*Original Article*

# The Cognitive Orientation to Daily Occupational Performance Approach and Transfer: A Scoping Review

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**Abstract**

Transferring learning from therapy to everyday life skills is a necessary step for successful therapy outcomes, yet rarely addressed and achieved. However, a cognitive approach to skill acquisition, and the Cognitive Orientation to daily Occupational Performance (CO-OP), explicitly identifies transfer as an objective and incorporates elements into the intervention to support transfer. A scoping review was undertaken to explore the nature and extent of the research regarding CO-OP and transfer. An online search of 10 databases was conducted to identify and examine research studies reporting on CO-OP and transfer. The search yielded 25 documents that addressed CO-OP and transfer. The studies used a variety of approaches to evaluate transfer; all reported transfer on at least one and, in many cases, multiple transfer outcome variables. The CO-OP literature addresses transfer across a variety of populations and settings using a variety of approaches. Further work is required to establish a common approach to examining transfer in the CO-OP literature and the literature in general.

**Keywords**

evidence-based practice, occupational performance, rehabilitation, intervention

A primary goal of rehabilitation is improvement in daily skill performance in the real world. This usually requires that the learning from skills acquired in clinical settings is applied to untrained skills outside of the therapeutic environment, most commonly referred to as "transfer" of learning. The importance of transfer cannot be overstated. Unfortunately, transfer is notoriously difficult to attain (Eiriksdottir & Catrambone, 2011; Geusgens, Winkens, van Heugten, Jolles, & van den Heuvel, 2007; Krakauer, 2006); most interventions, if they address it, fail to demonstrate transfer of learning (Ylvisaker, Turkstra, & Coelho, 2005; Zelinski, 2009). As Krakauer (2006) has noted, "training subjects on a task repeatedly in the clinic may lead to improved performance in that particular task but not transfer to any other activities of daily living (ADL) when they get back home" (p. 85).

An important exception may be the Cognitive Orientation to daily Occupational Performance approach (CO-OP; CO-OP Approach™), which specifically identifies transfer as an objective; CO-OP studies frequently include an evaluation of transfer. The purpose of this study was to examine the nature and extent of transfer in the published CO-OP literature. We begin with an overview of transfer and a brief description of the CO-OP Approach™, and then present the findings from a scoping review of studies addressing transfer in the CO-OP literature.

## An Overview of Transfer

Transfer of skill from previous learning to new learning is discussed in many bodies of literature, including motor learning, education/psychology, human resources (HR), and rehabilitation, often in different ways. In motor learning, where transfer is considered a primary objective (Adams, 1987; Levin, Weiss, & Keshner, 2015), it is commonly defined as the degree to which learning one motor skill influences the learning of another skill or a variation of that skill across time (Mussgens & Ullen, 2015), for example, from initially throwing an object to one point, then transferring that skill to throwing to a point further away (Sanli & Lee, 2015). In the psychology/educational literature, definitions of transfer involve the ability to apply knowledge obtained in the classroom to another context or concept (Perkins & Salomon, 2012). Within the HR literature, transfer has been defined as the generalization

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of knowledge gained from HR training to its use in the actual workplace, as well as maintenance of this over time (Baldwin & Ford, 1988; Burke & Hutchins, 2007). As can be seen from the above, in the literature, the term *transfer* is variably used to refer to previous learning being applied to new skills, to new contexts, or both. In the book introducing CO-OP, Polatajko and Mandich (2004) distinguish between applying learning to new skills and to new contexts, referring to the former as transfer and the latter as generalization. They indicate that transfer "refers to the degree to which learning one skill influences the learning of another skill . . ." (Polatajko & Mandich, 2004, pp. 32-33). This is consistent with the definition of transfer provided in the rehabilitation science literature by Geusgens (2007) in her comprehensive overview of transfer as it relates to cognitive rehabilitation, that is, transfer is ". . . the way in which prior learning affects new learning or performance" (p. 11).

## Operational Definition and Evaluation of Transfer

Transfer is a complex process (Rienhoff et al., 2013) and reaching a consensus on a definition and evaluation of transfer is a difficult undertaking (Barnett & Ceci, 2002). Recognizing the difficulties of defining transfer, we chose to draw on the definition from Geusgens (2007) and that cited by the CO-OP authors, Polatajko and Mandich (2004), to develop our operational definition. For the purposes of this review, we defined transfer as occurring when learning one skill influences the learning of a new skill, allowing the learner to draw on previous experiences to perform new skills. For example, transfer can be seen in the soccer coaching literature when it is noted that once an "instep pass" is learned at a particular speed, height, distance, and direction, it still needs to still be practiced at different speeds, heights, distances, and directions (Williams & Hodges, 2005). Also for the purposes of this scoping review, we accepted as indicators of transfer any data related to the performance of a skill that was not the direct target of the intervention. To operationalize that further, we drew on a review of transfer in cognitive rehabilitation by Geusgens (2007) in which it is suggested that transfer can be measured by examining untrained skills, daily tasks that are tested in a standardized manner, or daily life outcomes provided by clients, caregivers, and staff that can include self-ratings or daily logs. Making a distinction between formal measures and anecdotal data, we identified four indicators of transfer (Figure 1):

1. Performance data on untrained skills—that is, skills that were not the focus of intervention.
2. Scores from standardized assessments of activities, skills, or performance components.
3. Scores from validated patient (family)-reported outcome measures of health status, health-related quality of life, participation, emotion, or self-efficacy.
4. Anecdotal reports.

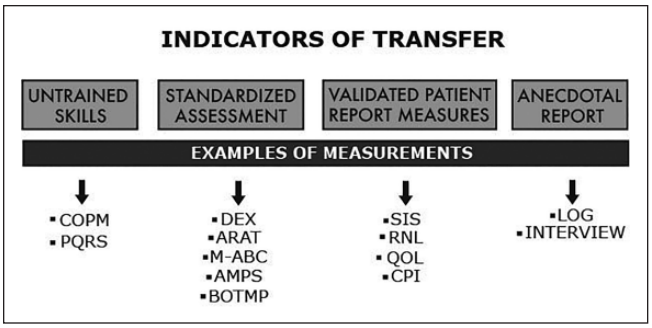


**Figure 1.** Summary of the indicators of transfer.
*Note.* COPM = Canadian Occupational Performance Measure; DEX = Dysexecutive Questionnaire; SIS = Stroke Impact Scale; PQRS = Performance Quality Rating Scale; ARAT = Action Research Arm Test; RNL = reintegration to normal daily life; MABC = Movement Assessment Battery for Children; QOL = Flanagan's Quality of Life Scale; AMPS = Assessment of Motor and Process Skills; CPI = Community participation index; BOTMP = Bruininks–Oseretsky Test of Motor Impairment; LOG = activity log.

