article inclusion, and conflicts were resolved by consensus. Covidence software[23] was used for screening and to monitor agreement. To minimize the risk of missing relevant articles, studies were included in the full-text screen if the abstract information was insufficient. If data for evaluating study eligibility were missing, the corresponding author of the original article was contacted, and studies were excluded if verification of eligibility could not be performed. Next, both authors independently read the full text of each article to determine eligibility. The references of full-text articles were manually screened for additional eligible publications. Disagreements were resolved by consensus or by discussion with a third reviewer (M.L. or C.R.).

Data extraction

To ensure the reviewers extracted data congruently, the data extraction and predesigned data sheets were piloted with 5 publications to assess agreement before the 2 authors (S.L.H. and I.M.H.B.) extracted data independently. Extracted data included patient, study and intervention characteristics, outcome measures, and results.

Quality assessment of evidence

Methodological quality, including risk of bias, was assessed by authors S.L.H. and I.M.H.B. independently while applying the 16 criteria developed by Cicerone and colleagues,[24] where 8 criteria relate to internal validity, 5 are descriptive, and 3 statistical. A score of 1 was given if the criterion was met ("yes"). A score of 0 was given if criterion was not met ("no"), or in case of insufficient or lacking information ("unclear"),[24] rendering a total score from low (0) to high (16) quality. The 2 independent extractions were cross-checked, and disagreements in 7 cases resolved by discussion with a third reviewer (C.R.).

Analytic approach

The interventions provided in the included studies were categorized into 3 overall types based on their content and aims: (*a*) holistic interventions (ie, targeting general improvements of multiple aspects of chronic consequences of ABI such as ABI symptoms and daily functioning, participation, global outcome, and QOL); (*b*) physical interventions (ie, motor or fitness training programs); and (*c*) specific interventions (ie, aiming to improve a single functional domain or symptom following ABI other than physical or motor sequela, such as memory or depression). For the meta-analyses, outcome measures were grouped into the 3 categories: functional capacities, participation, and QOL (see Supplemental Digital Content 2, available at: http://links.lww.com/JHTR/A520, for an overview of outcome categories). When studies reported multiple outcomes, the prioritized order of outcome measures chosen for the pooled effect analysis was (1) outcomes defined as primary outcome by authors of the original study and (2) the most well-established outcome and the most relevant subscale. Continuous outcome data were summarized by sample size, mean outcome, and SD postintervention for both the control and intervention groups in each study. Hedge's g standardized mean outcome difference (SMD) corrected for small sample size bias was calculated with 95% CI.[25] Outcome differences from each study were further organized so that the highest score reflected optimal outcome.[25] Heterogeneity across studies was assessed through inspection of the I^2 statistics.[26] Both fixed- and random-effects models were explored. Although I^2 statistics may not demonstrate significant heterogeneity, the current review applied random-effects meta-analysis[25] to estimate the pooled effect size due to large clinical variations in the targeted population and intervention approaches across studies. Cochrane Software Review Manager (RevMan) was used for meta-analysis.[27]

RESULTS

Included studies

The overall search returned 7386 records, as presented in Figure 1. Of the total, 149 duplicated records were excluded, and 6913 records were excluded through title and abstract screens. Of 322 reviewed full-text articles, 48 met the inclusion criteria, and one additional study was included from the manual search in the identified articles, rendering 49 included studies, in which 37 were randomized controlled trials (RCTs). A wide variety of community-based intervention types were applied, and most programs were uniquely designed for the individual study. One exception was the scheduled telephone intervention by Bell et al,[28] which was later replicated by the same authors.[29] The study by Trexler and colleagues[30] was a replication study of a previously evaluated intervention,[31] but the original study did not meet inclusion criteria regarding time since injury. An overview of the community-based intervention characteristics and study results is shown in Supplemental Digital Content 4 (available at: http://links.lww.com/JHTR/A522, short description) and Supplemental Digital Content 5 (available at: http://links.lww.com/JHTR/A523, full characteristic description).

Quality assessment

Quality assessment scores ranged from 3 to 16, with a mean score of 11.4 for RCTs and 7.6 for controlled studies (see Table 1 for quality ratings of each study). Across all 49 included studies, the most common cause of reduced quality scores was lack of long-term follow up (>3 months after end of intervention). Furthermore, information regarding similar or no cointerventions across intervention arms was poorly described in many of the studies. In 43% of all studies, the groups were not comparable at baseline, with respect to either demographic characteristics or outcome measure scores (see Supplemental Digital Content 6, available at: http://links.lww.com/JHTR/A524, for comparison mean baseline scores). Thirty-seven percent of the studies lacked detailed description of the intervention and/or the control condition. For the RCTs, risk of bias was particularly related to lack of concealment of group allocation during randomization.

Subjects and settings

Of all eligible studies, 5778 participants were included. Nearly half of the studies had relatively small sample sizes, with 50 or fewer subjects (see Supplemental Digital Content 3, available at: http://links.lww.com/JHTR/A521, for study characteristics); however, one included

