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Systematic Review

Examining the Efficacy of Communication Partner Training for Improving Communication Interactions and Outcomes for Individuals With Traumatic Brain Injury: A Systematic Review

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KEYWORDS
Communication;
Rehabilitation;
Systematic review;

Abstract *Objective:* To describe the evidence regarding communication partner training (CPT) interventions for individuals with traumatic brain injury (TBI) and their conversation partners. *Data Sources:* Eleven key databases—PubMed, CINAHL, Cochrane Registry of Controlled Trials, Embase, Linguistic and Language Behavior Abstracts, ProQuest, Scopus, Web of Science, PsycBITE, SpeechBITE, and ERIC—were searched from inception through 2019.

List of abbreviations: CP, communication partner; CPT, communication partner training; ECP, everyday communication partner; OCEBM, Oxford Centre for Evidence-Based Medicine; RCT, randomized controlled trial; ROBINS-I, Risk Of Bias In Non-randomized Studies - of Interventions; RoBINT, Risk of Bias in N-of-1 Trials; SCED, single-case experimental design; TBI, traumatic brain injury.

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Traumatic brain injuries

Study Selection: Selected articles had to be peer reviewed, written in English, experimental or quasiexperimental design, report on TBI communication partners, and describe interventions or strategies targeting communication partners.
Data Extraction: Of 1088 articles identified, 12 studies were selected for data extraction, critical appraisal, and analysis with considerations of sex and gender. The Oxford Centre for Evidence-Based Medicine's guideline was used to critically appraise Levels of Evidence. Assessment of bias was conducted using the Cochrane Collaboration tools for randomized controlled trials and risk of bias in nonrandomized studies of interventions for nonrandomized controlled trials and the risk of bias in N-of-1 trials scale.
Data Synthesis: A systematic review with a qualitative meta-analysis of themes and findings across the selected studies identified 3 major categories: (1) benefits of the training for those with TBI, (2) risks of CPT, and (3) suggestions to improve its efficacy.
Conclusion: Most of the evidence comes from 1 research group, which may be viewed as a weakness in the current body of literature. However, although the evidence to date is modest, CPT may help to increase accessibility and reduce participation inequities in the community for individuals with TBI.

Traumatic brain injury (TBI) is recognized as a global health priority in view of the social and economic costs to society, and the complex and expensive medical and rehabilitation care it necessitates.[1] Moreover, as one of the peak ages of injury ranges from 15 to 24 years,[2] this leaves many young people with the burden of a lifelong injury that is globally recognized as chronic disease.[3] After TBI, >75% of individuals will experience some form of communication impairment.[4] This can be devastating as communication underlies all human social life and is the means by which social and vocational goals are achieved, group decisions are made, and by which people receive and provide support.[5] It is therefore critical that health care and community service providers working with persons with TBI have an understanding of the latest evidence that informs their practice with respect to communication issues. There is a need for reviews that comprehensively and critically appraise the literature on important issues such as communication partner training (CPT).

Communication can be viewed as a partnership, a bidirectional process involving 2 or more persons[6] following an unspoken and inherent set of culturally biased rules including implied rules of *politeness* based on social contexts.[7] Individuals with TBI experience communication impairments particularly in the realm of social communication, whereby they have difficulty adhering to the unspoken rules of conversation.[7-9] These impairments are evidenced on standardized tests and in everyday conversations[10] and may include challenges such as difficulty understanding and responding,[7,11,12] difficulty recognizing and repairing communication breakdowns, and apparent lack of awareness and insensitivity to the communication needs of others.[7,13,14] Furthermore, these impairments often have a devastating effect on interpersonal relationships, participation, and community reintegration[4,9-11,14-16] and lead to inequities in social and health care supports.[17]

Not only do these impairments affect the person with TBI, but they also contribute to stress and burden for families and caregivers.[16,18] Family members have described their loved one's communication as ranging from slow and hesitant, restricted to a limited repertoire of stereotypic expressions, to being tangential or inappropriate and overtalkative.[19-21] These communication behaviors are perceived by others as challenging, and sometimes, as exhausting and embarrassing.[8,22] Historically, interventions to remediate communication impairments have focused on the individual, and there is a body of evidence of interventions for cognitive-communication disorders.[11,23]

Consistent with a more social and environmental perspective, involving communication partners (CPs) have also become a recognized approach to intervention[24,25] and originated as a means of intervention and support for people with aphasia.[26] This method, referred to as CPT, aims to facilitate improvements in the quality of interactions and information transfer[27] and has been found to be a potentially efficacious method of helping families, caregivers, and community members optimize communication success.[6,23,28] CPT after TBI has evolved because of a paradigm shift in approaches to rehabilitation that have altered the emphasis from remediation of individual cognitive and communication skills in isolation, to one which emphasizes participation, community integration, and quality of life.[4,29-31] CPT is in keeping with the context-sensitive approach defined by Ylvisaker[30] that includes context-supported participation with the goal of enabling participation in everyday activities.[30] Inherent within this approach is the aim of reducing participation inequities through building of partnerships between the person with TBI and their CPs.[11,23,32,33]

Given that communication is a bidirectional process, CPT alters the goal from communication competence, where the burden is placed on the individual with TBI, to one of communication success with shared responsibility between CPs. With this shared responsibility, the individual with TBI can gain acceptance from family and peers,

establish and maintain friendships, and meet the demands of school, work, and community.[4,34]

It is also recognized that communication is highly gendered,[35] and recently, there is an increased understanding of the effect of sex and gender on recovery from TBI.[15,36,37] This is also reflected in an emerging body of research regarding communication outcomes after TBI. For example, Byom et al[38] examined intimate and nonintimate conversations of individuals with and without TBI and identified differences by sex.[38] Specifically, as conversations become more intimate, men with TBI have difficulty adjusting and using vocabulary referring to emotion.[38] Patient-care-giver communication has also been postulated to be affected by sex or gender, because women with TBI are more aware of their pragmatic social communication impairments than men with TBI.[39] Thus, examining the influence of sex and gender on communication interventions and outcomes is increasingly relevant.

Given the prevalence of communication impairments and subsequent health and participation inequities after TBI, reducing these inequities requires community participation and increased community accessibility. Thus, it is imperative that clinical practitioners, decision and policy makers, and researchers have a broader understanding of the state of current evidence regarding CPT interventions to improve health and participation inequities and increase accessibility and quality of life for individuals with TBI.

Purpose

A descriptive review of CPT and TBI was conducted by Wiltshire and Ehrlich in 2014,[28] who described 4 published studies. The authors reported that sample sizes in general were small and that the evidence was not sufficient to make recommendations on the clinical efficacy of CPT for individuals with TBI and their CPs.[28] The authors did not conduct a quality appraisal of the included studies.

The purpose of this review was to expand the descriptive results of Wiltshire and Ehrlich[28] and systematically examine the efficacy of CPT as an intervention for individuals with TBI and their CPs. Specifically, we aimed to identify, evaluate, and synthesize the evidence, and, to identify analysis by sex and gender within each study to elucidate any gender-specific differences, needs, and practice recommendations. We aimed to answer the following questions:

1. What is the efficacy of CPT as an intervention for individuals with TBI and their CPs?
2. What types of CPs benefit from this type of training?
3. Is there any evidence to suggest that sex and gender play a role in the efficacy of CPT?

Methods

We defined a research protocol and registered it in PROSPERO, an international prospective register of systematic reviews, under registration number CRD42019130167.[40]

Inclusion criteria

We sought studies relating to communication or conversation partners and TBI. CPT was defined as an intervention that provides training to a person or persons other than the individual with the communication impairment, with the intent of improving language, communication, participation, and/or well-being of the individual with the communication impairment. The review was limited to papers published in English. Given that the evidence regarding CPT and TBI is in the early stages, our search criteria was kept fairly broad in relation to year of publication, study type (original research only), or design (eg, controlled trials or qualitative reports). Thus, to identify all potentially relevant information that could guide knowledge transfer, training and clinical practice, and inform future research and policy, all peer-reviewed publications were considered for inclusion in the review except for the criteria below.

Exclusion criteria

Studies were excluded that were not peer reviewed, did not relate specifically to TBI, were a commentary rather than original research, or were a scoping or systematic review.