## CO-OP

The CO-OP Approach™ is a customized cognitive-based, client-centered, task-specific training approach that has four identified objectives: skill acquisition, strategy use, generalization, and transfer. In CO-OP, both the transfer of skills and strategies used are targeted. CO-OP represents a departure from typical task-specific approaches in several important ways, three of which are highlighted here. First, CO-OP employs a *problem-solving framework*, captured by a global strategy "GOAL-PLAN-DO-CHECK" (GPDC; Meichenbaum, 1977). This framework entails establishing a goal (GOAL), making a plan for achieving that goal incorporating specific strategies (PLAN), carrying out the plan (DO), and then evaluating whether or not the plan was employed and, if so, whether or not it was effective (CHECK). If the PLAN was not effective (i.e., GOAL was not attained), the client is guided to modify it to identify new potential strategies and the process is repeated. Second, CO-OP applies the problem-solving framework using *guided discovery* as the instructional approach to identifying cognitive strategies to improve performance. Guided discovery is discussed primarily in the educational and psychological literature as a method of instruction that sits in the middle ground between direct teaching and pure discovery learning (Mayer, 2004). In a guided discovery approach, the learner is encouraged to self-discover but works under the close guidance of an instructor, or as in the case of CO-OP, usually an occupational or physical therapist. Learners are not provided with answers; rather, they are

guided toward finding a strategy that works for them. Third, throughout CO-OP, a process of *dynamic performance analysis* (DPA) is used to ascertain where the performance is breaking down and identify potential strategies that may improve performance (Polatajko, Mandich, Miller, & Macnab, 2001). DPA is a structured method of "understanding" the performance by scrutinizing and describing its breakdown, and differs from typical task analysis in that it avoids assigning causality of performance breakdowns to underlying impairments such as weakness, poor coordination, inattention, or memory deficits.

CO-OP is different from typical task-specific approaches in one other important way. Unlike many approaches, CO-OP embeds transfer techniques into the approach: the CO-OP literature frequently reports on transfer of learning (Scammell, Bates, Houldin, & Polatajko, 2016). The purpose of this review was to explore the nature and extent of transfer in the published CO-OP literature. To achieve this objective, we posed three questions:

**Research Question 1:** What is the nature of the literature addressing CO-OP and transfer?
**Research Question 2:** Which transfer outcomes are reported in the CO-OP literature?
**Research Question 3:** What is the nature of the findings reported regarding transfer following CO-OP intervention?

## Method

A scoping review approach, as described by Arksey and O'Malley (2005), was used. Through an examination of the breadth of the literature, a key aim of a scoping review is to consolidate research outcomes and to determine the "gaps" within a particular literature. In providing an overview across studies, a new interpretation of the study outcomes may emerge. Levac and colleagues (2010) acknowledge the relevance of this type of review within the Rehabilitation Sciences, in which randomized control trials (RCTs) may be limited and case studies are more common. The methodological framework designed by Arksey and O'Malley was used to conduct this review; this included (a) identification of the research question, (b) identification of studies relevant to the research question, (c) selection of studies, (d) data charting, and (e) collation and summary of results. To conduct this scoping review, we applied the Population, Intervention, Comparison, Outcome (PICO) framework (Richardson, Wilson, Nishikawa, & Hayward, 1995). The literature was searched for intervention studies with any adult or child population (P), in which CO-OP was the primary intervention under investigation (I), with or without comparison with control interventions (C), and in which transfer was addressed as an outcome (O). For the purposes of this study, outcomes were deemed to be "transfer outcomes" if they met either of the following criteria: (a) the authors specifically indicated that a particular outcome or measure was used to evaluate transfer, or (b) the measures reported fell under one of the four broad evaluation indicators of transfer we described above.

To form the initial list of articles, a search was conducted using the terms "cognitive orientation to daily occupational performance" and "cognitive orientation to occupational performance," in the following search engines: CINAHL, MEDLINE, COCHRANE library, EMBASE (1980-2016), Scopus, AMED, Proquest, PsychInfo (1806-present), Pubmed, and Web of Science. From that list, the inclusion criteria were (a) use of the term "cognitive orientation to [daily] occupational performance" in the body of the document, (b) written in English, (c) >100 words on CO-OP, and (d) an experimental research study. The exclusion criteria were reviews, study protocols, discussion papers, and non-journal documents (i.e., books, dissertations, newspaper articles, presentations, abstracts, conference documents, and magazine articles, etc.). The reference lists of the articles identified through this search were hand searched to ensure no articles were missed or included duplicates. Articles previously known to the authors were also included. Next, a second exclusion was applied by following the PICO criteria described above, resulting in the final list of articles for full-text review.

Prior to extracting data, two raters (A.H. and M.H.) independently classified the articles into criterion (A) articles that addressed transfer, according to the criteria described above, even though the authors did not specifically indicate that the data they reported addressed transfer outcomes, or (B) articles that explicitly reported on transfer. For any discrepancies in article sorting among the raters, the articles in question were read again in full and issues were discussed until a consensus was reached. The full text of articles was then examined and data were extracted to answer the three research questions listed above. To describe the CO-OP literature on transfer, we extracted typical descriptors: year of publication, journal, authors, country, population addressed, sample size, research question, design, intervention delivery, skills addressed, outcome measures, and findings. To identify the indicators of transfer, we applied the classification system described above. To explore the findings regarding transfer, we both noted the findings for each indicator of transfer, as reported, and explored the results according to their contribution to the literature.

## Results

**Objective 1:** "What is the nature of the literature that addresses CO-OP and transfer?"

Figure 2 displays a flowchart of articles considered for the review and the process of selecting/eliminating relevant articles. Initially, 347 articles were identified, plus an additional eight articles known to the authors. A total of 211 duplicate

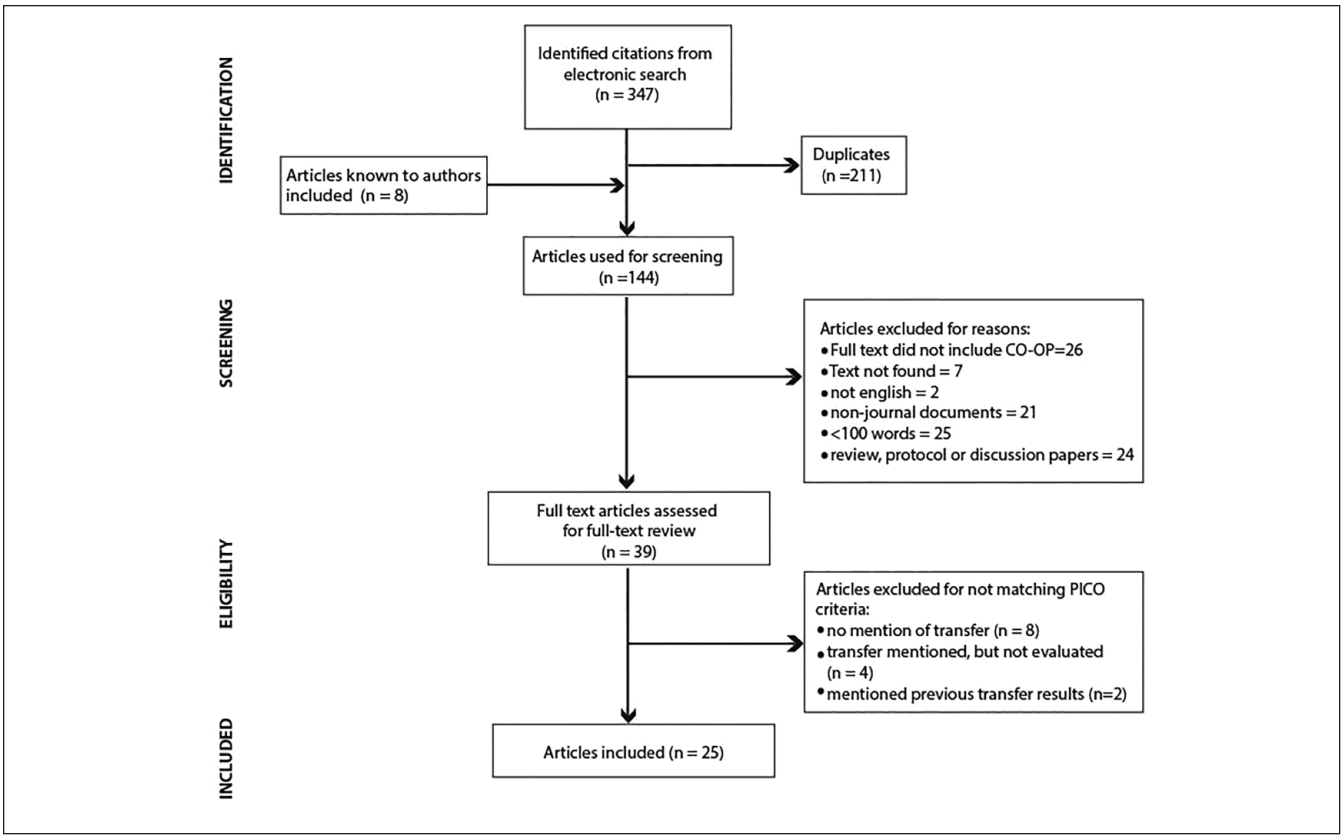


**Figure 2.** PRISMA flowchart of inclusion and exclusion of studies for this review.
*Note.* PRISMA = preferred reporting items for systematic reviews and meta-analyses; CO-OP = cognitive orientation to daily occupational performance; PICO = population, intervention, comparison, outcome.