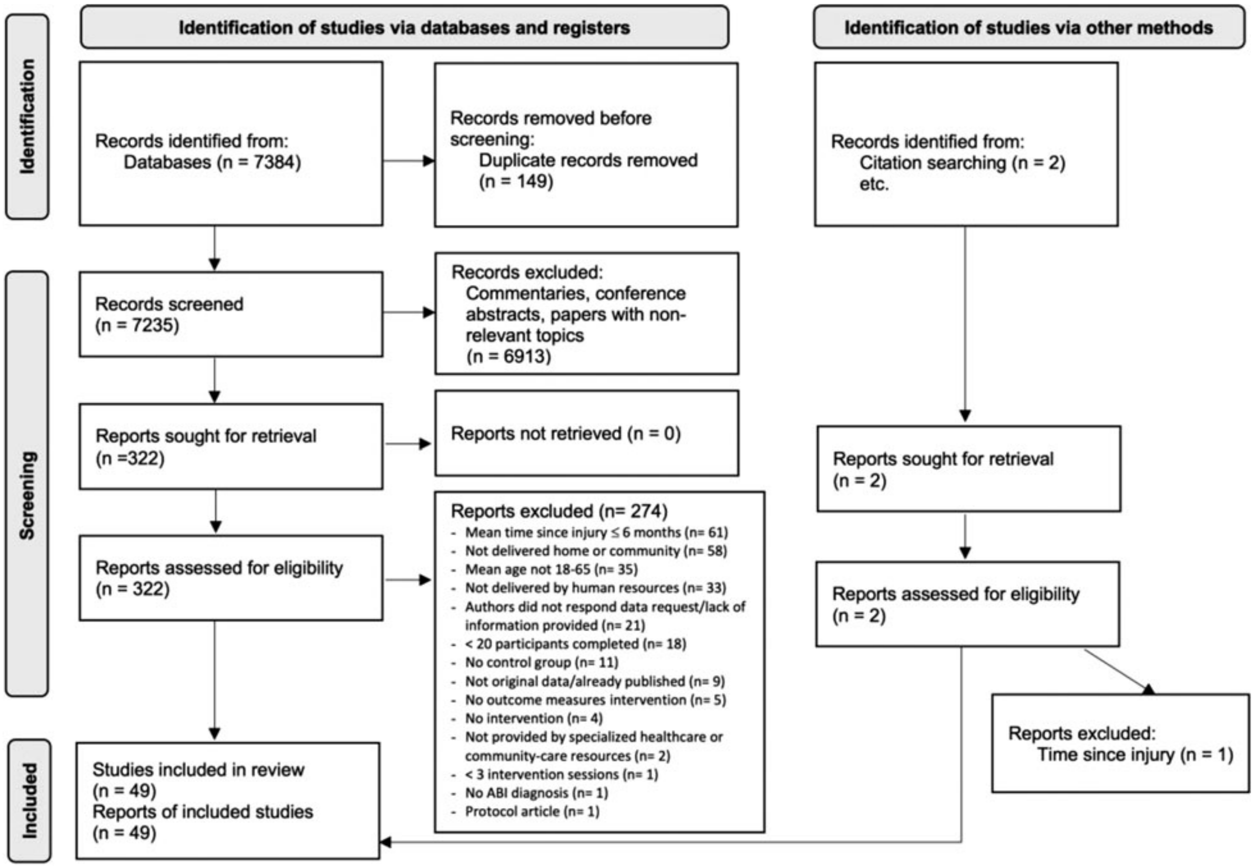

Figure 1. PRISMA 2020 flow diagram for systematic review, which included searches of databases and other sources. ABI indicates acquired brain injury.

1534 participants.[32] The percentage of men ranged from 29% to 91%, and mean time since injury ranged from 6 months to 12 years postinjury. Mean age of the intervention groups ranged from 33 to 72 years. Family members or caregivers participated in 41%. As expected, the setting of the community-based interventions varied; 59% of the studies comprised home visits, 39% delivered interventions in a community resource facility (eg, primary healthcare facility), and one study did not specify the community-based setting.[33]

Mode, frequency, and type of intervention programs and their content

Most studies delivered intervention through face-to-face mode, irrespective of intervention type, 24% delivered the intervention remotely via telephone or telerehabilitation, and 2 studies involved a combination of face-to-face and remote sessions.[32,34] The number of intervention sessions across all studies ranged from 4[35,36] to 96 sessions,[37] with a median of 12 sessions across the 45 studies that included information on dosage. Intervention durations ranged from 2 weeks[38] to 2 years.[32] Many of the interventions (54%) were delivered during a 2- to 4-month time frame, with a median duration of 3 months across the 46 studies providing information on duration.

Holistic interventions

Interventions from 14 studies (29%) were categorized as holistic, targeting multiple aspects of ABI consequences. Five of these focused on improving participation in daily life and community reintegration, applying interventions with multiple ingredients such as psychosocial support and mentoring, psychoeducation, access to community resources, physical strengthening, and task-specific training.[30,34,39–41] See Supplemental Digital Content 4 (available at: http://links.lww.com/JHTR/A522) for details. Six studies aimed to improve global functioning, using ingredients such as counseling, and restorative and compensatory training of skills and body functions,[28,29,32,42–44] 2 studies targeted psychosocial functioning through methods such as goal attainment, activity training, psychoeducation, and psychotherapy,[45,46] and 1 study aimed to improve communication skills and QOL by project work in groups and feedback from peers.[47]

TABLE 1 *Quality assessment*[a]

Study	Internal validity descriptions								Descriptive					Statistical			
	Eligibility criteria	Method of randomiza-tion	Treatment allocation concealed	Similar baseline characteris-tics	Intervention description	Cointerventions avoided or similar	Outcome measures blinded	Outcome measures relevant	Withdrawal and dropout	Short-term outcome measures	Long-term outcome measures	Timing outcome measures equiva-lent	Sample size described	-Intention-to-treat analysis	Point estimates and variability	Statistical compari-son treatment effects	Sum score
RCT design																	
Aydin et al (2016)[49]										X		X	X		X		4
Barzel et al (2015)[58]	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	16
Bèdard et al (2014)[74]	X	X	X	X				X		X		X	X		X	X	10
Bell et al (2005)[28]	X	X	X	X	X		X	X	X	X		X	X	X	X	X	14
Bell et al (2011)[29]	X	X	X	X	X		X	X	X	X		X	X	X	X	X	14
Bellon et al (2105)[59]	X				X					X		X	X		X	X	7
Brouwer et al (2018)[50]	X	X	X	X	X		X	X	X	X		X	X	X	X	X	14
Brown et al (2015)[35]	X			X	X		X	X	X	X		X	X	X	X	X	12
Carnevale et al (2006)[76]	X	X	X		X			X	X	X		X	X			X	10
Chan and Tsang (2018)[64]	X	X			X		X	X	X	X		X	X	X	X	X	12
Chen et al (2021)[56]	X	X		X	X			X	X	X		X	X		X	X	11
das Nair and Lincoln (2012)[69]	X	X	X		X		X	X	X	X	X	X	X	X	X	X	14

(continues)

TABLE 1 *Quality assessment*[a] (Continued)

	Internal validity descriptions								Descriptive					Statistical			
Study	Eligibility criteria	Method of randomization	Treatment allocation concealed	Similar baseline characteristics	Intervention description	Cointerventions avoided or similar	Outcome measures blinded	Outcome measures relevant	Withdrawal and dropout	Short-term outcome measures	Long-term outcome measures	Timing outcome measures equivalent	Sample size described	- Intention-to-treat analysis	Point estimates and variability	Statistical comparison treatment effects	Sum score
Fann et al (2015)[75]	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	15
Gordon et al (2013)[60]	X			X	X	X	X	X	X	X		X	X	X	X	X	13
Graef et al (2016)[52]	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	15
Hanks et al (2012)[34]								X			X	X	X				4
Hesse et al (2011)[37]	X	X	X	X				X	X	X		X	X	X	X	X	12
Hoffman et al (2010)[67]	X		X		X			X	X	X		X	X	X		X	10
Huijgen et al (2008)[36]	X			X		X		X	X	X		X	X	X	X	X	11
Jeong and Kim(2007)[66]		X			X			X		X			X		X	X	7
Lima et al (2014)[38]	X	X	X		X		X	X	X	X		X	X	X	X	X	13
Llorens et al (2015)[61]	X	X	X	X	X	X	X	X	X	X		X	X		X	X	14
Mayo et al (2015)[39]		X	X	X	X		X	X	X	X		X	X	X	X	X	13
Meltzer et al (2018)[70]	X			X				X	X	X		X	X		X	X	9
Ownsworth et al (2008)[46]		X	X		X			X		X		X		X	X		8
Ownsworth et al (2015)[45]		X						X	X	X		X	X	X	X	X	9

(*continues*)

TABLE 1 *Quality assessment*[a] (Continued)