Search strategy

On March 27, 2019, 11 key databases were searched from inception to the present—PubMed, CINAHL, the Cochrane Registry of Controlled Trials, Embase, Linguistic and Language Behavior Abstracts, ProQuest, Scopus, Web of Science, PsycBITE, SpeechBITE, and ERIC—to identify citations addressing the use of conversation partners or communication partners for patients with a TBI. TBI was searched using the MeSH TBI/and postconcussion syndrome/and keywords encephalopathy, edema, and concussion. Also included were terms for common measurements of brain injury: Glasgow outcome scale and Rancho Los Amigos Scale. Conversation partner was defined by the keywords communication partner, conversation partner, conversation advocate, communication advocate*, or communication train*, as well the MeSH caregivers appearing alongside words pertaining to communication disorders. After a gray literature search was performed in PsycBITE and SpeechBITE, we expanded the search to include in-service or noncaregiver training. One other paper not indexed in the 11 databases was identified by a colleague. After the citations were screened, a citation search was run on all articles that met the study's inclusion criteria. The titles and abstracts of all work quoting these 11 of the 12 articles were identified in the Web of Science. The article identified by the colleague was not identified in our searches because it was not indexed by any database other than Google Scholar.

The search yielded 1088 potentially relevant titles that were imported into EndNote 9.0 for further consideration. These were submitted to 2 reviewers for title and abstract review.

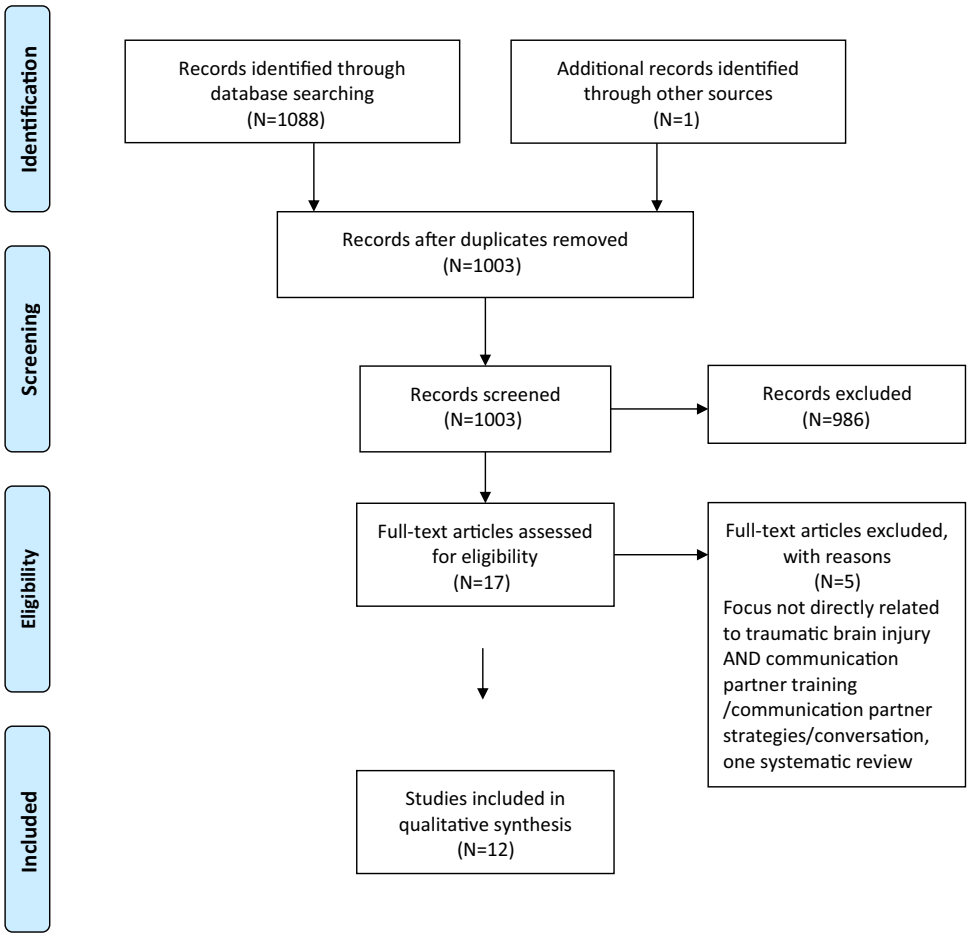

Fig 1 PRISMA flow diagram detailing search strategy and selection criteria.

Study selection

After removing duplicates, 1003 titles and abstracts were screened by 2 authors for eligibility. A further 981 were excluded, leaving 17 potentially relevant studies as full text. To ensure interrater reliability, 2 authors read the text of 3 of the same papers and then conferred regarding eligibility. Because there was 100% agreement, the 2 authors independently applied the selection criteria to decide on inclusion or exclusion of the remaining studies. Five additional studies were excluded based on focus or type of publication, yielding 12 studies for data extraction, critical appraisal, and analysis.[21,27,31,41-49] Figure 1 provides a summary of the search results and application of the inclusion or exclusion criteria to potentially relevant studies.[50]

Data extraction and critical appraisal

Data for the 12 included studies were extracted and entered into a Microsoft Excel file by the first author, followed by a review for accuracy and completeness by the second author. Data included bibliographic information, country of study origin, design, population characteristics, description of the CPT, description of the outcome measure(s), documentation of any analysis by sex and gender, findings, and presence or absence of follow-up evaluation.

Each of the 9 quantitative studies were appraised for their methodological quality and rigor. Where applicable, we critically appraised the Level of Evidence of each of the studies, as per the guidelines of the Centre for Evidence-Based Medicine Oxford Levels of Evidence.[51] See table 1.

We assessed bias for randomized controlled trials (RCTs) using the Cochrane Collaboration tool,[52] and for non-RCTs using the Risk Of Bias In Non-randomized Studies - of Interventions (ROBINS-I).[53] We assessed internal validity of the single case studies with the Risk of Bias in N-of-1 Trials (RoBINT) Scale.[54] A quality assessment was not conducted on the qualitative studies. For each tool, 2 authors independently scored the methodological features as being present or absent, discrepancies were discussed, and consensus reached. A summary of Risk of Bias is shown in tables 2 and 3, and fig 2.

Data synthesis

A qualitative meta-analysis of themes and findings across the studies was conducted, structured around the types of CPs trained (eg, paid caregivers, police officers, family members), the CPT intervention as well as the perceptions of participants regarding the functional efficacy of the interventions. We discussed the findings in the context of TBI rehabilitation with application to knowledge transfer,

Table 1 Summary of included studies

Title, Author, and Country of Origin	Study Design	Level of Evidence	Participants/ Population of Interest: Target Communication Partner	CPT Intervention	Outcome Measure(s)	Sample Size and Demographics	Analysis by Sex and/or Gender	Main Findings	Length of Follow-up
Training of communication partners of persons with TBI: a randomised controlled trial Togher et al,[42] Australia	RCT with cross-over of groups with-between group equivalence at baseline	II	CPs: police officers Individuals with severe TBI and pragmatic communication disorder	Six 2-hour sessions with 6 modules 1. What is TBI 2. Communication in context 3. Telephone inquiries 1 4. Telephone inquiries 2 5. Practice with people with TBI 6. Revision and role plays	No. of moves according to the analytic framework Generic Structure Potential pre- and posttraining and control	N=20 police officers Men=20 Training group: Mean age=33 y Mean education=18.6 y Control group: Mean age=27 y Mean education=17.1 y N=20 individuals with TBI Men=20 Mean age=36.3 y	No: NA as all participants were men	Trained officers had more efficient-focused interactions in telephone calls posttraining Mean no. of moves decreased Shorter interactions	None
Effectiveness of communication/ interaction strategies with patients who have neurological injuries in a rehabilitation setting, Shelton and Shyrock,[43] United States	Cross-sectional observational survey No experimental manipulation	V	CPs: licensed health care providers Hospitalized patients in rehabilitation with TBI	NA: an examination effectiveness, frequency, and types of communication strategies used by staff	NA	36 staff: Physician N=1 Nursing=7 Physiotherapist and physiotherapist assistant N=8 SLP N=7 Sex: not specified Mean age and education: not specified 36 patients Sex: not specified Mean age: not specified	No	Use of communication strategies aided the interactions Use of more strategies increased success of interactions	None
Sales assistants serving customers with traumatic brain injury, Goldblum and Alant,[31] South Africa	3 phase RCT	II	CPs: customer service managers, customer care assts., deli/ bakery sales assts	1X 4-hour training session with original onsite videotaped scenarios within small group discussion format	Pre- and postquestionnaires designed specifically for study Pre- and posttraining	Experimental group: N=31 Sex: women=30 Mean age=38.4 y and education=not	No	Experimental group was more confident and more knowledgeable than controls after training	None

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Table 1 (*continued*)