documents were excluded. An additional 105 articles were removed according to the exclusion criteria, leaving 39 articles identified for full-text review. Of those, 14 were excluded based on the PICO criteria or exclusion criteria: (a) articles that neither mentioned transfer nor provided data on transfer outcomes ($n = 8$); (b) articles that mentioned transfer but did not evaluate it, as per our definition ($n = 4$); and (c) articles that discussed the transfer results previously reported in other articles ($n = 2$).

At the time of the final article count for this study (April 2016), the CO-OP literature on transfer consisted of 25 articles, nine meeting Criterion A and 16 meeting Criterion B. They were published between 2001 and April 2016, in a variety of journals in five countries (Canada, America, Australia, Hong Kong, and Iran). The articles, in all but one case (Chan, 2007), had multiple authors involved, 65 different authors in total. In a number of cases, the articles came from the same lab and one of the authors appeared on 15 of the articles. All reported data were based on intervention studies with two using secondary analyses and 23 reporting original data. In three cases, the studies reported on the same participants as previous studies but in each case the data reported had not been reported in the earlier study.

The studies addressed eight populations with a broad range of sample sizes (see Table 1). The earlier CO-OP studies were exclusively with child participants (Table 2), beginning with the study of children with developmental coordination disorder (DCD, $n = 8$ studies) and followed by the study of children with Asperger's ($n = 3$ studies), pediatric acquired brain injury (ABI, $n = 1$ study), and attention deficit hyperactivity disorder (ADHD, $n = 1$ study). As of 2009, studies began to address adult populations including stroke ($n = 7$ studies), traumatic brain injury (TBI, $n = 4$ studies), and subjective mild cognitive difficulty ($n = 1$ study).

The majority of skills trained were motor, or daily life skills requiring motor skills (e.g., catching a ball, using kitchen utensils); a few evaluated cognitive skills related to problem solving and attention during daily life tasks. The vast majority of studies examined the CO-OP intervention in a one-on-one face-to-face format. However, there were examples of CO-OP being delivered one-on-one in tele-rehabilitation (Ng, Polatajko, Marziali, Hunt, & Dawson, 2013), in group settings (Thornton et al., 2015), and in a group via their parents (Chan, 2007).

All Criterion B articles (16) were examined for how the authors defined transfer or, when no definition was provided (Criterion A), how they described transfer (see Table 3). As

**Table 1.** Main Outcomes Listed for Each Article in Review.

| First author | Year of publication | Population | *n* | Age group | Control group type | Design of transfer component of study | Main transfer outcomes |
|---|---|---|---|---|---|---|---|
| Studies without control condition | | | | | | | |
| McEwen | 2010b | Stroke | 5 | Adult | × | | Interviews provide examples of skills not trained in the intervention attempted at home |
| Chan | 2007 | DCD | 6 | Children | × | | The differences in AMPS motor and process scores pre- and postintervention were statistically significant. The difference in the fine motor component of the BOTMP score was not significant. |
| Green | 2008 | DCD | 43 | Children | × | | MABC total impairment outcomes improved (greater than 4 points). |
| Rodger | 2007 | Asperger's | 2 | Children | × | | Parent diary entries provide examples of improved performance on tasks not addressed in intervention. |
| Rodger | 2008 | Asperger's | 2 | Children | × | | Parent rating for Child 1 improved from fewer social skills to average. Child's own rating improved, but remained at average level. For Child 2, no SSRS category changes occurred. |
| Rodger | 2009 | Asperger's | 2 | Children | × | | Both children showed improvement on VABS, degree of improvement variable. However, the daily living, socialization, and composite scores of both children remained below 1st percentile. |
| Ward | 2004 | DCD | 2 | Children | × | | VABS—communication, daily living, composite score—improved for both participants. No change for either child on the VMI. |
| Henshaw | 2011 | Stroke | 2 | Adult | × | | Improvement of 10 points or more on SIS Recovery (1), strength (1), emotion (1). Both improved on FIM and one on RNL. Decrease on SIS: hand function (2), communication (1), memory (1). No change on CES-D or ACS. |
| Dawson | 2009 | TBI | 3 | Adult | × | | With a change of at least 2 points considered meaningful on the COPM, self-report of perceived performance improved for 4/7 skills and for satisfaction for 7/7 skills. Significant others' reports showed improvement on performance for 2/7 skills and for satisfaction, 3/7 skills. Two participants improved on the DEX. |
| McEwen | 2009 | Stroke | 3 | Adult | × | | Posttest significance for SIS domains: physical and hand (×2 participants), participation (1), overall (1), SEM (1), ABC (1). Decrease of clinical significance for SIS emotional (1), hand (1). Follow-up—significance for SEM (1), SIS physical (1), ADL (2), hand (2), overall (1), participation (2), ABC (1). Decrease for SIS emotional (1). |
| Missiuna | 2010 | ABI | 6 | Children | × | | VABS—all domains—statistically significant at posttest for average of all participants |
| Ng | 2013 | TBI | 3 | Adult | × | | 1-2 participants showed significant improvement on DEX, QOL, MPAI. One participant improved to criterion at posttest and follow-up for all untrained goals for COPM performance, other did not improve at post or follow-up. Two subjects improved on COPM satisfaction at follow-up, other did not. No significance on DEX, QOL, MPAI maintained at follow-up except one. Interviews revealed transfer demonstrated outside of therapy. |
| Skidmore | 2011 | Acute stroke | 1 | Adult | × | | All assessment scores improved to varying amount, most notably, NIHSS from moderate to minor stroke (7 to 3). HRSD from less than normal to normal (13 to 6) range. FIM clinically significant by 29 points. PASS improved by 1.8 on 4-point scale. Engagement score from 3 to 5 points. |
| Studies with a control condition—Person as own control | | | | | | | |
| Gharebaghy | 2015 | ADHD | 6 | Children | × | SCED multiple baseline | BOTMP improved in all participants except one. All pre–post COPM satisfaction and performance scores improved greater than 2 points (with the exception of one child's goal that improved by 1 point) in both children and parent scores. Many instances were greater than 4 to as much as 8 points. |
| McEwen | 2010a | Stroke | 3 | Adult | × | SCED multiple baseline | 10 points or greater improvement on SIS domains for physical (1 participant), cognitive (1 participant), mobility (1 participant), hand (all 3 participants). All improved on one or more of CMSA domains. SEM and ABC improved in all participants for posttest. COPM performance and satisfaction improved by 2 or more points for and all skills all participants except one. All PQRS for untrained tasks improved significantly above baseline and standard deviations for follow-up. Posttests improved but were mostly within *SD* range. MAL did not improve at posttest but did at follow-up on amount of use and quality of movement of affected arm. RNL score demonstrated a drop at posttest and follow-up. |