	Internal validity descriptions								Descriptive					Statistical			
Study	Eligibility criteria	Method of randomiza-tion	Treatment allocation concealed	Similar baseline characteris-tics	Intervention description	Cointerventions avoided or similar	Outcome measures blinded	Outcome measures relevant	Withdrawal and dropout	Short-term outcome measures	Long-term outcome measures	Timing outcome measures equiva-lent	Sample size described	- Intention-to-treat analysis	Point estimates and variability	Statistical compari-son treatment effects	Sum score
Pang et al (2005)[53]	X	X	X	X	X		X	X	X	X		X	X	X	X	X	14
Piron et al (2009)[62]	X	X	X	X	X		X	X	X	X		X	X	X	X	X	14
Powell et al (2002)[40]	X	X	X	X			X	X	X	X			X	X	X	X	12
Raina et al (2016)[77]	X			X	X			X	X	X		X	X			X	9
Rotenberg-Shpigelman et al (2012)[41]		X		X		X		X	X	X		X	X		X	X	10
Stuart et al (2019)[57]	X			X	X	X	X	X		X		X	X	X	X	X	12
Trexler et al (2016)[30]	X	X	X		X		X	X	X	X		X	X	X	X	X	13
Wang et al (2015)[43]	X	X		X			X	X	X	X		X	X	X	X	X	12
Winter et al (2016)[44]	X	X	X	X	X	X		X	X	X		X	X	X	X	X	14
Xie et al (2011)[65]	X	X	X				X	X	X	X		X	X	X	X	X	12
Yoo and Yoo (2011)[55]	X			X			X	X		X		X	X		X		8

(*continues*)

TABLE 1 *Quality assessment*[a] (Continued)

	Internal validity descriptions								Descriptive					Statistical			
Study	Eligibility criteria	Method of randomization	Treatment allocation concealed	Similar baseline characteristics	Intervention description	Cointerventions avoided or similar	Outcome measures blinded	Outcome measures relevant	Withdrawal and dropout	Short-term outcome measures	Long-term outcome measures	Timing outcome measures equivalent	Sample size described	-Intention-to-treat analysis	Point estimates and variability	Statistical comparison treatment effects	Sum score
Non-RCT																	
Arkan et al (2019)[48]	X			X	X			X		X		X	X		X	X	9
Behn et al (2019)[47]	X			X	X		X	X		X		X	X		X	X	10
Bourgeois et al (2007)[68]	X				X	X		X		X		X	X		X	X	9
Clanchy et al (2016)[51]	X			X	X		X	X		X		X	X		X	X	10
Donnelly et al (2017)[63]				X				X		X		X	X		X	X	7
Efstratiadou et al (2019)[72]	X				X	X	X	X		X		X			X	X	9
Grill et al (2007)[32]	X				X			X		X			X			X	6
Hartman-Maeir et al (2007)[42]								X		X			X				3
Heinemann et al (2004)[33]	X							X		X		X	X		X	X	7
Patterson et al (2010)[54]	X									X		X	X			X	5
Rietdijk et al (2020)[73]	X			X		X	X	X		X			X		X	X	9
Woolf et al (2016)[71]	X					X		X		X		X	X		X		7

Abbreviation: RCT, randomized controlled trial.
[a]Assessment of study quality and risk of bias of the included studies according to criteria by Cicerone and colleagues.[24]

TABLE 2 *Intervention type by etiology[a]*

Holistic interventions		Physical interventions		Specific interventions	
5 (36%)	TBI	2 (9%)	TBI	7 (58%)	TBI
4 (28.5%)	Stroke	18 (78%)	Stroke	3 (25%)	Stroke
1 (7%)	Other non-TBI	0 (0%)	Other non-TBI	0 (0%)	Other non-TBI
4 (28.5%)	Mixed etiology	3 (13%)	Mixed etiology	2 (17%)	Mixed etiology

Abbreviation: TBI, traumatic brain injury.
[a]Number of studies according to the type of patient etiology within the holistic, physical, and specific interventions.

Physical interventions

Interventions from 23 studies (47%) were categorized as physical, and the majority delivered to persons who have a stroke (see Table 2 for an overview of intervention type by etiology). Of these, 10 applied specific physical ingredients such as exercises, mobility training, fitness, and strength.[37,48–57] Two RCTs applied constraint-induced therapy to improve body function,[38,58] while 2 RCTs applied a walking program.[59,60] Three RCTs delivered a program with physical exercises through either virtual reality technology or telerehabilitation to improve motor function or balance.[36,61,62] Three studies applied yoga or Tai Chi,[63–65] one study a motion-rhythmic program,[66] and 3 studies used a physical intervention to improve nonphysical impairments, such as emotional problems and QOL.[59,63,67]

Specific interventions

Interventions from the remaining 12 studies (24%) were categorized as a specific program aiming to improve isolated ABI symptoms other than physical. Five were designed to improve cognitive deficits. Herein, errorless learning techniques were applied for memory training, speech training tasks for language improvements, and education, feedback, and rehearsal for improving social communication skills.[68–73] Two interventions aimed to improve depressive symptoms after TBI,[74,75] both applying components from cognitive behavioral therapy. Four studies included training programs with ingredients characterized by behavioral training, shaping adaptive behaviors, and providing management support, thus targeting advocacy behavior, cognitive behavioral problems, management of fatigue, or management of substance abuse.[33,35,76,77]

Intervention effects on functional outcome, participation, and quality of life

Effects of holistic interventions

Meta-analysis was carried out on holistic interventions (see Figure 2A), and the results indicated no significant pooled effect regarding functional outcome (SMD = −0.01, $z = 0.02$, $P < .99$; 95% CI, −0.86 to 0.85), of which one study with TBI and one with mixed population were included. No significant pooled effect was found regarding participation (ses Figure 2B) (SMD = −0.03, $z = 0.13$, $P < .89$; 95% CI, −0.36 to 0.41), where the analysis included one TBI and 2 mixed studies. Likewise, no significant pooled effect was found on QOL (see Figure 2C) (SMD = −0.01, $z = 0.05$, $P < .96$; 95% CI, −0.51 to 0.54), where analysis included patients with TBI in one mixed study.

Effects of physical interventions

The meta-analysis performed on physical interventions indicated no significant pooled effect on functional outcome (SMD = −0.07, $z = 0.34$, $P < .73$; 95% CI, −0.35 to 0.50) (see Figure 2D). This analysis included 2 TBI studies and 2 studies with mixed etiology. No significant pooled effect was found on QOL (see Figure 2E) (SMD = −0.56, $z = 0.52$, $P < .60$; 95% CI, −1.54 to 2.66). Analysis included 4 studies with non-TBI samples and one study with mixed etiology.

Effects of specific interventions

For the specific interventions, data and relevant outcome measures were only available for meta-analysis of the effects regarding functional outcome, and no significant pooled effect was found (see Figure 2F) (SMD = −0.00, $z = 0.02$, $P < 0.99$; 95% CI, −0.27 to 0.28), including 4 studies with TBI and one mixed study.