Title, Author, and Country of Origin	Study Design	Level of Evidence	Participants/ Population of Interest: Target Communication Partner	CPT Intervention	Outcome Measure(s)	Sample Size and Demographics	Analysis by Sex and/or Gender	Main Findings	Length of Follow-up
					confidence rating scale	specified Control group: N = 33 Sex: women = 32 Mean age = 41.9 y and education: not specified			
Evaluating communication training for paid carers of people with traumatic brain injury, Behn et al,[44] Australia and United Kingdom*	Single-blind RCT	II	CPs: paid caregivers in long-term care or in-patient rehabilitation facility	17-hour programme (across 8wk) with conversational interactions (ie, structured and casual) between paid careers and people with TBI	Primary outcome measures: adapted MSC and adapted MPC, and global impression scales of conversation Secondary outcome measures: LCQ Modified Burden Scale	Experimental group: (Trained) N = 5 Sex: not specified Mean age = 24.2 years Mean education = 12.6 y Control group: N = 5 Sex: not specified Mean age = 38.6 y Mean education = 12.6 y Persons with TBI: N = 5 Sex: men = 3, women = 2 Mean age = 29.2 y	No	Trained paid careers more able to acknowledge and reveal competence Of those with TBI, conversations perceived as more appropriate, interesting, and rewarding compared to control group	6 mo
An exploration of participant experience of a communication training program for people with traumatic brain injury and their communication partners, Togher et al,[41] Australia*	Qualitative	NA	CPs: ECPs: mothers, fathers, husbands, wives, caregivers Outpatients with moderate-severe TBI at least 9 mo postinjury	TBI Express: 10-wk conversational skills therapy program; TBI Express: weekly group and individual sessions for both treatment groups Joint condition focused on both partner person	Analysis of semistructured videotaped interviews with questions regarding the treatment, participants' experience of the training program, information regarding strengths of the program and	N = 44 TBI N = 44 ECP ECP TBI JOINT condition: N = 14 Sex: men = 11, women = 3 Mean age = 30.3 y Mean education = 12 y ECP TBI SOLO condition: N = 15	Informal notations: 1. CPs who were mothers (women) experienced more anxiety about their own communication and may need more support 2. The	Participants described improvements in communication skills, the effect of improved communication skills, valuable components of the programs, and components that needed changes	None

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Table 1 (*continued*)

Title, Author, and Country of Origin	Study Design	Level of Evidence	Participants/ Population of Interest: Target Communication Partner	CPT Intervention	Outcome Measure(s)	Sample Size and Demographics	Analysis by Sex and/or Gender	Main Findings	Length of Follow-up
				with TBI while TBI SOLO condition focused on individual with TBI only	potential changes, and information on participant satisfaction with the program and outcomes	Sex: men = 14, women = 1 Mean age = 39.7 y Mean education = 12.8 y ECP TBI control condition: N = 15 Sex: men = 13, women = 2 Mean age = 38.1 y Mean education = 12.7 y CP JOINT: N = 14 Sex: men = 4, women = 10 Mean age = 50.3 y Mean education = 13.1 y CP TBI: SOLO: N = 15 Sex: men = 2, women = 13 Mean age = 49 y Mean education = 12.9 y CP control: N = 15 Sex: men = 3, women = 12 Mean age = 49.7 y Mean education = 12.4 y	interviewers were all women and thus may have led female participants to express a greater depth of emotion about their experiences than the male participants		
Training communication partners of people with severe traumatic	3 arm non-RCT CPT (joint) with individual treatment	III	CPs: ECPs Outpatients with moderate-severe TBI at least 9 m postinjury	TBI express: 10-wk conversational skills therapy program; TBI Express: weekly	Blind ratings of the person with TBI's level of participation during	N = 44 TBI N = 44 ECP ECP TBI JOINT condition: N = 14 Sex: men = 11,	No	CPT improved conversational performance relative to training the person with	6 mo

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Table 1 (*continued*)

Title, Author, and Country of Origin	Study Design	Level of Evidence	Participants/ Population of Interest: Target Communication Partner	CPT Intervention	Outcome Measure(s)	Sample Size and Demographics	Analysis by Sex and/or Gender	Main Findings	Length of Follow-up
brain injury improves everyday conversations: a multicenter single blind clinical trial, Togher et al,[46] Australia*	(TBI solo) and a waitlist control group with 6-mo follow-up			group and individual sessions for both treatment groups Joint condition focused on both partner person with TBI while TBI solo condition focused on individual with TBI only	conversation on the measure of participation in communication adapted Kagan scales	women = 3 Mean age = 30.3 y Mean education = 12 y ECP TBI SOLO condition: N = 15 Sex: men = 14, women = 1 Mean age = 39.7 y Mean education = 12.8 y ECP TBI CONTROL condition: N = 15 Sex: men = 13, women = 2 Mean age = 38.1 y Mean education = 12.7 y ECP JOINT: N = 14 Sex: men = 4, women = 10 Mean age = 50.3 y Mean education = 13.1 y ECP TBI SOLO: N = 15 Sex: men = 2, women = 13 Mean age = 49 y Mean education = 12.9 y ECP CONTROL: N = 15 Sex: men = 3, women = 12 Mean age = 49.7 y Mean education = 12.4 y		TBI alone and a waitlist control group	

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Table 1 (*continued*)

Title, Author, and Country of Origin	Study Design	Level of Evidence	Participants/ Population of Interest: Target Communication Partner	CPT Intervention	Outcome Measure(s)	Sample Size and Demographics	Analysis by Sex and/or Gender	Main Findings	Length of Follow-up
Describing conversations between individuals with traumatic brain injury (TBI) and communication partners following communication partner training: using exchange structure analysis, Sim et al,[45] Australia*	Multisite non-RCT	III	CPs: ECPs Community-dwelling individuals with severe TBI at least 1 year postinjury	TBI Express: 10-wk conversational skills therapy program; weekly group and individual sessions for both treatment groups Joint condition focused on both partner person with TBI, while TBI SOLO condition focused on individual with TBI only	Adapted MPC	TBI JOINT condition: N=14 Sex: men=11, women=3 Mean age=30.3 y Mean education=12 y TBI CONTROL condition: N=15 Sex: men=13, women=2 Mean age=38.1 y Mean education=12.7 y ECP JOINT condition: N= 14 Sex: men=4, women=10 Mean education=13.1 y ECP CONTROL condition: N=15 Sex: men=3, women=12 Mean age=49.7 y Mean education=12.4 y	No	Exchange structure analysis and productivity analysis revealed significant change in the use of testing moves by trained ECPs and significant change in productivity by trained participants with TBI	None
Experiences from a communication training programme of paid carers in a residential rehabilitation centre for people with	Qualitative	NA	CPs: paid caregivers in long-term care facility	17-hour programme (across 8 wk) with conversational interactions (ie, structured and casual) between paid careers and people with TBI	Semistructured interviews	N=5 Sex: women=5 Mean age=38.6 y Mean education=12.6 y	No	Paid careers described improved knowledge and use of strategies, improved communication, positive emotional experiences,	None

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Table 1 (*continued*)

Title, Author, and Country of Origin	Study Design	Level of Evidence	Participants/ Population of Interest: Target Communication Partner	CPT Intervention	Outcome Measure(s)	Sample Size and Demographics	Analysis by Sex and/or Gender	Main Findings	Length of Follow-up
traumatic brain injury, Behn et al,[47] Australia and United Kingdom								barriers and facilitators to consider for future communication training programmes	
Questioning in conversations before and after communication partner training for individuals with traumatic brain injury, Mann et al,[27] Australia*	Descriptive qualitative	NA	CPs: ECPs (family members) Community-dwelling individuals with severe TBI at least 1 year postinjury		Analysis of transcribed conversations using adapted Kagan scales	N = 8 4 with TBI Sex: men = 1, women = 3 Mean age = 25.5 y Mean education = 12.3 y 4 ECPs Sex: men = 1, women = 3 Mean age = 52.3 y Mean education = 17.3 y	No	*Kagan plus* dyads had obvious changes in their questioning practices which facilitated selection of topics and development of related talk, ie, improved communication *Kagan neutral* had less obvious differences, thus less apparent improved communication	None
The effectiveness of social communication partner training for adults with severe chronic TBI and their families using a measure of perceived communication ability, Togher et al,[21] Australia*	Non-RCT	III	CPs: ECPs (family members) Community-dwelling individuals with severe TBI at least 1 year postinjury	TBI express: 10-wk conversational skills therapy program; weekly group and individual sessions for both treatment groups Joint condition focused on both partner person with TBI while TBI solo condition	LCQ	N = 44 TBI N = 44 ECP ECP TBI JOINT condition: N = 14 Sex: men = 11, women = 3 Mean age = 30.3 y Mean education = 12 y ECP TBI SOLO condition: N = 15 Sex: men = 14,	No	Training communication partners of people with chronic-severe TBI using TBI express led to perceived improvements in everyday communication ability by both the person with TBI and their family	6 mo

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Table 1 (*continued*)