*(continued)*

**Table 1. (continued)**

| First author | Year of publication | Population | *n* | Age group | Control group type | Design of transfer component of study | Main transfer outcomes |
|---|---|---|---|---|---|---|---|
| Studies with control condition—Control Group | | | | | | | |
| Dawson | 2013 | Chronic TBI | 13 | Adult | No treatment | Partially randomized RCT—double blind | Significant difference for untrained goals on COPM performance and satisfaction, compared with control group, with large effect size. Significant difference in favor of CO-OP on MPAI general participation, large effect size. DEX and AMPs were not significantly different between groups, small effect size. |
| Dawson | 2014 | subjective cognitive | 19 | Adult | No treatment | RCT | Statistically significant for self-efficacy posttest and follow-up for CO-OP group, small effect size and no between-group differences with control. Half the CO-OP group improved on COPM performance and satisfaction, (clinically) significantly more than control (20%) for performance. Not maintained at follow-up. Variable results for remainder of tests including General Health Behaviors and DKEFs. Four participants decreased scores of perceived performance on COPM. |
| Hyland | 2012 | DCD | 13 | Children | CTA | Secondary analysis | No significant differences between groups on number of DPAs during observation of skipping videos. However, within-and between-group descriptive statistics show CO-OP group used more Level-2 DPAs spontaneously, CTA group had no spontaneity. |
| McEwen | 2015 | stroke | 26 | Adult | usual care (UC) | Exploratory RCT—single blind | PQRS improved post and follow-up with large effect sizes (1.2, 1.1, respectively). COPM satisfaction improved, small effect size. SIS participation and SEG improved for CO-OP, moderate effect size. CPI, importance of participation improved for CO-OP, small effect size. Control over participation and satisfaction with participation improved for CO-OP (medium and small effect size, respectively). |
| Miller | 2001 | DCD | 20 | Children | CTA | RCT | Both CO-OP and CTA increased significantly on VABS Composite and Socialization. CO-OP increased significantly more than CTA on VABS communication and motor, and approached significance for daily living skills. Both groups increased on all BOTMP domains. Both approached significance on developmental test of VMI. Neither improved on SPPC. |
| Polatajko | 2001 | DCD | 10 | Children | CTA | RCT | All VABS scores showed significant improvement. VMI (small effect size) and TOMI (medium effect size) not significant. |
| Poulin | 2017 | severe TBI | 9 | Adult | Computer training | Partial RCT | COPM performance improved at posttest in both groups, though not statistically significant. COPM satisfaction improved and had large effect sizes in both groups. Significant others' ratings had large effect sizes for performance and satisfaction of both groups. Mann–Whitney U test showed no significant differences between groups. Variable results for CWIT, self-efficacy, LIFE-H and TMT (DKEFs). DEX improved with large effect size for CO-OP group, but between-group differences not significant. |
| Sangster | 2005 | DCD | 18 | Children | CTA | Secondary analysis | CO-OP generated significantly more strategies than CTA at posttest during observation of video skipping. |
| Thornton | 2015 | DCD | 20 | Children | No treatment | Quasi (stratified)-experimental RCT | At posttest: CO-OP group had significantly less range of motion in overflow arm at shoulder, elbow, wrist, compared with control; clip pinching test significantly better. CO-OP scored significantly higher than control for handwriting speed and word legibility. No difference between groups on pegboard task, MABC or letter legibility. Positive results on parent satisfaction survey. |
| Wolf | 2016 | Stroke | 26 | Adult | Usual care | Exploratory RCT—single blind | Greater improvement for CO-OP over UC for SIS × SIS domains that were not reported in McEwen et al., 2015: ADLs (medium effect size), hand function (medium effect size, also at follow-up), SIS (medium effect size and small at follow-up), recovery (large effect size), physical, emotion, memory, communication (medium effect size). ARAT and ARAT impairment improved, small and medium at post and follow-up, respectively. DKEFS condition 4, medium effect size at post and follow-up. |

*Note.* Study design: DCD = developmental coordination disorder; AMPS = assessment of motor and process skills; BOTMP = Bruininks–Oseresky test of motor proficiency; MABC = Movement Assessment Battery for Children (previously known as the TOMI = Test of Motor Impairment); SSRS = Social Skills Rating Scale; VABS = Vineland Adaptive Behavior Scales; CO-OP = cognitive orientation to daily occupational performance; VMI = Beery–Buktenica developmental test of visual motor integration; SIS = Stroke Impact Scale; RNL = reintegration to normal daily life; CES-D = Center for Epidemiological Studies Depression Scale; ACS = activity card sort; TBI = traumatic brain injury; COPM = Canadian occupational performance measure; DEX = Dysexecutive Questionnaire; SEM = Stanford self-efficacy for managing chronic disease; ABC = Activity Specific Balance Confidence Scale; ADL = activities of daily living; ABI = acquired brain injury; QOL = Flanagan's Quality of Life Scale; MPAI = Mayo-Portland Adaptability Inventory–4 participation index; NIHSS = National Institutes of Health Stroke Scale; PASS = Performance Assessment of Self-Care Skills; ADHD = attention deficit hyperactivity disorder; SCED = single-case experimental design; Assessments; CMSA = Chedoke–McMaster Stroke Assessment; PQRS = Performance Quality Rating Scale; MAL = motor activity log; RCT = randomized control trial; DKEFS = Delis-Kaplan executive function system (subcomponents—TMT = Trail-Making Test; CWIT = Color Word Interference Test); CTA = contemporary treatment approach; DPA = dynamic performance analysis; ;SEG = self-efficacy gauge; CPI = Community Participation Index; FIM = Functional Independence Measure; HRSD = Hamilton Rating Scale for Depression; LIFE-H = Assessment of Life Habits; ARAT = action research arm task; SPPC = self-perception profile for children.

**Table 2.** List of Articles in Chronological Order.

| First author | Year | Population | Life span | Indicator of transfer |
|---|---|---|---|---|
| Miller | 2001 | DCD | Child | 2,3,4 |
| Polatajko | 2001 | DCD | Child | 3,4 |
| Ward | 2004 | DCD | Child | 2,3 |
| Sangster | 2005 | DCD | Child | 1b |
| Rodger | 2007 | Asperger's | Child | 4 |
| Chan | 2007 | DCD | Child | 2 |
| Rodger | 2008 | Asperger's | Child | 3,4 |
| Green | 2008 | DCD | Child | 2 |
| Dawson | 2009 | TBI | Adult | 1,2,4 |
| Rodger | 2009 | Asperger's | Child | 3 |
| McEwen | 2009 | Stroke | Adult | 3 |
| McEwen | 2010a | Stroke | Adult | 1,2,3 |
| McEwen | 2010b | Stroke | Adult | 4 |
| Skidmore | 2011 | Acute stroke | Adult | 2,3,4 |
| Missiuna | 2010 | ABI | Child | 3 |
| Henshaw | 2011 | Stroke | Adult | 2,3 |
| Hyland | 2012 | DCD | Child | 1b |
| Ng | 2013 | TBI | Adult | 1,2,3,4 |
| Dawson | 2013 | Chronic TBI | Adult | 1,2,3 |
| McEwen | 2015 | Stroke | Adult | 1,3 |
| Dawson | 2014 | Cognitive difficulties | Adult | 1,2,3 |
| Gharebaghy | 2015 | ADHD | Child | 1,2 |
| Thornton | 2015 | DCD | Child | 1,2 |
| Poulin | 2017 | Severe TBI | Adult | 1,2,3 |
| Wolf | 2016 | Acute stroke | Adult | 2,3 |

*Note.* Information includes population, life span age, and types of indictors of transfer: 1 = untrained skills; 1b = strategy; 2 = assessments of activities, skills or performance components; 3 = validated patient(family)-reported outcomes of health status, participation and emotion; 4 = anecdotal. DCD = developmental coordination disorder; TBI = traumatic brain injury; ABI = acquired brain injury, ADHD = attention deficit hyperactivity disorder.

can be seen the definitions/descriptions differed in detail, however, all addressed past learning applied to new learning. For example, McEwen et al. (2015) examined transfer "to a completely unrelated task" while Henshaw, Polatajko, McEwen, Ryan, and Baum (2011) referred to the difference in material used as an indicator of transfer, such as light to heavyweight jeans for sewing or different types of earrings.