Heterogeneity assessment

The results of the I^2 statistics for all meta-analyses in Figure 2 did not suggest any statistically significant heterogeneity. Considering significant clinical variations across studies, potential insufficient power for I^2 statistics, and that both fixed- and random-effects estimations are almost identical, only results from the random-effects estimations are reported.

DISCUSSION

This systematic review sought to identify types of existing community-based interventions and to evaluate their effectiveness in improving functional outcome,

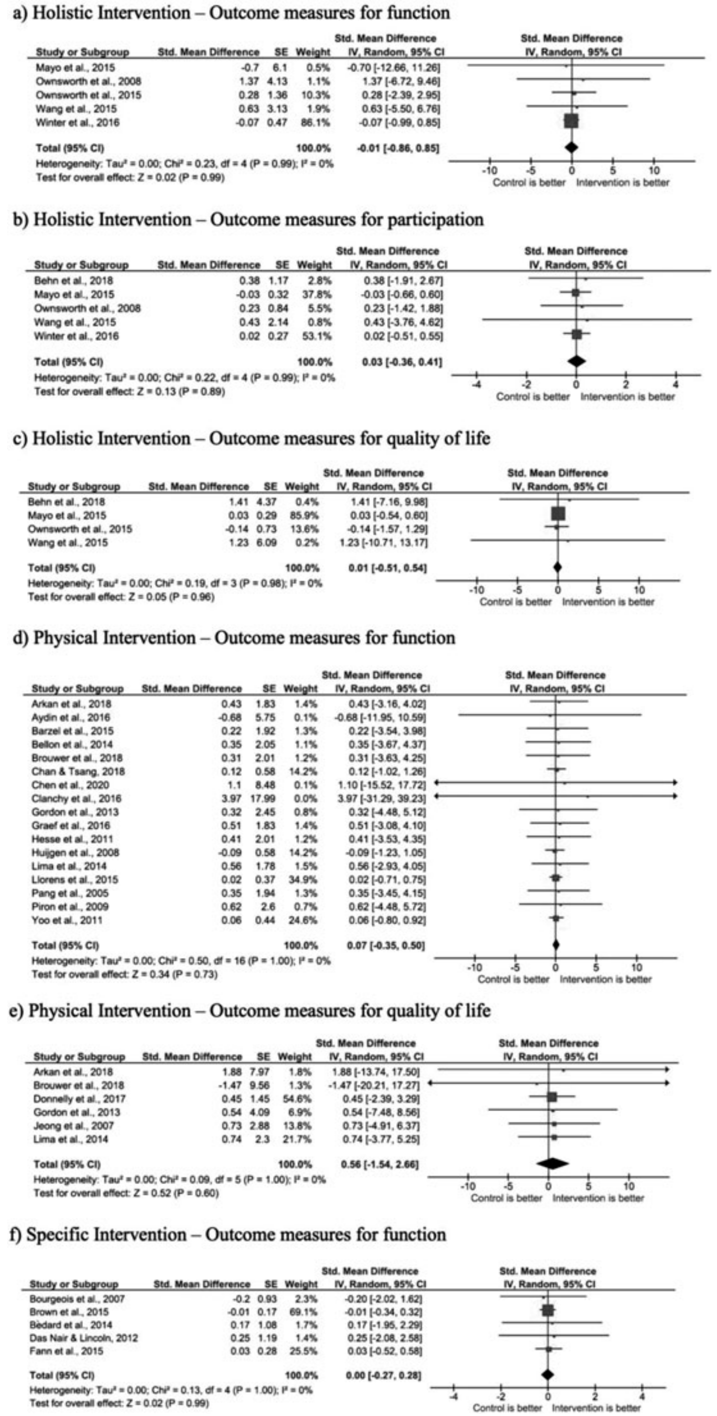

Figure 2. Meta-analyses investigating effects of (A) holistic interventions on outcome measures for function, (B) holistic interventions on outcome measures for participation, (C) holistic interventions on outcome measures for quality of life, (D) physical interventions on outcome measures for function, (E) physical interventions on outcome measures for quality of life, (F) specific interventions on outcome measures for function. Std Mean Difference indicates standard mean difference; SE, standard error; IV, Random, 95% CI, inverse variance, random effect, 95% confidence interval.

participation, and QOL in adults with ABI. Forty-nine eligible studies were included, and rigorous procedures for study selection, review, and assessment of methodological quality were applied. The results demonstrated the diversity of both intervention content and outcome measures utilized across studies. Regarding intervention type, 14 holistic, 23 physical, and 12 specific interventions were identified. It is striking that most interventions are physical and mainly delivered to persons who have a stroke and with a short-time follow-up, considering the diversity of long-term ABI problems.

Effectiveness of community-based interventions

This review is the first to inspect the overall effectiveness of community-based interventions targeting long-lasting difficulties related to function, participation, and QOL across etiologies of ABI. Meta-analyses performed on the holistic, physical, and specific interventions found no significant pooled effects, nor significant effect estimates from any of the individual studies, including studies involving patients with TBI. As illustrated in the forest plots, most studies showed results in favor of the intervention. However, inspection of the CIs discloses large variability of effects both within and between studies. This indicates that it is highly variable whether or not participating individuals benefit from the interventions. Hence, there is a need for further studies to investigate potential subgroups, as well as establish predictors and moderators of treatment effects, to better tailor the intervention to the patients and their problem profiles.

The lack of significant pooled effects in the meta-analyses does not necessarily mean the absence of clinical effects, as several factors may contribute to nonsignificant findings. First, for many of the studies, the intervention and control groups differed on outcome measures at baseline (see Supplemental Digital Content 6, available at: http://links.lww.com/JHTR/A524, for mean baseline and end of intervention), complicating comparison of effects. Possibly, change scores are more advantageous to apply for pooled effect estimates, thus integrating the relative change from baseline to end of intervention for the 2 arms compared. This was not feasible in the current review due to lack of necessary data to compute mean change scores.

Second, many studies employed a "standard care" comparator group but lacked detailed descriptions of what this treatment involved. Consequently, this leaves little transparency on what treatment the control group received and whether standard care included ingredients overlapping with the intervention being tested. A previous meta-analysis has shown that standard treatment may include components that overlap with intervention content and illustrated that failing to adjust for this lead to underestimation of intervention effects.[78] The synthesis of data in the current review demonstrated that several of the intervention studies included an experimental control condition with highly overlapping ingredients compared with the intervention condition.[38,55,56,58,61,62,68] For example, in a study investigating the effect of home-based constraint-induced movement therapy for improving upper-limb impairments, the addition of trunk restraint was the only difference between the intervention group and the comparator.[38] In addition, many studies lacked information on whether participants received concurrent treatment (see Table 1). Hence, interventions can only improve clinical outcomes when they target important ingredients that are not addressed during standard care or in an active control treatment.