Title, Author, and Country of Origin	Study Design	Level of Evidence	Participants/ Population of Interest: Target Communication Partner	CPT Intervention	Outcome Measure(s)	Sample Size and Demographics	Analysis by Sex and/or Gender	Main Findings	Length of Follow-up
				focused on individual with TBI only		women = 1 Mean age = 39.7 Mean education = 12.8 y ECP TBI CONTROL condition: N = 15 Sex: men = 13, women = 2 Mean age = 38.1 y Mean education = 12.7 y ECP JOINT: N = 14 Sex: men = 4, women = 10 Mean age = 50.3 y Mean education = 13.1 y ECP TBI SOLO: N = 15 Sex: men = 2, women = 13 Mean age = 49 y Mean education = 12.9 y ECP control: N = 15 Sex: men = 3, women = 12 Mean age = 49.7 y Mean education = 12.4 y		members	
Joint video self-modeling as a conversational intervention for	Mixed methods: qualitative and	IV	CP: spouse Individual with moderate-severe TBI and 27 mo	16 sessions of joint video self-modeling, jointly reviewing	LCQ MPC MSC	TBI: N = 1 Sex: men = 1 Age = 53 y Education: not	No	Pre- and postmeasures of social communication	6 mo

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Table 1 (*continued*)

Title, Author, and Country of Origin	Study Design	Level of Evidence	Participants/ Population of Interest: Target Communication Partner	CPT Intervention	Outcome Measure(s)	Sample Size and Demographics	Analysis by Sex and/or Gender	Main Findings	Length of Follow-up
an individual with traumatic brain injury and his everyday partner: a pilot investigation, Hoepner and Olsen,[48] United States	quantitative Single-case design		postinjury	recordings of conversations from their home and community under the guidance of a coach		Specified ECP: N = 1 Sex: women = 1 Age = 50 y Education: not Specified		identified improvements in self-awareness and self-regulation. The partner increased positive conversational supports and reduced setups and antagonistic statements	
A single case experimental design study on improving social communication skills after traumatic brain injury using communication partner telehealth training, Rietdijk et al,[49] Australia	Single-case experimental design	IV	Individuals with TBI and their ECP	TBIconneCT (a telehealth version of TBI express): 10-wk program with one 1.5-h session per week directed by a clinician Sessions occurred online via Skype Program content includes didactic instruction, structured role plays, practice of conversation and recordings for identification of communication difficulties, and strategies to address said difficulties	Exchange structure analysis LCQ CCRSA QOLIBRI PART-O Global ratings of conversation quality	TBI: N = 1 Sex: men = 1 Age = 33 y Education = 14 y ECP: N = 1 Sex: women = 1 Age = 36 y Education = 18 y	No	Positive change found on blinded ratings of conversation and self-reported measures for both participants Exchange structure analysis conducted on session-by-session data did not demonstrate treatment effects due to variability during baseline	Participant 1 = 3 mo postintervention Participant 2 = 9 mo postintervention (was unavailable earlier due to traveling)

Abbreviations: CCRSA, Communication Confidence Rating Scale for Aphasia; LCQ, La Trobe Communication Questionnaire; MPC, measure of participation in conversation; MSC, measure of support in conversation; PART-O, Participation Assessment with Recombined Tools (Objective); QOLIBRI, Quality of Life After Brain Injury; SLP, speech-language pathologist.

* Denotes papers from the same study.

Table 2 Risk of bias summary using the ROBINS-I assessment: review authors' judgments about each risk of bias outcome for the included studies

Bias Domains	Sim et al[45,*]	Togher et al[46,*]	Togher et al[21,*]
Preintervention			
1. Confounding	L	L	L
2. Selection of participants	L	M	M
3. Classification of interventions	L	L	L
Postintervention			
4. Deviation from intervention	L	L	L
5. Missing data	L	L	L
6. Outcome measurement	L	L	L
7. Selection of reported result	L	L	L
Overall risk	Low	Low	Low

Abbreviations: C, critical; L, low; M, moderate; NI, no information; S, serious.
* Papers from same study.

training, and clinical practice. Results are displayed in evidence tables (see table 1). Excerpts from the findings are included in the body of the text to illustrate key aspects of the qualitative meta-synthesis.

Determining overall quality of the evidence

According to the Oxford Centre for Evidence-Based Medicine (OCEBM), the Oxford Levels of Evidence (2011) were not designed to provide a definitive judgement regarding the quality of the evidence or a specific recommendation.[51] To determine the overall quality of the evidence, we considered the following four questions specified by the OCEBM to make the determination:

1. Do you have good reason to believe that your patient is sufficiently similar to the patients in the studies you have examined?
2. Does the treatment have a clinically relevant benefit that outweighs the harms?
3. Is another treatment better?
4. Are the patient's values and circumstances compatible with the treatment?

Table 3 Risk of bias summary using the RoBiNT: review authors' judgments about each risk of bias outcome for the included studies

Bias Domains	Hoepner and Olsen[48]	Rietdijk et al[49]
IV subscale		
1. Design with control	0 (unclear)	1
2. Randomization	0	0
3. Sampling of behavior	2	2
4. Blinding of people involved in the intervention	0	0 (unclear)
5. Blinding of assessor(s)	2	2
6. Interrater agreement	1 (built into the MPC with anchor ratings)	0 (unclear)
7. Treatment adherence	2	2
Overall IV score/14	8	8

NOTE. 0, failed to meet criteria; 1, met previously accepted standards; 2, meets currently recommended criteria.
Abbreviations: IV, internal validity; MPC, measure of participation in conversation.

Results

Type of evidence

Twelve studies met the inclusion criteria (see fig 1) and consisted of 3 RCTs,[31,42,44] a non-RCT yielding 3 substudies,[21,45,46] 1 single-case experimental design,[49] 1 mixed method single-case qualitative and experimental study,[48] 1 observational study,[43] and 3 qualitative semistructured studies.[27,41,47] See table 1.

Participants

The total number of participants varied by study and ranged from 2 to 88, with the total from all studies being 525 and 291 when excluding substudies from the same research program. There were 223 individuals with TBI, and 302 communication partners across all studies, with 106 individuals with TBI and 185 communication partners when excluding substudies. Although most studies included individuals with TBI and CPs, Goldblum and Alant[31] and Behn et al[44] included only CPs.[31,44] Types of CPs included police officers, health care professionals, sales assistants, caregivers within inpatient rehabilitation, family members, and everyday communication partners (ECPs). Across all studies, 218 men and 225 women were included, and 93 men and 116 women were included when excluding substudies. Across all studies, there were only 3 female participants with TBI; however, most of CPs (n=143) were women. The average age was 38.2 years and average education was 13.8 years. Participant inclusion and exclusion criteria were fairly consistent across studies. For those with TBI participants, inclusion criteria (where specified) were (1) chronic moderate-severe or severe TBI, (2) significant social communication or pragmatic impairments, (3) have a CP with whom they interact regularly, (4) at least average premorbid intelligence confirmed from the most recent

Author	Sequence Generation (Selection Bias)	Allocation Concealment (Selection Bias)	Blinding of Participants and Personnel (Performance Bias)	Blinding of Outcome (Detection Bias)	Incomplete Outcome Data (Attrition Bias)	Selective Outcome Reporting (Reporting Bias)	Other Threats to Validity	Overall Study Rating
Togher et al[42]	+	?	+	+	?	+	+	+
Goldblum et al[31]	+	?	?	?	+	+	?	?
Behn et al[44]	+	+	?	?	+	+	+	+

+ = Low risk ? = Unclear or moderate risk – = High risk

Fig 2 Risk of bias summary using the Cochrane Collaboration tool: review authors' judgments about each risk of bias outcome for the included studies.

neuropsychological assessment, and (5) intelligible speech and English proficiency.[21,27,41,45,46,49] Rietdijk et al[49] used the above inclusion criteria with the exception of average premorbid intelligence and also specified a home computer with internet.[49] Behn et al's[44] study of paid caregivers specified the following inclusion criteria: (1) no active drug and/or alcohol use, (2) no evidence of psychosis, (3) no university level credentials, (4) English proficiency, and (5) full-time work as a caregiver.[44] For those studies including TBI participants, exclusion criteria were mostly consistent across studies including the presence of (1) severe dysarthria or aphasia preventing intelligibility in conversation with an unfamiliar listener; (2) drug or alcohol addiction, or active psychosis; and (3) multiple TBIs.[27,41,45,46] Rietdijk et al[49] also had an exclusion criteria of (1) cooccurring degenerative neurologic disorder or (2) severe amnesia preventing participants from providing informed consent, and, for CPs, no history of TBI.[49] Please refer to supplemental appendix S1 (available online only at http://www.archives-pmr.org/) for details of the outcome measures and interventions.

Thematic content analysis of qualitative studies

A meta-synthesis and analysis of qualitative findings identified 3 main categories of content themes: (1) benefits of CPT and TBI including improved understanding and awareness of the effect of TBI on communication, improved understanding and awareness of communication roles, and specific strategies to support the communication competence of the person with TBI; (2) risks of CPT including increased awareness of negative communication behaviors or barriers on behalf of the communication partners and increased anxiety during the early sessions of the program; and (3) suggestions for improving the CPT programs including increased role play and less didactic teaching.