Criterion A articles ($N$ = 9) were deemed to addressed transfer, as we have defined for the purposes of this study, in a variety of ways. For example, while Skidmore et al. (2011) did not label improvements on the Functional Independence Measure (FIM; Keith, Granger, Hamilton, & Sherwin, 1987) and Performance Assessment of Self-Care Skills (PASS; Holm, Rogers, & Hemphill-Pearson, 2008) as an indication of transfer, they did remark that this was evidence of "the ability to learn and apply the meta-cognitive strategy to . . . daily activities." Similarly, in an article by Missiuna et al. (2010), the Vineland Adaptive Behavior Scales (VABS; Sparrow, Cicchetti, & Balla, 2005) score improvements were not explicitly labeled as "transfer" but were defined as ". . . [the ability] to generalize skills to other tasks and settings" (p. 216).

The 25 articles reported on numerous measures, deemed to evaluate transfer (see Table 4). In line with the CO-OP transfer objectives, we categorized the transfer outcomes as evaluating transfer of skill and transfer of strategy use. For measurements that did not fit under these categories, we created categories as outcomes that evaluate (a) foundational components that underlie strategy use and/or skill performance, such as memory or motor processes, respectively; (b) a combination of skill and foundational components; and (c) secondary effects that may result from training and influence transfer such as communication or self-efficacy.

**Objective 2:** "Which transfer outcomes are reported in the CO-OP literature?"

All four indicators of transfer listed above were found in the CO-OP literature.

1. *Performance on untrained skills*—Nine studies (see Table 2) reported on the postintervention performance of specific goals that were not the focus of treatment, referred to as "untrained goals" in some studies. In each case, at the outset of the intervention, participants were asked to identify four or five goals; three would be the focus of

**Table 3.** Statements of Transfer.

| Criterion | First author | Year | Statements related to transfer |
|---|---|---|---|
| A | Chan | 2007 | ". . . generalize the learnt skill and techniques in different daily living situations in different environments." (p. 42) |
| | Green | 2008 | ". . . transfer of skills to new situations." (p. 16) |
| | McEwen | 2009 | ". . . transfer of learning to new tasks in everyday life." (p. 1042) |
| | | | ". . . the seeming tendency for skills to continue improving after intervention withdrawal." (p. 1050) |
| | Missiuna | 2010 | "transfer to functional skills of daily living." (p. 208) |
| | | | ". . . to other tasks and settings." (p. 216) |
| | Sangster | 2005 | "As children develop, they acquire the ability to more effectively use these knowledge bases to identify and implement cognitive strategies as they encounter motor challenges in their everyday environment." (p. 69) |
| | Skidmore | 2011 | ". . . ability to learn and apply the meta-cognitive strategy to his daily activities." (p. 219) |
| | Thornton | 2015 | ". . . transfer of the strategies developed to other tasks" (p. 6) |
| | | | ". . . to other core impairments." (p. 7) |
| | Ward | 2004 | ". . . transfer of skills outside the intervention . . ." (p. 257) |
| | Wolf | 2016 | "transfer . . . beyond the specific activities trained." (p. 7) |
| B | Dawson | 2009 | ". . . transfer to other goals." (p. 117) |
| | | | ". . . to everyday behaviours." (p. 123) |
| | Dawson | 2013 | **". . . far transfer—that is, evidence that the learning that has occurred in the training can be applied in new contexts related to everyday life activities—"** (p. 1960) |
| | Dawson | 2014 | **". . . far transfer . . . whether the learning that occurred in the training could be applied in new contexts . . ."** (p. 2) |
| | Gharebaghy | 2015 | ". . . transferring the skills and strategies to the other motor based daily activities that are not addressed during intervention." (p. 14) |
| | Henshaw | 2011 | ". . . transfer of skills to the home environment." (pp. 61-62) |
| | Hyland | 2012 | "transferred to other motor skills." (p. 989) |
| | | | "to transfer knowledge learned from the intervention to other situations." (p. 996) |
| | McEwen | 2010a | **". . . intertask transfer, transfer of learning from one task or skill to a very different one . . ."** (p. 542) |
| | McEwen | 2010b | "transfer of learning to new tasks in everyday life . . . to other aspects of life." (p. 541) |
| | | | ". . . to skills unrelated to treatment goals." (p. 544) |
| | | | ". . . to the home environment." (p. 545) |
| | McEwen | 2015 | "Transfer of skills learned in rehab to novel skills . . ." (p. 530) |
| | | | **". . . far transfer (transfer to a completely unrelated task) . . ."** (p. 531) |
| | Miller | 2001 | ". . . transfer to other tasks . . ." (p. 186) |
| | | | "It is possible for treatment of specific tasks to affect performance of various behaviours, not just those treated directly." (p. 192) |
| | Ng | 2013 | **"Transfer of learning is defined as the ability to adapt and transfer the learned skills or strategies to meet the demands of the new skills that one may encounter in everyday life."** (p. 550) |
| | Polatajko | 2001 | ". . . transferred to other related skills." (p. 101) |
| | Poulin | 2017 | **"Transfer allows the individual to draw on his or her previous skills and experiences to perform untrained skills."** (p. 2) |
| | | | ". . . transfer of training effects to untrained skills—indicating that the learning that occurred in the training could be applied to perform new skills . . ." (p. 2) |
| | Rodger | 2007 | ". . . transfer of learned strategies and skills to everyday life." (p. 7, abstract) |
| | | | ". . . to new materials, contexts, situations and tasks." (p. 20) |
| | Rodger | 2008 | ". . . transfer of learned skills to new environments." (p. 23, abstract) |
| | Rodger | 2009 | ". . . generalising newly learned skills to other contexts or applying component motor skills to functional tasks." (p. 42) |

*Note.* Bolded statements are considered definitions.

intervention, the remaining would not be addressed during the course of the intervention but would be monitored. The measures used to evaluate performance were the Performance Quality Rating Scale (PQRS; Miller, Polatajko, Missiuna, Mandich, & Macnab, 2001) and/or the Canadian

**Table 4.** Organization of Measurements Used in the Studies That Evaluate Transfer of Skill, Foundational Components, a Combination of the Two, As Well As Secondary Outcomes and Strategy Use.

| Skills | Foundational | Combined | Secondary | Strategy use |
|---|---|---|---|---|
| ACS | Biomechanical analysis | CMSA | AES | DPA |
| AMPS | BOTMP | FIM | CPI | DSS |
| ARAT | DEX | MABC | General health behaviors | GPDC |
| COPM | Digitspan of WAIS | PASS | HRSD | *Anecdotal*—includes interview, activity log, and diary entry |
| Handwriting | DKEFS [TMT and CWIT] | *Anecdotal*—includes interview, activity log, and diary entry | LIFE-H | |
| Pegboard | VMI | | MPAI | |
| Clip pinching | NIHSS | | QOL | |
| PQRS | | | RNL | |
| *Anecdotal*—includes interview, activity log, and diary entry | | | SEMCD, SEG, ABC, PEGS | |
| | | | SIS | |
| | | | SPPC | |
| | | | SSRS | |
| | | | VABS | |
| | | | CES-D | |