Third, underpowered studies are a major concern, where small but clinically meaningful true differences between groups can remain undetected. The current review only included studies with at least 20 participants, but the data synthesis showed that nearly half of the studies included fewer than 50 subjects. Thus, small sample sizes may also explain the lack of significant pooled effects.[79] Furthermore, this review uncovered a large heterogeneity in outcome measures across studies. The abundance of outcome measures available for the ABI population may be one reason for the challenges with comparing effects, and current initiatives on defining common data elements for ABI, such as the collaborative work conducted in the field of TBI,[80] may be one solution to increase future comparability.

Finally, the level of professional skills of the intervention facilitators may also affect the study results. Professional background of therapists delivering the interventions was unknown in 31% of the studies and in 12% a non–health professional delivered the intervention. People with ABI struggle with a broad spectrum of long-term consequences and may thus present with multiple barriers for improvement in function, participation, and QOL. Professional skills and experience level of the interventionist are therefore imperative for managing the multiple consequences of ABI.

In summary, some reviews have found home-based intervention programs to be at least equivalent to interventions taking place in a hospital setting in the early phase after stroke[81] and effective in improving physical function among persons who have a stroke.[82,83] However, the current review illustrate that because of the lack of estimated pooled effects, a high heterogeneity in both intervention types, study design, and outcome measures, no specific evidence-based recommendations can be made about types of community-based intervention programs in the later phases of ABI.

LIMITATIONS

Our review has certain limitations. The search only included English publications. Only controlled studies were included in the review. However, there are examples of well-designed studies that do not meet the controlled criteria.[84,85] Inclusion of these studies could possibly have altered the review results. The generalizability is limited to the patient populations included in the studies covered by this review. A further limitation is the diversity of interventions of the included studies, with meta-analyses performed across various interventions and across multiple outcome measures. Meta-analysis requires selection of outcome measures, but the selection may contaminate the display of effects at the individual study level. A limited amount of data contributed to all meta-analyses, except function measures of physical interventions. Furthermore, the research field of ABI is challenged by unexplored subgroups and a lack of gold standard outcome measures, which, in turn, hampers the conduction of valid meta-analysis.

CONCLUSION

This review highlights essential implications for future studies investigating the effectiveness of community-based interventions targeting long-lasting impairments after ABI. First, relative change scores from baseline to end of treatment should be included for both the intervention and the control groups to enable meta-analysis to select the best-fitted effect measure for computing estimates of effects, especially in nonrandomized studies. Second, there is a need to improve descriptions of the control interventions. Although the CONSORT guidelines[86] emphasize the need for precise details for both experimental treatment and comparator, the quality assessment disclosed that this is not always adequately reported. Third, future community-based intervention studies should include sufficient sample sizes based on sample size calculations to address intervention effectiveness. Finally, future intervention studies need to target the various aspects of living with long-lasting ABI-related difficulties and further try to disentangle the effective ingredients in intervention programs addressing ABI symptoms. Lately, taxonomy frameworks aiming at describing concepts for active ingredients in interventions have been developed,[87,88] thus mitigating the "black box" of what accounts for patient change in interventions. Initiatives such as the Rehabilitation Treatment Specification System may thus enable comparison of effective ingredients across studies. Future studies should describe intervention content in line with this taxonomy.

To optimize individual treatment effects within each intervention study, one must also apply well-adapted inclusion criteria that ensure inclusion of subjects who have the targeted symptom or problem area for the study objective(s). Evidence-based knowledge of effective intervention types is required to better inform community-based health services in the chronic phase of ABI.

REFERENCES

1. Tibaek M, Forchhammer HB, Dehlendorff C, Johnsen SP, Kammersgaard LP. Incidence and mortality of acquired brain injury in young Danish adults between 1994 and 2013: a nationwide study. *Brain Inj*. 2017;31(11):1455–1462. doi:10.1080/02699052.2017.1376757
2. Sigurdardottir S, Andelic N, Wehling E, et al. Neuropsychological functioning in a national cohort of severe traumatic brain injury: demographic and acute injury-related predictors. *J Head Trauma Rehabil*. 2015;30(2):E1–E12. doi:10.1097/HTR.0000000000000039
3. Dikmen SS, Corrigan JD, Levin HS, Machamer J, Stiers W, Weisskopf MG. Cognitive outcome following traumatic brain injury. *J Head Trauma Rehabil*. 2009;24(6):430–438. doi:10.1097/HTR.0b013e3181c133e9
4. Cumming TB, Packer M, Kramer SF, English C. The prevalence of fatigue after stroke: a systematic review and meta-analysis. *Int J Stroke*. 2016;11(9):968–977. doi:10.1177/1747493016669861
5. Norup A, Svendsen SW, Doser K, et al. Prevalence and severity of fatigue in adolescents and young adults with acquired brain injury: a nationwide study. *Neuropsychol Rehabil*. 2019;29(7):1113–1128. doi:10.1080/09602011.2017.1371045
6. Andelic N, Hammergren N, Bautz-Holter E, Sveen U, Brunborg C, Roe C. Functional outcome and health-related quality of life 10 years after moderate-to-severe traumatic brain injury. *Acta Neurol Scand*. 2009;120(1):16–23. doi:10.1111/j.1600-0404.2008.01116.x
7. Andelic N, Sigurdardottir S, Schanke AK, Sandvik L, Sveen U, Roe C. Disability, physical health and mental health 1 year after traumatic brain injury. *Disabil Rehabil*. 2010;32(13):1122–1131. doi:10.3109/09638280903410722
8. Soberg HL, Roe C, Anke A, et al. Health-related quality of life 12 months after severe traumatic brain injury: a prospective nationwide cohort study. *J Rehabil Med*. 2013;45(8):785–791. doi:10.2340/16501977-1158
9. Dahm J, Ponsford J. Predictors of global functioning and employment 10 years following traumatic brain injury compared with orthopaedic injury. *Brain Inj*. 2015;29(13/14):1539–1546. doi:10.3109/02699052.2015.1075141
10. Livingston DH, Tripp T, Biggs C, Lavery RF. A fate worse than death? Long-term outcome of trauma patients admitted to the surgical intensive care unit. *J Trauma*. 2009;67(2):341–348; discussion 48–49. doi:10.1097/TA.0b013e3181a5cc34
11. Walsh ME, Galvin R, Loughnane C, Macey C, Horgan NF. Community re-integration and long-term need in the first five years after stroke: results from a national survey. *Disabil Rehabil*. 2015; 37(20):1834–1838. doi:10.3109/09638288.2014.981302
12. Spreij LA, Visser-Meily JM, van Heugten CM, Nijboer TC. Novel insights into the rehabilitation of memory post acquired brain injury: a systematic review. *Front Hum Neurosci*. 2014;8:993. doi:10.3389/fnhum.2014.00993
13. Andelic N, Soberg HL, Berntsen S, Sigurdardottir S, Roe C. Self-perceived health care needs and delivery of health care services 5 years after moderate-to-severe traumatic brain injury. *PM R*. 2014; 6(11):1013–1021; quiz 21. doi:10.1016/j.pmrj.2014.05.005
14. Eriksson G, Tham K, Borg J. Occupational gaps in everyday life 1-4 years after acquired brain injury. *J Rehabil Med*. 2006;38(3):159–165. doi:10.1080/16501970500415322
15. McKevitt C, Fudge N, Redfern J, et al. Self-reported long-term needs after stroke. *Stroke*. 2011;42(5):1398–1403. doi:10.1161/STROKEAHA.110.598839