Study findings

To answer the questions posed in this review, we have synthesized the findings according to (1) type of communication partner trained and (2) considerations of sex and gender.

Communication partners: community members (nonfamily or caregivers)

Two studies, both RCTs and thus Level 2 evidence,[51] assessed the effect of CPT on community members who were not directly related to people with TBI.[31,42] Both studies incorporated a broad array of context-sensitive skills and awareness relating to effective communication and produced a positive result. Togher et al[42] conducted an RCT with cross-over of groups to determine whether a training program would improve the interaction style of police officers during telephone-based service inquiries with participants with TBI.[42] Twenty male police officers were recruited from the Police Services and randomly assigned to an intervention group or control group. Twenty males with TBI were also recruited to participate in the telephone interactions. The intervention involved a 6-week group training program. Pre- and posttreatment effects were evaluated using transcribed telephone service encounters. Positive changes for the experimental group included spending more time to establish the nature of the inquiry, taking increased time to respond, more efficient, focused interactions and reduced overall interaction time, and fewer unrelated utterances by participants with TBI.[42]

Goldblum and Alant[31] also conducted an RCT to determine whether a group training program could improve the interaction styles of sales assistants with customers with TBI. Sixty-four staff (62 women) including customer service managers, customer care assistants, and frontline customer sales assistants were recruited from a retail supermarket chain and randomly assigned to the experimental and control groups. The intervention involved one 4-hour small group training session (see supplemental appendix S1). Pre- and posttreatment effects were evaluated using 2 questionnaires developed specifically for the trial and administered on 2 different occasions to the experimental and control groups pre- and posttraining. Positive changes were observed for the experimental group who became more confident and more knowledgeable. For both studies, training of CPs led to greater understanding, provision of

appropriate supports, and greater feedback and structure of everyday interactions. Overall, although the format, content, and duration of these interventions varied, results from these two Level 2 studies suggest that increasing awareness and skill of community-based CPs were beneficial in improving conversational interactions.

Communication partners: paid caregivers

Two studies with differing methodologies assessed the effect of CPT on paid caregivers working directly with people with TBI. Behn et al[44] conducted a single-blinded RCT Level 2 study[51] to determine whether a CPT program could improve interactions with individuals with TBI.[44] Ten paid caregivers (sex not specified) were recruited from a residential rehabilitation center and randomly allocated to a training or control group. Five individuals with TBI (3 men) were recruited from consecutive admissions to the rehabilitation center, as conversation partners. The intervention was adapted from the previously published *TBI Express*.[55] The program was adapted to be context sensitive by introducing situations common to the rehabilitation center. Pre- and posttreatment effects were evaluated by two primary outcome measures (see supplemental appendix S1). Despite the small sample size, positive changes for the experimental group were observed by blind assessors, including being better able to acknowledge and use supported communication strategies to reveal the competence of people with TBI. These improvements were confined to structured conversation yet were maintained at 6-month follow-up.

Behn et al[47] later conducted a qualitative investigation of the experiences of these same caregivers[47] and aimed to determine the effect of the previously described CPT program using qualitative, semistructured interviews to gather information regarding participants' experiences of talking with TBI patients, the training program, and any suggested changes. This later study revealed that the paid caregivers were women. Each 5- to 20-minute videotaped interview was conducted prior to and after the training program. The interview time varied depending on the amount of information the participant wished to provide. The data were coded and analyzed for themes and revealed 4 major categories including experiences of (1) improved knowledge and use of strategies, (2) improved communication, (3) positive emotional experiences, and (4) barriers and facilitators of the training program. One particular participant's quote appeared to exemplify the value of CPT in terms of increased awareness, skill, and altering perspectives about the communication of persons with TBI and recognizing the need for respect and dignity for their patients (with TBI).

"It's definitely improved my skills, it's definitely made me see things differently and I look at the clients differently … one of the clients who is the hardest to try and work your skills around, that test your skills I think, but it also tests your emotions … it [CPT] teaches us to respect these people [with TBI], they are human beings … that's how I want to be spoke to in a normal tone of voice not a domineering tone, like I am up here you are there."[47(p1157-8)]

Additionally, the authors solicited feedback on the CPT program, which is particularly relevant from the perspective of stakeholder engagement. The involvement of people and organizations directly affected by research in the research process itself is increasingly recognized as an important and ecologically valid means of affecting positive change.[56] Participants identified that functional, practical activity-based approaches were more effective than the didactic lecture-based components and provided the following suggestions:

> We would like … "Probably more time to, like, practice with tape recorders and stuff [be]cause we didn't get a lot of time…[and] some time in our work time that we can practice."
>
> "Perhaps we could do it with you as the client… I still wish I could see myself back [on video]…[I] find that useful, with body language, posture, what am I saying to you…"[47(p1558)]

Although the evidence for CP training of paid caregivers remains limited with this small-N Level 2 study and qualitative study, the combination of findings suggests that training of paid caregivers can result in improved knowledge, better conversations, greater satisfaction, and confidence with their interactions with TBI patients. Additionally, participants developed a greater understanding of the effect of cognition on communication and increased awareness of strategies to encourage people with TBI to express their own thoughts and opinions.

Communication partners: health care professionals

One study examined correlations between the use of communication strategies by licensed health care providers and the success of interactions with adults with neurologic injuries and communication or cognitive impairments within an in-patient rehabilitation setting.[43] This observational study included a mixed patient population; however, almost two-thirds had a diagnosis of TBI, and the remaining one-third had a diagnosis of ABI, (primarily stroke and some with anoxic brain injury). Thus, the findings may have application to other health care providers working with TBI patients. Thirty-six health care providers (sex not specified) including a physician (n=1), nurses (n=7), physical therapists and physical therapy assistants (n=13), occupational therapists and certified occupational therapy assistants (n=8), and speech-language pathologists (n=7) were recruited from a rehabilitation center to participate in this study, along with 36 in-patients with neurologic injury and varying levels of *cognitive-linguistic* severity from mild-moderate to severe-profoundly impaired. This Level 5 cross-sectional study involved the rating of 102 five-minute videotaped interactions (between in-patients and licensed health care providers) by 5 judges (trained speech language pathologists) who were unfamiliar with the patients and staff being videotaped. Participants were blinded as to when conversations were being recorded. Immediately after the interaction, a judge rated conversational success according to a predetermined 5-point scale of the level of attentiveness, compliance with and participation in the task or topic discussed. The staff member or research participant completed a 7-choice questionnaire about their perceived awareness of and use of specific strategies.

After establishing interrater reliability, the judges identified that the most successful interactions, regardless

of patient severity, were those involving the strategies of *short, direct sentences and directions presented one at a time* and *facing the patient and making eye contact*. For mild-moderately impaired patients, strategies of *allowing the patient extra time to respond* and *supplementing communication with gestures and/or pointing* resulted in the most successful interactions, and for severe-profoundly impaired patients, the strategies of *repetition of information* and *clarification of communication attempts* resulted in the most successful interactions. Positive correlations were also found between the number and use of strategies and success of the interactions. Although this study did not provide any CP training, and thus does not provide any evidence to support the efficacy of CPT, it provides some limited evidence that awareness and use of specific communication strategies has a positive effect on the success of interactions between patients with neurologic injuries including TBI and health care providers within inpatient rehabilitation.

Communication partners: ECPs

Seven of the included studies used varying methodologies to assess the effect of CPT on family members, referred to as ECPs of individuals with TBI.[21,27,41,45,46,48,49] Each study incorporated an array of context-sensitive skills and heightened awareness relating to effective communication; findings from the quantitative studies yielded positive results including increased awareness of strategies and confidence in more effective communication.

Togher et al[46] conducted a multicenter, non-RCT to assess the efficacy of the program TBI Express[55] for individuals with TBI and their ECPs as compared to training the individuals with TBI alone. TBI Express is a communication training program for people with TBI and their families, friends, and caregivers. It includes ten modules of 2.5-hour group sessions and 45-minute individual sessions. It is available for purchase and includes a manual and DVD resources to support the delivery of the program for individuals with TBI and their family or caregivers or for individuals with TBI alone. Please refer to supplemental appendix S1 for further details.

Forty-four participants with TBI (men = 38) were recruited from three different brain injury units along with their ECP (women = 34). This 3-arm Level 3 clinical trial allocated participants to 1 of 3 groups: (1) *JOINT* condition; both the individual with TBI and their ECP received communication training; (2) *SOLO* condition; only the individual with TBI received training; and (3) *CONTROL* condition; a delayed training group. Casual conversations between individuals and their ECPs were rated by blinded assessors. Positive changes were identified and differed significantly between groups. Specifically, both treatment groups significantly improved in social affiliation, information transfer, and communicative support. However, the JOINT group had greater gains than the SOLO group for information transfer and aspects of communicative support and maintained their improved communication skills at 6 months posttraining.