*Note.* ACS = activity card sort; CMSA = Chedoke–McMaster Stroke Assessment; AES = Apathy Evaluation Scale; DPA = dynamic performance analysis; AMPS = assessment of motor and process skills; BOTMP = Bruininks–Oseretsky Test of Motor Impairment; FIM = Functional Independence Measure; CPI = Community Participation Index; DSS = domain specific strategies; ARAT = action research arm task; DEX = Dysexcutive Questionnaire; MABC = Movement Assessment Battery for Children (previously known as TOMI = Test of Motor Impairment); GPDC = GOAL-PLAN-DO-CHECK; COPM = Canadian Occupational Performance measure; WAIS = Wechsler Adult Intelligence Scale; PASS = Performance Assessment of Self-Care Skills; HRSD = Hamilton Rating Scale for Depression; DKEFS = Delis-Kaplan executive function system (subcomponents—TMT = Trail-Making Test and CWIT = Color Word Interference Test); LIFE-H = Assessment of Life Habits; VMI = Beery–Buktenica developmental test of visual motor integration visual motor integration; MPAI = Mayo-Portland Adaptability Inventory–4 participation index; NIHSS = National Institute of Health Stroke Scale; QOL = Flanagan's Quality of Life Scale; PQRS = Performance Quality Rating Scale; RNL = reintegration to normal daily life; SEMCD = Stanford self-efficacy for managing chronic disease; SEG = self-efficacy gauge; ABC = Activity Specific Balance Confidence Scale; PEGS = perceived efficacy and goal setting; SIS = Stroke Impact Scale; SPPC = self-perception profile for children; SSRS = Social Skills Rating Scale; VABS = Vineland Adaptive Behavior Scale; CES-D = Center for Epidemiological Studies Depression Scale; PRPS = Pittsburg Rehab Participation Scale.

Occupational Performance Measure (COPM; Law et al., 1990; Table 4).

An interesting variant on the notion of untrained skills was observed in two studies. These examined performance on untrained strategy use (Tables 4 and 2). One study addressed strategy use specifically (Sangster, Beninger, Polatajko, & Mandich, 2005), the other addressed DPA (Hyland & Polatajko, 2012)—described above, DPA is a CO-OP specific approach to performance analysis used by therapists and fostered in clients through the course of the intervention but never explicitly trained.

2. *Measures of activities, skills, or performance components*—15 studies reported postintervention scores on one or more standardized measures (Table 2; note: this includes some of the studies included under No. 1 as these studies evaluated transfer in multiple ways). All the assessments used in the studies reviewed addressed transfer of skill only; none address transfer of strategy use. The skills addressed included both motor skills, for example, the Movement Assessment Battery for Children (MABC; Henderson & Sugden, 1992) and nonmotor skills, for example, the VABS (Sparrow et al., 2005). In some studies, the assessments also addressed more basic functions (Table 4) believed to support performance, for example, upper limb function—Action Research Arm Test (ARAT; Lyle, 1981), or components of performance such as cognitive flexibility (Delis–Kaplan Executive Function System [DKEFS]; Delis, Kaplan, & Kramer, 2001).
3. *Validated patient (family)–reported outcome measures of health status, health-related quality of life, participation, or self-efficacy*—16 studies reported on one or more such measures (Table 2).
4. *Anecdotal reports of daily life outcomes*—eight studies provided anecdotal reports indicating transfer. In all cases, the data were gleaned from interviews or diary/log entries (see Table 2).

**Objective 3:** "What is the nature of the findings reported regarding transfer and CO-OP?"

All 25 studies reporting on transfer, whether skill or strategy, provided positive evidence on at least one variable measured, and for the majority of studies, on multiple variables. The studies used a variety of research designs to evaluate transfer (see Table 1); some had no control condition (e.g., single group pre–post designs and qualitative interviews), some had participants serve as their own control (e.g., single-case experimental design), and some employed a control group (e.g., RCT). The findings are presented separately for those addressing skill transfer (i.e., participants learned a new skill or activity that was not the focus of intervention) and those that addressed transfer of strategy use (i.e., participants

learned to use problem-solving cognitive strategies for purposes beyond what they were taught to do in therapy).

### *Skill Transfer: Studies With No Control Condition*

Thirteen of the reviewed studies, all reporting on skill transfer, did not report any control transfer data. Three evaluated CO-OP and transfer in children with DCD (Chan, 2007; Green, Chambers, & Sugden, 2008; Ward & Rodger, 2004). Ward and Rodger (2004) examined the effects of CO-OP with two children, aged 6 years, with DCD and found pre- to posttest improvement on most domains of VABS, an adaptive behavior measure that tests communication, social, motor, and daily living skills (Sparrow et al., 2005). There were no changes on the Beery–Buktenica Developmental Test of Visual Motor Integration (VMI; Beery, Buktenica, & Beery, 1997). In a study in Hong Kong (Chan, 2007) in which CO-OP was delivered in a group setting via parent involvement, the fine motor subtest (only subtest evaluated) of the Bruininks–Oseretsky Test of Motor Impairment (BOTMP; Bruininks, 1978) was not significant; however, significant results were found on both the motor and process components of the Assessment of Motor and Process Skills (AMPS; Fisher & Jones, 1999). With a change score of 4 or greater considered clinically significant, Green et al. (2008) reported an average of 8.7 point ($SD$ = 5.2) improvement on the total score of the MABC in children with DCD.

A study by Rodger, Springfield, and Polatajko (2007) evaluated transfer of learning following CO-OP training with the use of a weekly parent diary entry of two sibling children with Asperger's Syndrome (AS): a boy and a girl aged 9 and 11 years, respectively, who both presented with motor difficulties. Each child demonstrated examples of transfer to novel skills (e.g., use of chopsticks and new swim strokes).

Studies with two other child populations also reported on transfer. In six children with ABI, Missiuna et al. (2010) reported a significant difference from pre- to posttraining for the composite score, communication, and the ADL scores of the VABS. Rodger and Brandenburg (2009) reported pre–post intervention improvements in daily living and communication scores of the VABS for two children with Asperger's Syndrome.

In adults with chronic TBI, Dawson et al. (2009) showed significant changes were demonstrated in two of the three participants on the Dysexecutive Questionnaire (DEX; Burgess, Alderman, Evans, Emslie, & Wilson, 1998), and for four of seven untrained goals on the perceived performance scale of the COPM and on all goals on the COPM satisfaction scale. In the same study, they also examined significant others' COPM ratings, which were more variable and did not always match participants' own ratings. In another study, tele-rehabilitation was used with three male participants with severe TBI (Ng et al., 2013) and transfer was suggested in that the DEX improved significantly for all participants and improvement in community integration was reported by two participants and two significant others. In addition, in anecdotal reports, participants stated they used the global cognitive strategy GPDC with untrained daily tasks such as grooming and waking up early to work.