16. Dillahunt-Aspillaga C, Jorgensen-Smith T, Ehlke S, Sosinski M, Monroe D, Thor J. Traumatic brain injury: unmet support needs of caregivers and families in Florida. *PLoS One*. 2013;8(12):e82896. doi:10.1371/journal.pone.0082896
17. Cicerone KD, Goldin Y, Ganci K, et al. Evidence-based cognitive rehabilitation: systematic review of the literature from 2009 through 2014. *Arch Phys Med Rehabil*. 2019;100(8):1515–1533. doi:10.1016/j.apmr.2019.02.011
18. Becker F, Kirmess M, Tornas S, Lovstad M. A description of cognitive rehabilitation at Sunnaas Rehabilitation Hospital—balancing comprehensive holistic rehabilitation and retraining of specific functional domains. *NeuroRehabilitation*. 2014;34(1):87–100. doi:10.3233/NRE-131015
19. Kumar KS, Samuelkamaleshkumar S, Viswanathan A, Macaden AS. Cognitive rehabilitation for adults with traumatic brain injury to improve occupational outcomes. *Cochrane Database Syst Rev*. 2017;6(6):CD007935. doi:10.1002/14651858.CD007935.pub2
20. McCabe P, Lippert C, Weiser M, et al. Community reintegration following acquired brain injury. *Brain Inj*. 2007;21(2):231–257. doi:10.1080/02699050701201631
21. Turner-Stokes L, Pick A, Nair A, Disler PB, Wade DT. Multi-disciplinary rehabilitation for acquired brain injury in adults of working age. *Cochrane Database Syst Rev*. 2015;(12):CD004170. doi:10.1002/14651858.CD004170.pub3
22. Page MJ, Moher D, Bossuyt PM, et al. PRISMA 2020 explanation and elaboration: updated guidance and exemplars for reporting systematic reviews. *BMJ*. 2021;372:n160. doi:10.1136/bmj.n160
23. *Covidence Systematic Review Software*. Veritas Health Innovation. Accessed February 11, 2019. www.covidence.org
24. Cicerone KD, Azulay J, Trott C. Methodological quality of research on cognitive rehabilitation after traumatic brain injury. *Arch Phys Med Rehabil*. 2009;90(11)(suppl):S52–S59. doi:10.1016/j.apmr.2009.05.019
25. Higgins JPT, Li T, Deeks JJ. Choosing effect measures and computing estimates of effect. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA, eds. *Cochrane Handbook for Systematic Reviews of Interventions*. Version 6.2. Cochrane; 2021:chap 6. Accessed April 23, 2021. www.training.cochrane.org/handbook
26. Deeks JJ, Higgins JPT, Altman DG. Analysing data and undertaking meta-analyses. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA, eds. *Cochrane Handbook for Systematic Reviews of Interventions*. Version 6.2. Cochrane; 2021:chap 10. Accessed April 23, 2021. www.training.cochrane.org/handbook
27. *Cochrane Software Review Manager (RevMan)*. Version 5.4. The Cochrane Collaboration; 2020.
28. Bell KR, Temkin NR, Esselman PC, et al. The effect of a scheduled telephone intervention on outcome after moderate to severe traumatic brain injury: a randomized trial. *Arch Phys Med Rehabil*. 2005;86(5):851–856. doi:10.1016/j.apmr.2004.09.015
29. Bell KR, Brockway JA, Hart T, et al. Scheduled telephone intervention for traumatic brain injury: a multicenter randomized controlled trial. *Arch Phys Med Rehabil*. 2011;92(10):1552–1560. doi:10.1016/j.apmr.2011.05.018
30. Trexler LE, Parrott DR, Malec JF. Replication of a prospective randomized controlled trial of resource facilitation to improve return to work and school after brain injury. *Arch Phys Med Rehabil*. 2016;97(2):204–210. doi:10.1016/j.apmr.2015.09.016
31. Trexler LE, Trexler LC, Malec JF, Klyce D, Parrott D. Prospective randomized controlled trial of resource facilitation on community participation and vocational outcome following brain injury. *J Head Trauma Rehabil*. 2010;25(6):440–446. doi:10.1097/HTR.0b013e3181d41139
32. Grill E, Ewert T, Lipp B, Mansmann U, Stucki G. Effectiveness of a community-based 3-year advisory program after acquired brain injury. *Eur J Neurol*. 2007;14(11):1256–1265. doi:10.1111/j.1468-1331.2007.01963.x
33. Heinemann AW, Corrigan JD, Moore D. Case management for traumatic brain injury survivors with alcohol problems. *Rehabil Psychol*. 2004;49(2):156–166. doi:10.1037/0090-5550.49.2.156
34. Hanks RA, Rapport LJ, Wertheimer J, Koviak C. Randomized controlled trial of peer mentoring for individuals with traumatic brain injury and their significant others. *Arch Phys Med Rehabil*. 2012;93(8):1297–1304. doi:10.1016/j.apmr.2012.04.027
35. Brown AW, Moessner AM, Bergquist TF, Kendall KS, Diehl NN, Mandrekar J. A randomized practical behavioural trial of curriculum-based advocacy training for individuals with traumatic brain injury and their families. *Brain Inj*. 2015;29(13/14):1530–1538. doi:10.3109/02699052.2015.1075173
36. Huijgen BC, Vollenbroek-Hutten MM, Zampolini M, et al. Feasibility of a home-based telerehabilitation system compared to usual care: arm/hand function in patients with stroke, traumatic brain injury and multiple sclerosis. *J Telemed Telecare*. 2008;14(5):249–256 doi:10.1258/jtt.2008.080104
37. Hesse S, Welz A, Werner C, Quentin B, Wissel J. Comparison of an intermittent high-intensity vs continuous low-intensity physiotherapy service over 12 months in community-dwelling people with stroke: a randomized trial. *Clin Rehabil*. 2011;25(2):146–156. doi:10.1177/0269215510382148
38. Lima R, Michaelsen S, Nascimento L, Polese J, Pereira N, Teixeira-Salmela L. Addition of trunk restraint to home-based modified constraint-induced movement therapy does not bring additional benefits in chronic stroke individuals with mild and moderate upper limb impairments: a pilot randomized controlled trial. *NeuroRehabilitation*. 2014;35(3):391–404.
39. Mayo NE, Anderson S, Barclay R, et al. Getting on with the rest of your life following stroke: a randomized trial of a complex intervention aimed at enhancing life participation post stroke. *Clin Rehabil*. 2015;29(12):1198–1211. doi:10.1177/0269215514565396
40. Powell J, Heslin J, Greenwood R. Community based rehabilitation after severe traumatic brain injury: a randomised controlled trial. *J Neurol Neurosurg Psychiatry*. 2002;72(2):193–202. doi:10.1136/jnnp.72.2.193
41. Rotenberg-Shpigelman S, Erez AB, Nahaloni I, Maeir A. Neurofunctional treatment targeting participation among chronic stroke survivors: a pilot randomised controlled study. *Neuropsychol Rehabil*. 2012;22(4):532–549. doi:10.1080/09602011.2012.665610
42. Hartman-Maeir A, Eliad Y, Kizoni R, Nahaloni I, Kelberman H, Katz N. Evaluation of a long-term community based rehabilitation program for adult stroke survivors. *NeuroRehabilitation*. 2007;22(4):295–301.
43. Wang TC, Tsai AC, Wang JY, et al. Caregiver-mediated intervention can improve physical functional recovery of patients with chronic stroke: a randomized controlled trial. *Neurorehabil Neural Repair*. 2015;29(1):3–12. doi:10.1177/1545968314532030
44. Winter L, Moriarty HJ, Robinson K, et al. Efficacy and acceptability of a home-based, family-inclusive intervention for veterans with TBI: a randomized controlled trial. *Brain Inj*. 2016;30(4):373–387. doi:10.3109/02699052.2016.1144080
45. Ownsworth T, Chambers S, Damborg E, Casey L, Walker DG, Shum DHK. Evaluation of the making sense of brain tumor program: a randomized controlled trial of a home-based psychosocial intervention. *Psychooncology*. 2015;24(5):540–547. doi:10.1002/pon.3687
46. Ownsworth T, Fleming J, Shum D, Kuipers P, Strong J. Comparison of individual, group and combined intervention formats in a randomized controlled trial for facilitating goal attainment and improving psychosocial function following acquired brain injury. *J Rehabil Med*. 2008;40(2):81–88. doi:10.2340/16501977-0124