This research program also yielded 3 other studies, 1 quantitative and 2 qualitative. Sim et al[45] aimed to specify the effects of the TBI Express and thus further examined the casual conversation samples collected from the JOINT and CONTROL groups.[45] Casual conversations were formally analyzed. Positive changes were reported whereby the ECPs in the JOINT group made improvements to their communicative style, significantly reducing their use of test questions (ie, questions where they already knew the answer) compared to controls. The authors suggested this likely contributed to the overall improved quality of the conversations.

Mann et al[27] used a qualitative methodology to describe the questioning patterns during casual conversations between 4 individuals with TBI and their ECP (from the study by Togher et al[46] described above) from the JOINT condition, before and after the CPT. Although the overall findings from Togher et al[46] were positive, there was variation in terms of the degree and presence of change within the JOINT group, as measured by the adapted Kagan scales (see supplemental appendix S1). For most dyads (conversations between 2 individuals), the conversation samples were rated more highly for information transfer and social affiliation after intervention and were thus termed *plus* dyads. A smaller number of dyads had little change in their pre- and postintervention ratings and were termed *neutral* dyads. Approximately, 10 minutes of casual conversations per dyad were transcribed. Questions within each sample were identified and qualitatively analyzed focusing on aspects of sequence organization. As described above, positive changes were observed after the training whereby plus dyads had obvious changes in their questioning practices after training which facilitated the selection of topics and the development of related talk, that is, improved communication. The neutral dyads revealed less obvious differences in questioning practices after training, indicating that improved communication in the postintervention samples was less apparent.

Togher et al[41] also conducted a qualitative study investigating the overall experiences of the participants who attended the communication training program described above.[46]

Semistructured videotaped interviews were completed by participants at the end of the training. Using a qualitative generic analysis procedure, data were categorized into topics and subtopics. Participants described improvements in communication skills, the effect of improved communication skills on relations, and provided insights into valuable components of the programs and components that were challenging or needed changes. A number of participant comments illustrate the value of the training:

> "I think the best thing was the way you did the role playing, it was a perfect way of explaining... of making each one look at ourselves and see." "You've shown us how to do that without just telling us how to do it, you've actually shown us."[41(p1568)]

The authors also reported comments from CPs who were mothers of individuals with TBI that were invaluable in understanding the participatory experience, as well as identifying supports needed going forward. The mothers reported that attending the groups was quite challenging especially the first few sessions. One mother stated:

"It's been probably a bit, was a bit daunting for myself. I thought it was, when I first came in, honestly, I could have left... it was just too confronting and the way that I felt in myself I just, because you don't know what, you're doing the best you can and now you're coming and people are going to tell you what you've done may not have been right... I just don't know whether I was ready for criticism but that's not how it was at all but that's how I thought... I actually had a panic attack for the first two things (sessions)..."[41(p1570)]

This feedback was of particular importance for application to clinical practice because the researchers identified that it would be of benefit to normalize the feelings of the CP as part of the program introduction and involve a clinical psychologist to assist participants to cope with any anxiety. Although these qualitative studies do not add to the body of evidence regarding changes in performance pre- and posttraining of CPs, they do add to our understanding of the potential benefits and useful components of the training programs. Furthermore, they demonstrate the value of stakeholder engagement and qualitative research methodologies as part of evaluating the outcomes of the clinical trial.

Finally, two Level 4 single-case experimental design (SCED) studies also assessed the effect of CPT on conversation and social communication for individuals with TBI and their ECPs. Hoepner and Olsen[48] conducted a pilot study to assess the effect of joint video self-modeling as a CPT intervention for social interactions by individuals with TBIs and their close communication partners.[48] Similar to the work of Togher et al,[41] the study design also included a qualitative component to understand the experiences of the participants. A 53-year-old man with moderate-severe TBI and his 50-year-old CP (female spouse) were recruited to participate in the study. Positive changes were identified, specifically improvements in self-awareness and self-regulation for the participant with TBI, and the ability of the CP to acknowledge and reveal the competence of the participant with TBI also increased. The findings suggest that CPT through the medium of video self-modeling appears to hold potential for increasing self-awareness and improving communication interactions for individuals with TBI and their partners.

Rietdijk et al[49] built on the work of Togher et al[46] and conducted a feasibility study to assess the effect of CPT with TBI Express[55] to improve social communication skills after TBI using a modified version called TBIconneCT with telehealth as the delivery medium to improve access to training.[49] Positive changes were identified. Two participants with TBI and their CPs were recruited and completed TBIconneCT training: modifications included module content formatted onto slides for screen sharing. Participants used a private video-conference website to enable completion of recordings of home practice conversations and to share recordings. Outcome measures included conversational analysis and blinded ratings of conversation samples and self-report measures (see supplemental appendix S1). Participants were recruited from a previous study by the authors and included a 33-year-old man with severe TBI and his CP, a 30-year-old female friend, and a 24-year-old woman with severe TBI and her CP, her 42-year-old mother. Treatment goals were individualized to reflect communication behaviors of interest as well as their shared and individual goals. The study indicated positive change on blinded ratings of conversation and self-reported measures for both participants; however, exchange structure analysis conducted on session-by-session data did not demonstrate treatment effects due to variability during baseline. The findings corroborated the efficacy of TBI Express and indicated potential for using telehealth to provide social communication skills training to people with TBI and their families.

With the exception of the single-case studies, a group format was used to deliver the training.[21,31,42,44-46] The hours of intervention ranged from 4 to 35 hours, spanning across 8.9 weeks on average.

Taken together, the findings of the quantitative Level 3 studies, the Level 4 SCED studies, and the associated qualitative findings provide moderate evidence of the benefits of CPT on improving conversational interactions among individuals with TBI and their ECPs. Moreover, the inclusion of qualitative data provides important social validation of the interventions because it reflects the end-user perspective and thus extends the conclusions that can be determined from quantitative data alone.[41]

Considerations of sex and gender

Given the relatively new and emerging understanding of the effect of sex and gender on overall recovery from TBI as well as communication outcomes, we did not identify any analysis or evaluation of findings according to sex or gender.

Critical appraisal

Levels of evidence

The studies varied in terms of their methodological quality. According to the Oxford Levels of Evidence,[51] 3 studies were deemed as Level 2 RCTs.[31,42,44] An additional 3 studies were deemed as Level 3 non-RCTs,[21,45,46] and 2 studies, both single-case experimental designs were deemed as Level 4.[48,49] One observational study with no intervention was deemed as Level 5 (Clinical reasoning). We did not critically appraise the qualitative studies.

Risk of bias

Figure 2 shows the risk of bias in each of the 3 RCTs using the Cochrane Risk of Bias tool.[52] Ratings ranged from low to moderate or unclear across domains. The overall risk of bias was low in 2 studies and moderate in 1. Risk of bias was most often due to selection bias and lack of blinding. The lack of randomization in 2 of 3 studies reflects the inherent challenges of conducting rehabilitation research, such as availability of participants. In Goldblum et al,[31] there was moderate performance bias because the researcher was not blinded to the data, while participants were blinded when baseline measures were taken. In Behn et al,[44] it was unclear if raters were blind to the condition.

The ROBINS-I tool[53] was used to assess bias in 3 non-randomized studies of interventions (see table 2). Overall,

all 3 studies were determined to have a low risk of bias. All studies provided detailed descriptions of most ROBINS-I domains. Only 1 domain, selection of participants, had a moderate risk of bias due to lack of randomization. However, it was clear that randomization was not possible within the context due to lack of availability of CPs as treatment was conducted during working hours.

The RoBiNT was used to assess the internal validity of the 2 SCED studies[54] (see table 3). Overall, the studies were determined to have a moderate-high risk of bias due to lack of randomization and lack of blinding of those administering the intervention.

Discussion

This review aimed to examine the evidence for CPT for individuals with TBI and their communication partners. Specifically, we aimed to analyze and critically appraise the evidence based on the research questions. The discussion below summarizes the findings on this basis.

What is the efficacy of CPT as a means of intervention for individuals with TBI and their communication partners?