Transfer was also examined in adults with stroke. McEwen, Polatajko, Huijbregts, and Ryan (2009) reported clinically meaningful changes on some domains of the Stroke Impact Scale (SIS; Duncan, Lai, Bode, Perera, & DeRosa, 2003) for three adults with stroke. In a qualitative study, McEwen, Polatajko, Davis, Huijbregts, and Ryan (2010) reported on interviews with five participants, two of which are reported in McEwen, Polatajko, Huijbregts, and Ryan (2010) and three in McEwen et al. (2009). The interviews were conducted to determine participant experience with CO-OP and elaborate on transfer. Participants offered examples of when they used strategies at home, for example, learning to use the VCR and exhibiting "some degree" of transfer. Skidmore et al. (2011) used the FIM to measure the effects of CO-OP on basic ADLs in a feasibility case study of one man with acute stroke during inpatient rehabilitation. The participant improved from requiring moderate to minimal assistance, to only supervised assistance. ADLs tested using the PASS showed an improvement from full physical assistance to small verbal guidance. Henshaw et al. (2011) also found improvements on the FIM and the SIS recovery component for both adult female participants with stroke.

### *Skill Transfer: Studies With a Control Condition With Participants as Their Own Control*

McEwen, Polatajko, Huijbregts, et al. (2010) found improvements on the SIS hand domain, at least one dimension of the Chedoke–McMaster Stroke Assessment Impairment Inventory for motor control (CMSA; Gowland et al., 1993) and the reintegration to normal daily living index (RNL), for all three participants. While these assessments were not tracked more than once at baseline, the PQRS for transfer skills were assessed 3 times on different occasions to obtain baseline data. Significant differences on the PQRS for untrained tasks were shown for each of the three adults with chronic stroke. Gharebaghy, Rassafiani, and Cameron (2015) demonstrated improvements on the BOTMP, administered weekly, in six Iranian children with ADHD. These children and their parents scored greater than 2-point improvements on all (except one child goal) performance and satisfaction ratings on the COPM post CO-OP; with improvements reaching as much as 9 points out of 10 (Gharebaghy et al., 2015).

## Skill Transfer: Studies With a Control Group

Eight studies reported on skill transfer relative to a control group; in five cases, the control group had an alternate form of intervention. The earliest studies to evaluate transfer

following CO-OP compared with another intervention were with children with DCD (Miller et al., 2001; Polatajko et al., 2001). Miller et al. (2001) performed a pilot RCT of CO-OP versus contemporary treatment approach (CTA) for 20 children with DCD, 10 children per group. Skill transfer was demonstrated. The motor domain and communication of the VABS (Sparrow et al., 2005) were significantly higher at postintervention for the CO-OP group in comparison with the CTA group. However, both groups showed similar significant results for the BOTMP composite and upper limb coordination scores. Polatajko et al. (2001) demonstrated significant improvements on the VABS between pre- and posttest scores in 10 children with DCD (Polatajko et al., 2001).

In 2013, Dawson and colleagues reported on skill transfer in a pilot study using CO-OP and a control group receiving no treatment in a total of 13 adults with chronic TBI. Significant differences between baseline and postintervention were found for performance and satisfaction on the COPM for untrained goals in the experimental group compared with the control group. Significant findings for participation in everyday life activities, as measured by the Mayo-Portland Adaptability Inventory–4 Participation Index (M2PI; Malec, 2004), were also found. However, no statistically significant findings were found for the scores on assessments of motor and executive function. Dawson et al. (2014) also conducted a pilot RCT with 17 participants, to evaluate whether transfer was achievable with CO-OP training adapted for older adults with subjective mild cognitive difficulties. Modification of CO-OP included the addition of three educational group sessions on brain health, executive function, and aging. The control group performed a cognitive exercise, such as Sudoku, in addition to receiving education on brain health. Fifty percent of the untrained participant goals in the CO-OP group ($n = 11/22$) compared with approximately 20% from the control group ($n = 9/46$) demonstrated clinically significant differences between baseline and posttraining times for perceived performance on all untrained skills that were identified as problematic. However, there was a decrease in perceived performance and satisfaction on the COPM for four out of the 10 participants in the experimental group. There were no significant group improvements on health behaviors and measures of executive dysfunction following CO-OP or control training. Significant differences in self-efficacy at posttest and follow-up for the CO-OP group were found compared with the control group.

Also working with participants with TBI, Poulin, Korner-Bitensky, Bherer, Lussier, and Dawson (2017) evaluated skill transfer in nine adults with severe TBI who experienced executive function problems using an untrained task. Participants underwent either a CO-OP ($n = 5$) intervention or computer training ($n = 4$) for aspects of executive function such as memory, attention, inhibition, and flexibility. This study found clinically significant changes of greater than 2 points and large effect sizes on the COPM for perceived performance of the untrained goals for participants in both groups. The CO-OP group was also reported to have significance on the Trail-Making Test (TMT B; Reitan & Wolfson, 1985) and the self-efficacy measure.

McEwen et al. (2015) examined skill transfer in a two-group RCT study with adults with stroke. Thirty-five participants less than 3 months poststroke at enrollment were randomized to CO-OP or to usual rehabilitation from two well established out-patient rehabilitation facilities. Postintervention data were available for a total of 26 participants (CO-OP, $n = 14$; McEwen et al., 2015). A large effect size (Cohen's $d = 1.2$) on the PQRS was found for untrained skills following CO-OP training and maintained 3 months later, in comparison with the usual rehabilitation program. Measured with the COPM, participant perceived performance on untrained goals improved; however, the effect size was small (Cohen's $d = 0.2$) over usual care at a 3-month follow-up. Furthermore, self-efficacy improved with a moderate effect size in the CO-OP group compared with usual care. In a second publication related to this trial, Wolf and colleagues (2016) reported on arm and cognitive function of the stroke participants (Wolf et al., 2016). A moderate effect size was seen in arm function on the ARAT as well as the DKEFS Trails at posttraining and follow-up, compared with the usual care control group.

Thornton et al. (2015) examined the effects of group run CO-OP ($n = 10$) versus no treatment control ($n = 10$) in children with DCD on a number of variables addressing writing, motor skills, and motor overflow. The CO-OP group demonstrated significant increases in letters per minute and word legibility following training, but not with letter legibility. No differences were found between groups with the pegboard task or the MABC-2. The CO-OP group demonstrated significant decrease, relative to the control group, in motor overflow at the shoulder, elbow, and wrist in the contralateral arm during finger sequence and clip pinching tasks based on the biomechanical measures of 3-D motion analysis software at the joints and sensor gloves at the fingers. Motor overflow in the fingers increased in both groups.

### *Transfer of Strategy Use: Secondary Analysis of Control Group Studies*

Sangster et al. (2005) explored transfer of strategy use with secondary analysis of the Miller et al. (2001) study. During the Miller et al. (2001) study, both the CO-OP group and CTA group participants observed a video recording of a young girl performing a skipping task with a degree of difficulty. The children were asked to comment on the child's performance and to suggest what she could do to improve her performance. A significant difference in number and appropriateness of recommended strategies identified between the groups was reported. At posttest, the CO-OP group showed an increase in total strategies and the CTA dropped in the number of strategies suggested. The CO-OP

group also suggested more specific and appropriate strategies. Using the same video recording just described, Hyland and Polatajko (2012) also performed secondary analysis to determine differences in spontaneous strategy development. No significant differences in frequency of DPA (number of self-analytical verbalizations) were found between the CO-OP and CTA group during video transfer observations; however, the children in the CO-OP group were able to identify a problem spontaneously and develop a potential solution, whereas, the CTA group was not able to do so.

### *Summary of Findings*

Thirty-nine CO-OP experimental articles were identified in this literature review: 25 presented data relevant to the issue of transfer and were fully reviewed. Of those 25, there were 16 that evaluated transfer explicitly (Criterion B) and nine were deemed to have addressed transfer by including evaluations of transfer that fell under at least one of our four indicators of transfer (Criterion A). The populations tested were DCD, ADHD, pediatric ABI, stroke, TBI, older adults with subjective cognitive difficulties, and Asperger's syndrome (now defined as high functioning Autism Spectrum Disorder—*Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; *DSM-5*; American Psychiatric Association, 2013).