47. Behn N, Marshall J, Togher L, Cruice M. Feasibility and initial efficacy of project-based treatment for people with ABI. *Int J Lang Commun Disord*. 2019;28:28 doi:10.1111/1460-6984.12452
48. Arkan G, Beser A, Ozturk V, Bozkurt O, Gulbahar S. Effects on urinary outcome of patients and caregivers' burden of pelvic floor muscle exercises based on the health belief model done at home by poststroke patients. *Top Stroke Rehabil*. 2019;26(2):128–135. doi:10.1080/10749357.2018.1552741
49. Aydin T, Taspinar O, Kepekci M, et al. Functional independence measure scores of patients with hemiplegia followed up at home and in university hospitals. *J Phys Ther Sci*. 2016;28(2):553–537. doi:10.1589/jpts.28.553
50. Brouwer B, Bryant D, Garland SJ. Effectiveness of client-centered "tune-ups" on community reintegration, mobility, and quality of life after stroke: a randomized controlled trial. *Arch Phys Med Rehabil*. 2018;97(7):1325–1332. doi:10.1016/j.apmr.2017.12.034
51. Clanchy KM, Tweedy SM, Trost SG. Evaluation of a physical activity intervention for adults with brain impairment: a controlled clinical trial. *Neurorehabil Neural Repair*. 2016;30(9):854–865. doi:10.1177/1545968316632059
52. Graef P, Michaelsen SM, Dadalt ML, Rodrigues DA, Pereira F, Pagnussat AS. Effects of functional and analytical strength training on upper-extremity activity after stroke: a randomized controlled trial. *Braz J Phys Ther*. 2016;20(6):543–552. doi:10.1590/bjpt-rbf.2014.0187
53. Pang MY, Eng JJ, Dawson AS, McKay HA, Harris JE. A community-based fitness and mobility exercise program for older adults with chronic stroke: a randomized, controlled trial. *J Am Geriatr Soc*. 2005;53(10):1667–1674. doi:10.1111/j.1532-5415.2005.53521.x
54. Patterson SA, Ross-Edwards BM, Gill HL. Stroke maintenance exercise group: pilot study on daily functioning in long-term stroke survivors. *Aust J Prim Health*. 2010;16(1):93–97.
55. Yoo IG, Yoo WG. Effects of a multidisciplinary supervised exercise program on motor performance and quality of life in community-dwelling chronic stroke survivors in Korean. *Southeast Asian J Trop Med Public Health*. 2011;42(2):436–443.
56. Chen S, Lv C, Wu J, Zhou C, Shui X, Wang Y. Effectiveness of a home-based exercise program among patients with lower limb spasticity post-stroke: a randomized controlled trial. *Asian Nurs Res (Korean Soc Nurs Sci)*. 2021;15(1):1–7. doi:10.1016/j.anr.2020.08.007
57. Stuart M, Dromerick AW, Macko R, et al. Adaptive physical activity for stroke: an early-stage randomized controlled trial in the United States. *Neurorehabil Neural Repair*. 2019;33(8):668–680. doi:10.1177/1545968319862562
58. Barzel A, Ketels G, Stark A, et al. Home-based constraint-induced movement therapy for patients with upper limb dysfunction after stroke (HOMECIMT): a cluster-randomised, controlled trial. *Lancet Neurol*. 2015;14(9):893–902. doi:10.1016/S1474-4422(15)00147-7
59. Bellon K, Kolakowsky-Hayner S, Wright J, et al. A home-based walking study to ameliorate perceived stress and depressive symptoms in people with a traumatic brain injury. *Brain Inj*. 2015;29(3):313–319. doi:10.3109/02699052.2014.974670
60. Gordon CD, Wilks R, McCaw-Binns A. Effect of aerobic exercise (walking) training on functional status and health-related quality of life in chronic stroke survivors: a randomized controlled trial. *Stroke*. 2013;44(4):1179–1181. doi:10.1161/STROKEAHA.111.000642
61. Llorens R, Noe E, Colomer C, Alcaniz M. Effectiveness, usability, and cost-benefit of a virtual reality-based telerehabilitation program for balance recovery after stroke: a randomized controlled trial. *Arch Phys Med Rehabil*. 2015;96(3):418–425.e2. doi:10.1016/j.apmr.2014.10.019
62. Piron L, Turolla A, Agostini M, et al. Exercises for paretic upper limb after stroke: a combined virtual-reality and telemedicine approach. *J Rehabil Med*. 2009;41(12):1016–1102. doi:10.2340/16501977-0459
63. Donnelly KZ, Linnea K, Grant DA, Lichtenstein J. The feasibility and impact of a yoga pilot programme on the quality-of-life of adults with acquired brain injury. *Brain Inj*. 2017;31(2):208–214. doi:10.1080/02699052.2016.1225988
64. Chan WN, Tsang WW. The effect of Tai Chi training on the dual-tasking performance of stroke survivors: a randomized controlled trial. *Clin Rehabil*. 2018;32(8):1076–1085. doi:10.1177/0269215518777872
65. Xie G, Rao T, Lin L, et al. Effects of Tai Chi Yunshou exercise on community-based stroke patients: a cluster randomized controlled trial. *Eur Rev Aging Phys Act*. 2018;15:17. doi:10.1186/s11556-018-0206-x
66. Jeong S, Kim MT. Effects of a theory-driven music and movement program for stroke survivors in a community setting. *Appl Nurs Res*. 2007;20(3):125–131. doi:10.1016/j.apnr.2007.04.005
67. Hoffman JM, Bell KR, Powell JM, et al. A randomized controlled trial of exercise to improve mood after traumatic brain injury. *PMR*. 2010;2(10):911–119. doi:10.1016/j.pmrj.2010.06.008
68. Bourgeois MS, Lenius K, Turkstra L, Camp C. The effects of cognitive teletherapy on reported everyday memory behaviours of persons with chronic traumatic brain injury. *Brain Inj*. 2007;21(12):1245–1257. doi:10.1080/02699050701727452
69. das Nair R, Lincoln NB. Evaluation of rehabilitation of memory in neurological disabilities (ReMiND): a randomized controlled trial. *Clin Rehabil*. 2012;26(10):894–903. doi:10.1177/0269215511435424
70. Meltzer JA, Baird AJ, Steele RD, Harvey SJ. Computer-based treatment of poststroke language disorders: a non-inferiority study of telerehabilitation compared to in-person service delivery. *Aphasiology*. 2018;32(3):290–311. doi:10.1080/02687038.2017.1355440
71. Woolf C, Caute A, Haigh Z, et al. A comparison of remote therapy, face to face therapy and an attention control intervention for people with aphasia: a quasi-randomised controlled feasibility study. *Clin Rehabil*. 2016;30(4):359–373. doi:10.1177/0269215515582074
72. Efstratiadou EA, Holland R, Varlokosta S, Hilari K. Efficacy of elaborated semantic features analysis in aphasia: a quasi-randomised controlled trial. *Aphasiology*. 2019;33(12):1482–1503. doi:10.1080/02687038.2019.1571558
73. Rietdijk R, Power E, Attard M, Heard R, Togher L. Improved conversation outcomes after social communication skills training for people with traumatic brain injury and their communication partners: a clinical trial investigating in-person and telehealth delivery. *J Speech Lang Hear Res*. 2020;63(2):615–632. doi:10.1044/2019_JSLHR-19-00076
74. Bèdard M, Felteau M, Marshall S, et al. Mindfulness-based cognitive therapy reduces symptoms of depression in people with a traumatic brain injury: results from a randomized controlled trial. *J Head Trauma Rehabil*. 2014;29(4):E13–E22. doi:10.1097/HTR.0b013e3182a615a0
75. Fann JR, Bombardier CH, Vannoy S, et al. Telephone and in-person cognitive behavioral therapy for major depression after traumatic brain injury: a randomized controlled trial. *J Neurotrauma*. 2015;32(1):45–57. doi:10.1089/neu.2014.3423
76. Carnevale GJ, Anselmi V, Johnston MV, Busichio K, Walsh V. A natural setting behavior management program for persons with acquired brain injury: a randomized controlled trial. *Arch Phys Med Rehabil*. 2006;87(10):1289–1297. doi:10.1016/j.apmr.2006.06.010
77. Raina KD, Morse JQ, Chisholm D, Leibold ML, Shen J, Whyte E. Feasibility of a cognitive behavioral intervention to manage