We identified 11 studies with differing methodologies that examined outcomes from, or perceptions of the experiences of CPT interventions for individuals with TBI and a variety of communication partners. All of the studies used a context-sensitive approach. A twelfth nonintervention study observed the effect of strategies on success of communication interactions. Although description of the interventions was limited, 8 of 12 studies used the publicly available program TBI Express[55] and 1 study used a version of this program adapted for telehealth delivery, TBIconneCT.[49] Thus, the replicability of the interventions is considered to be fairly high. There was also consistency across most of the outcome measures, which provides additional support for the replicability of the studies and synthesis of the findings. For all of the studies, the intervention was delivered for CPs of individuals with TBI in the postacute, more chronic stage of injury, who were primarily community dwelling. The risk of bias was moderate for most of the quantitative studies. All 11 studies found a positive effect of the intervention on at least 1 of the target communication behaviors of interest as indicated by positive changes on the outcome measures. Only 3 studies included follow-up analyses at 6 months and all 3 reported some maintenance of skill. The number of RCTs was small, and while this study design provides the highest quality of evidence as compared to other study designs, the challenges inherent within this population such as lack of availability of a CP or lack of participants with equivalence at baseline, are recognized as being valid reasons for implementing other designs (such as non-RCTs), which can also provide high-quality evidence.[57] Both SCED studies were pilot or feasibility studies and provide the basis for further exploration. In total, 302 communication partners and 223 individuals with TBI (including substudies) and 185 communication partners and 106 individuals with TBI (excluding sub-studies) received the interventions. Most of the evidence comes from 1 research group in Australia.

We applied the following four questions from the OCEBM to help determine the overall efficacy of the evidence for CPT training:

1. Do you have good reason to believe that your patient is sufficiently similar to the patients in the studies you have examined? Other than the majority of research being conducted in Australia, the patient profiles are very similar to those that would be seen clinically in North America and the United Kingdom, as well as Australia and New Zealand.
2. Does the treatment have a clinically relevant benefit that outweighs the harms? We conclude based on the evidence that the clinically relevant benefits far outweigh any potential harm, which was limited to a report of potential initial distress by mothers of people with TBI, and for which specific recommendations have been made by the researchers to mitigate this.[41]
3. Is another treatment better? The treatment has been compared to solo conditions where only the person with TBI receives the training and the partner training results are significantly better.
4. Are the patient's values and circumstances compatible with the treatment? Yes, we conclude that this treatment is highly contextualized and functional.

Although we conclude that in general, the methodological quality of the studies is modest, these studies provide some quantitative and qualitative evidence that CPT was beneficial in improving the communication interactions and quality of communication competence for individuals with TBI and their CPs, particularly when using a context-sensitive approach.

What types of communication partners benefit from this type of training?

Of the 12 included studies, 7 focused on CPs who were family members including spouses, partners, and parents. The remaining 5 studies included CPs who were nonfamily members. Three RCTs with sample sizes ranging from 5 to 31 focused on training police officers, shop keepers or retail personnel, and care givers. One observational study examined the strategies used by licensed health care providers. Overall, these studies provide a modest level of evidence to suggest that CPT can be effective for a variety of communication partners.

Is there any evidence to suggest that sex and gender play a role in the efficacy of CPT?

As anticipated, we did not find any formal evidence to suggest that sex and gender play a role in the efficacy of CPT because there was no formal analysis of findings according to sex or gender. However, it is of interest to note that the most of participants with TBI were men across all studies, and with the exception of the study by Togher et al[42] where the communication partners were all men,[42] most of the communication partners were

women. Of additional interest, Togher et al[41] reported that the mothers (women) in their qualitative study experienced an emotional response to the training as well as expressions of self-doubt and perceived negative judgment during the initial training sessions, and some of the mothers also reported experiencing anxiety.[41] In contrast, these feelings and experiences were not reported by any of the male communication partners. Furthermore, the authors pointed out that the interviewers in this qualitative study were all women and thus may have affected the dynamics of the interview situation which perhaps led female participants to express a greater depth of emotion about their experiences than the male participants.[41]

Study limitations

There were several limitations to the included studies and our review. Although the evidence to support CPT is emerging, in general, sample sizes were relatively small and as such were inadequately powered. This may have led to a type II error whereby there exists a failure to detect true differences between groups. Furthermore, most of the studies are from 1 research laboratory in Australia and thus there may be cultural bias in the findings. We also recognize that the risk of bias varied across studies and was sometimes unclear. We acknowledge that those studies with unclear risks were likely published either before, or early on in the implementation of, publication standards for reporting of non-RCTs[53] and for SCED (N of 1 trials).[54] The inclusion and exclusion criteria were also somewhat restrictive in that individuals with active mental health challenges and/or addictions or multiple TBIs were not included in the studies. This is despite the fact that these individuals are among the most vulnerable with TBI, as evidenced by the high prevalence of comorbid mental health issues,[58] unstable housing,[59] and criminal justice involvement.[60] Finally, although our search strategy was broad, it is possible we may have missed some relevant studies that were not in English or not published in the peer-reviewed literature.

We also recognize that despite there being no evidence of an effect of sex or gender on the findings of the included studies, we cannot definitively conclude there was no effect because this was not analyzed. Accordingly, we suggest that future studies should add analysis by sex and gender. We acknowledge that in general the research on CPT is still in the early stages and there is additional work to be done. We further recommend that additional research be of higher methodological rigor, with more clearly described interventions and consistent postintervention follow-up. Future research is needed to examine the benefits of CPT for pediatric populations including parents, siblings, and educators, as well as for frontline staff working with vulnerable individuals with TBI and comorbid mental health and addictions, vulnerable housing, and criminal justice involvement. A larger scale study examining the efficacy of TBIconneCT, the telehealth adaptation of TBI Express is reportedly planned[49] and has potential to provide access to training for those in remote communities.

Conclusions

What this paper adds: To our knowledge, this is the first comprehensive systematic review to examine CPT as an intervention to improve the communication outcomes of individuals with TBI. We have also attempted to identify the types of communication partners who have benefitted from this training. Finally, we have highlighted the need for consideration of sex and gender in the development, evaluation and efficacy of interventions for individuals with TBI, particularly in the realm of communication.

The studies included in this review identified the potential of CPT to enhance both activity and participation domains in the International Classification of Functioning, Disability and Health[29] for individuals with TBI, by increasing positive supported communication, interaction, and social connections. Given that interventions for TBI have been found to be most effective when using a collaborative and contextualized approach that also includes consideration of the barriers existing within the social environment,[30,31,42] CPT is an intervention with minimal risk that has the potential to improve health and participation inequities and increase accessibility and quality of life for individuals with TBI.

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References

1. James L, Theadom A. GBD 2016 Traumatic Brain Injury and Spinal Cord Injury Collaborators. Global, regional, and national burden of traumatic brain injury and spinal cord injury, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. Lancet Neurol 2019;18:56-87.
2. Taylor C, Bell JM, Breiding MJ, Xu L. Traumatic brain injury–related emergency department visits, hospitalizations, and deaths—United States, 2007 and 2013. MMWR Surveill Summ 2017;66:1-16.
3. Masel BE, DeWitt DS. Traumatic brain injury: a disease process, not an event. J Neurotrauma 2010;27:1529-40.
4. MacDonald S. Introducing the model of cognitive-communication competence: a model to guide evidence-based communication interventions after brain injury. Brain Inj 2017;31:1760-80.
5. Greenaway K, Gallois C, Haslam SA. Social psychological approaches to intergroup communication. Oxford research encyclopedia of communication. Oxford: Oxford University Press; 2017.
6. Togher L. Training communication partners of people with TBI: communication really is a two way process. In: McDonald S, Leanne T, Chris C, editors. Social and communication disorders following traumatic brain injury. 2nd ed. New York: Psychology Press; 2014. p 336-60.
7. Togher L, McDonald S, Coehlo CA, Byom L. Cognitive-communication disability following TBI: examining disocurse, pragmatics, behaviour and exectuive functioning. In: McDonald S,