fatigue in individuals with traumatic brain injury: a pilot study. *J Head Trauma Rehabil*. 2016;31(5):E41–E49 doi:10.1097/HTR.0000000000000196

78. de Bruin M, Viechtbauer W, Schaalma HP, Kok G, Abraham C, Hospers HJ. Standard care impact on effects of highly active antiretroviral therapy adherence interventions: a meta-analysis of randomized controlled trials. *Arch Intern Med*. 2010;170(3):240–250. doi:10.1001/archinternmed.2009.536
79. Dickinson K, Bunn F, Wentz R, Edwards P, Roberts I. Size and quality of randomised controlled trials in head injury: review of published studies. *BMJ*. 2000;320(7245):1308–1311. doi:10.1136/bmj.320.7245.1308
80. Hicks R, Giacino J, Harrison-Felix C, Manley G, Valadka A, Wilde EA. Progress in developing common data elements for traumatic brain injury research: version two—the end of the beginning. *J Neurotrauma*. 2013;30(22):1852–1861. doi:10.1089/neu.2013.2938
81. Doig E, Fleming J, Kuipers P, Cornwell PL. Comparison of rehabilitation outcomes in day hospital and home settings for people with acquired brain injury—a systematic review. *Disabil Rehabil*. 2010;32(25):2061–2077. doi:10.3109/09638281003797356
82. Evans L, Brewis C. The efficacy of community-based rehabilitation programmes for adults with TBI. *Int J Ther Rehabil*. 2008;15(10):446–458. doi:10.12968/ijtr.2008.15.10.31213
83. Chi NF, Huang YC, Chiu HY, Chang HJ, Huang HC. Systematic review and meta-analysis of home-based rehabilitation on improving physical function among home-dwelling patients with a stroke. *Arch Phys Med Rehabil*. 2020;101(2):359–373. doi:10.1016/j.apmr.2019.10.181
84. Altman IM, Swick S, Parrot D, Malec JF. Effectiveness of community-based rehabilitation after traumatic brain injury for 489 program completers compared with those precipitously discharged. *Arch Phys Med Rehabil*. 2010;91(11):1697–1704. doi:10.1016/j.apmr.2010.08.001
85. Malec JF, Parrot D, Altman IM, Swick S. Outcome prediction in home- and community-based brain injury rehabilitation using the Mayo-Portland Adaptability Inventory. *Neuropsychol Rehabil*. 2015;25(5):663–676. doi:10.1080/09602011.2015.1013139
86. Boutron I, Altman DG, Moher D, Schulz KF, Ravaud P, Group CN. CONSORT statement for randomized trials of nonpharmacologic treatments: a 2017 update and a CONSORT Extension for nonpharmacologic trial abstracts. *Ann Intern Med*. 2017;167(1):40–47. doi:10.7326/M17-0046
87. Hart T, Ferraro M, Myers R, Ellis CA. Opening the black box: lessons learned from an interdisciplinary inquiry into the learning-based contents of brain injury rehabilitation. *Arch Phys Med Rehabil*. 2014;95(1)(suppl):S66–S73. doi:10.1016/j.apmr.2013.03.033
88. Van Stan JH, Whyte J, Duffy JR, et al. Rehabilitation treatment specification system: methodology to identify and describe unique targets and ingredients. *Arch Phys Med Rehabil*. 2021;102(3):521–531. doi:10.1016/j.apmr.2020.09.383