Leanne T, Chris C, editors. Social and commuication disorders following traumatic brain injury. 2nd ed. London and New York: Psychology Press; 2014. p 89-118.
8. Togher L, McDonald S, Code C. Social and communication disorders following traumatic brain injury. In: McDonald S, Leanne T, Chris C, editors. Social and communication disorders following traumatic brain injury. 2nd ed. London and New York: Psychology Press; 2014. p 1-26.
9. Douglas J, Bracey CA, Snow PC. Return to work and social communication ability following severe traumatic brain injury. J Speech Lang Hear Res 2016;59:511-20.
10. Johnson JE, Turkstra LS. Inference in conversation of adults with traumatic brain injury. Brain Inj 2012;26:1118-26.
11. MacDonald S, Wiseman-Hakes C. Knowledge translation in ABI rehabilitation: a model for consolidating and applying the evidence for cognitive-communication interventions. Brain Inj 2010;24:486-508.
12. Lê K, Mozeiko J, Coelho C. Discourse analyses: characterizing cognitive-communication disorders following TBI. ASHA Leader 2011;16:18-21.
13. Wiseman-Hakes C, Stewart M, Wasserman RA, Scheuller R. Peer group training of pragmatic skills in adolescents with acquired brain injury. J Head Trauma Rehabil 1998;13:23-8.
14. Dahlberg C, Hawley L, Morey C, Newman J, Cusick CP, Harrison-Felix C. Social communication skills in persons with post-acute traumatic brain injury: three perspectives. Brain Inj 2006;20:425-35.
15. Wiseman-Hakes C, Saleem M, Poulin V, Nalder E, Balachandran P, Gan C, Colantonio A. The development of intimate relationships in adolescent girls and women with traumatic braininjury: a framework to guide gender specific rehabilitation and enhance positive social outcomes. Disabil Rehabil 2019:1-8.
16. Malec J, Van Houtven CH, Tanielian T, Atizado A, Dorn MC. Impact of TBI on caregivers of veterans with TBI: burden and interventions. Brain Inj 2017;31:1235-45.
17. Colantonio A, Vanderlaan R, Parsons D, Zagorski B. Poster 90: addressing inequities for acquired brain injury care: strategic use of administrative data in a publicly insured population. Arch Phys Med Rehabil 2009;90:e39.
18. Nonterah C, Jensen BJ, Perrin PB, Stevens LF, Cabrera TV, Jiménez-Maldonado M, Arango-Lasprilla JC. The influence of TBI impairments on family caregiver mental health in Mexico. Brain Inj 2013;27:1287-93.
19. Thomsen IV. Evaluation and outcome of aphasia in patients with severe closed head trauma. J Neurol Neurosurg Psychiatry 1975;38:713-8.
20. Levin H, Grossman RG, Rose JE, Teasdale G. Long-term neuropsychological outcome of closed head injury. J Neurosurg 1979;50:412-22.
21. Togher L, McDonald S, Tate R, Rietdijk R, Power E. The effectiveness of social communication partner training for adults with severe chronic TBI and their families using a measure of perceived communication ability. Neuro-Rehabilitation 2016;38:243-55.
22. Douglas JM. Relation of executive functioning to pragmatic outcome following severe traumatic brain injury. J Speech Lang Hear Res 2010;53:365-82.
23. Togher L, Wiseman-Hakes C, Douglas J, et al. INCOG Expert Panel. INCOG recommendations for management of cognition following traumatic brain injury, part IV: cognitive communication. J Head Trauma Rehabil 2014;29:353-68.
24. Ylvisaker M, Feeney TJ, Urbanczyk B. A social-environmental approach to communication and behavior after traumatic brain injury. Semin Speech Lang 1993;14:74-86.
25. Simmons-Mackie N, Raymer A, Armstrong E, Holland A, Cherney L. Communication partner training in aphasia: a systematic review. Arch Phys Med Rehabil 2010;91:1814-37.
26. Simmons-Mackie NN, Kearns KP, Potechin G. Treatment of aphasia through family member training. Aphasiology 2005;19:583-93.
27. Mann K, Power E, Barnes S, Togher L. Questioning in conversations before and after communication partner training for individuals with traumatic brain injury. Aphasiology 2015;29:1082-109.
28. Wiltshire G, Ehrlich C. Is conversation partner training effective in assisting individuals with a traumatic brain injury to display improved communication outcomes? J Soc Incl Stud 2014;5:9-26.
29. WHO. International classification of functioning, disability and health: ICF. Geneva, Switzerland: WHO; 2001.
30. Ylvisaker M. Context-sensitive cognitive rehabilitation after brain injury: theory and practice. Brain Impair 2003;4:1-16.
31. Goldblum G, Alant E. Sales assistants serving customers with traumatic brain injury. Aphasiology 2009;23:87-109.
32. WHO. Neurological disorders: public health challenges. Geneva, Switzerland: WHO; 2006.
33. Elbourn E, Togher L, Kenny B, Power E. Strengthening the quality of longitudinal research into cognitive-communication recovery after traumatic brain injury: a systematic review. Int J Speech Lang Pathol 2017;19:1-16.
34. Ylvisaker M, Turkstra LS, Coelho C. Behavioral and social interventions for individuals with traumatic brain injury: a summary of the research with clinical implications. Semin Speech Lang 2005;26:256-67.
35. Eunson B. Gender and communication, Communicating in the 21st century. 2nd ed. Milton, Queensland, Australia: John Wiley and Sons; 2008. p 803.
36. Colantonio A, Harris JE, Ratcliff G, Chase S, Ellis K. Gender differences in self-reported long term outcomes following moderate to severe traumatic brain injury. BMC Neurol 2010;10:102.
37. Munivenkatappa A, Agrawal A, Shukla DP, Kumaraswamy D, Devi BI. Traumatic brain injury: does gender influence outcomes? Int J Critical Illn Inj Sci 2016;6:70-3.
38. Byom LJ, Turkstra L. Effects of social cognitive demand on theory of mind in conversations of adults with traumatic brain injury. Int J Lang Commun Disord 2012;47:310-21.
39. Despins E, Turkstra LS, Struchen MA, Clark AN. Sex-based differences in perceived pragmatic communication ability of adults with traumatic brain injury. Arch Phys Med Rehabil 2016;97:S26-32.
40. NIHR. PROSPERO: International prospective register of systematic reviews. Available at: https://www.crd.york.ac.uk/prospero/. Accessed March 28, 2019.
41. Togher L, Power E, Rietdijk R, McDonald S, Tate R. An exploration of participant experience of a communication training program for people with traumatic brain injury and their communication partners. Disabil Rehabil 2012;34:1562-74.
42. Togher L, McDonald S, Code C, Grant S. Training communication partners of people with traumatic brain injury: a randomised controlled trial. Aphasiology 2004;18:313-35.
43. Shelton C, Shryock M. Effectiveness of communication/interaction strategies with patients who have neurological injuries in a rehabilitation setting. Brain Inj 2007;21:1259-66.
44. Behn N, Togher L, Power E, Heard R. Evaluating communication training for paid carers of people with traumatic brain injury. Brain Inj 2012;26:1702-15.
45. Sim P, Power E, Togher L. Describing conversations between individuals with traumatic brain injury (TBI) and communication partners following communication partner training: using exchange structure analysis. Brain Inj 2013;27:717-42.

46. Togher L, McDonald S, Tate R, Power E, Rietdijk R. Training communication partners of people with severe traumatic brain injury improves everyday conversations: a multicenter single blind clinical trial. J Rehabil Med 2013;45:637-45.
47. Behn N, Togher L, Power E. Experiences from a communication training programme of paid carers in a residential rehabilitation centre for people with traumatic brain injury. Brain Inj 2015;29:1554-60.
48. Hoepner J, Olsen S. Joint video self-modeling as a conversational intervention for an individual with traumatic brain injury and his everyday partner: a pilot investigation. Clin Arch Commun Disord 2018;3:22-41.
49. Rietdijk R, Power E, Brunner M, Togher L. A single case experimental design study on improving social communication skills after traumatic brain injury using communication partner telehealth training. Brain Inj 2019;33:94-104.
50. Moher D, Liberati A, Tetzlaff J, Altman DG. The PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. BMJ Open 2009;339:b2535.
51. CEBM. OCEBM levels of evidence. Available at: http://www.cebm.net/index.aspx?o=5653. Accessed May 22, 2019.
52. Higgins J, Altman DG, Gøtzsche PC, et al. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. BMJ 2011;343:d5928.
53. Sterne J, Hernán MA, Reeves BC, et al. ROBINS-I: a tool for assessing risk of bias in non-randomized studies of interventions. Med Monatsschr Pharm 2017;40:175-7.
54. Tate R, Rosenkoetter U, Wakim D, et al. The Risk-of-Bias in N-of-1 Trials (RoBiNT) scale: an expanded manual for the criticalappraisal of single-case reports. Sydney, Australia: The PsycBITE Group; 2015.
55. Togher L, McDonald S, Tate R, Power E, Ylvisaker M, Rietdijk R. TBI Express: a social communication training manual for people with TBI and their communication partners. Sydney, Australia: Australian Society for the Study of Brain Impairment; 2010.
56. Willyard C, Scudellari M, Nordling L. How three research groups are tearing down the ivory tower. Nature 2018;562:24-8.
57. Wiseman-Hakes C, MacDonald S, Keightley M. Perspectives on evidence based practice in ABI rehabilitation. "Relevant Research": who decides? NeuroRehabilitation 2010;26:355-68.
58. Bogner J, Corrigan JD, Yi H, et al. Lifetime history of traumatic brain injury and behavioral health problems in a population-based sample. J Head Trauma Rehabil 2019;35:E43-50.
59. Hwang S, Colantonio A, Chiu S, et al. The effect of traumatic brain injury on the health of homeless people. CMAJ 2008;179:779-84.
60. Durand E, Chevignard M, Ruet A, Dereix A, Jourdan C, Pradat-Diehl P. History of traumatic brain injury in prison populations: a systematic review. Ann Phys Rehabil Med 2017;60:95-101.