All articles that evaluated transfer in CO-OP demonstrated statistically significant and/or clinically meaningful results (according to author definition of meaningful) on at least one and, in many cases, the majority of transfer outcome variables assessed. Twelve studies examined the effects of CO-OP relative to a control, two of which were single-case experimental design and 10 of which included a control group. In all controlled studies, the CO-OP group demonstrated larger change on more indicators of transfer than the comparison group.

## Discussion

Transfer is a focus of CO-OP research; it is not only a stated objective of CO-OP treatment (Polatajko et al., 2001) but is also an outcome addressed in the majority of CO-OP intervention studies published. However, in the transfer literature as a whole, there is a lack of consensus on the definition of transfer (Barnett & Ceci, 2002) and how to assess it, even though transfer is considered to be a necessary component of motor learning (Levin et al., 2015) and training transfer is believed to promote success in daily life activities (Krakauer, 2006). CO-OP incorporates promoting transfer throughout therapy. This review yielded three main findings: (a) transfer is frequently addressed in the CO-OP literature for a range of skills and populations; both skill transfer and strategy use transfer are addressed, although the latter far less frequently; (b) there are a variety of approaches and measures used to evaluate transfer in the CO-OP literature including the "untrained skill" approach, considered to be a strong indicator of transfer; and (c) positive transfer outcomes are reported in all CO-OP studies addressing transfer and, when compared with a contrast, CO-OP is reported as supporting greater transfer.

In this review, we used a broad operational definition of transfer and allowed for four different broadly defined categories of indicators of transfer, with the first, "untrained skills" represented as the most meaningful indicator. This led to a great variation in measures used, ranging from the examination of motor overflow or the examination of transfer from a trained skill to changes in health status and participation. In light of this, we divided the compiled list of outcomes into those that address transfer of skill and transfer of strategy, or both. It became apparent that only two studies addressed transfer of strategy directly (Hyland & Polatajko, 2012; Sangster et al., 2005). Provided that this is one of the aims of CO-OP, it is highly encouraged that future research incorporates the evaluation of transfer of strategy use and problem solving into study design. There were several outcomes that did not fit within these categories, but did fit alongside them as either foundational to the development of transferred strategies or skills, or could be considered as peripheral (secondary) effects of training or transfer. Examples of foundational skills are tests of memory or communication and examples of tests of secondary effects are those that measure self-efficacy, participation, or quality of life.

### *Transfer Outcomes Explored*

The results are presented in three categories based on whether or not a control condition (person or group) was included in the study design. There were significant results for outcomes in both the noncontrol group and control group studies (Chan et al., 2007; Dawson et al., 2009; Green et al., 2008; Henshaw et al., 2011; McEwen et al., 2009; Missiuna et al., 2010; Ng et al., 2013; Skidmore et al., 2011). While many of the studies in this article were single-case experimental designs for the primary trained skills, there were only two studies that specifically tested transfer outcomes at multiple testing occasions. Therefore, we have included these studies in their own category and left the other studies as noncontrol studies. Both single-case experimental design studies reported improvement during and after CO-OP training. McEwen, Polatajko, Huijbregts, et al. (2010) noted significant change on the PQRS in adults with stroke and Gharebaghy et al. (2015) reported improved scores on the BOTMP in children with ADHD. In eight of 10 studies that used a control group, the improvements on the indicators of transfer that CO-OP demonstrated were all greater than the control. Notable findings included a large effect size for improvements on the PQRS of untrained goals in adults with stroke compared with usual care and maintained at follow-up (McEwen et al., 2015), significant changes on perceived performance and

satisfaction of untrained goals and participation in everyday life compared with a control (no training) group in adults with TBI (Dawson, Binns, Hunt, Lemsky, & Polatajko, 2013), and significant improvements on the VABS and strategy counts in the CO-OP group compared with traditional OT therapy in children with DCD (Miller et al., 2001; Polatajko et al., 2001; Sangster et al., 2005).

A decrease in perceived goal performance and satisfaction was found in four adults with subjective cognitive impairment (Dawson et al., 2014). The authors suggest that perceptions of performance could have shifted throughout training due to greater awareness of ability. And while studies evaluating transfer in participants with actual cognitive impairment (i.e., TBI), found significant gains in a variety of skills, transfer may be more difficult for populations such as TBI. Inherent executive function problems in TBI patients can impede one's ability to generate ideas that can be transferable (Dawson et al., 2009). Therefore, this population may need additional cueing in comparison with other neurological populations. Lengthier training time may also better promote transfer. Dawson et al. (2013) did, in fact, increase CO-OP training time from the usual 10 hr to 20 hr in a study with adults with TBI.

## *CO-OP Effects Beyond Transfer*

Because of our broad inclusion criteria for indicators of transfer, a number of studies were included in this review that reported on measures that could be considered to evaluate changes in more basic functions, perhaps even at an impairment level. For this reason, these outcomes were listed under the "Foundational" category in Table 4. One particular study is highlighted here because the investigators tested for changes in motor overflow to the contralateral arm during an arm movement task, with the use of motion analysis software (Thornton et al., 2015). All joints of the contralateral arm showed decreased range of motion in comparison with the control group that showed no change, suggesting that a cognitive intervention can significantly improve biomechanical outcomes, even in the unused limb (Thornton et al., 2015). In addition, multiple studies in this review included assessments addressing skills that are typically considered to be impairment-based rather than function-based, for example, the CMSA or VIM. It is important to reiterate that the authors did not necessarily state that the measures tested for transfer but were included in this review because they fit within our "indicators of transfer" criteria (e.g., Thornton et al., 2015, did not label the outcomes of the study, including motor overflow, as transfer).

As a result of the inclusion of impairment-based tasks in this review, questions arose such as whether these types of tasks are truly indicators of transfer. Furthermore, at what point does one draw the line between impairment and functional skills? For example, the MABC is explicitly defined as a measure of impairment; however, there are certain tasks that are functional such as catching a ball with one hand. In addition, if a measure evaluates impairment and a change is reported, does this perhaps indicate a mechanism for transfer or does it qualify as transfer itself? We suggest that in the rehabilitation sciences research, transfer should focus on functional, activity-based outcomes, such as those studies that evaluate "untrained skills" as well as examples of outcome assessments listed under "skills" in Table 4. The role of body functions and structures, or impairments, in transfer requires further study and discussion. Specifically, a debate about whether specific body functions are part of the mechanism of transfer is encouraged. Related questions arose about whether changes in health status, participation, and associated constructs are indicative of transfer, and this too is an area that requires further research and discussion. For example, it has been suggested that emotive changes such as self-efficacy are mechanisms of transfer and not transfer itself (Stevens, Anderson, Dwyer, & Williams, 2012).

## *Gaps in the Literature*

This scoping review was conducted not only to describe the nature and extent of the CO-OP transfer literature but also to identify potential gaps. To do this, we examined the CO-OP transfer literature informed by the work of Geusgens (2007), which suggests that several approaches should be used to examine transfer. As can be seen from the findings and the discussion above, the CO-OP transfer literature does indeed contain several approaches to examining transfer. So while using the Geusgens's framework, we did not identify a particular gap. Indeed, there was considerable variability in the approaches to evaluating transfer, in particular, in the measures and definitions used. This state of affairs did, however, create a synthesis gap in as much as it makes a systematic review of the CO-OP transfer literature premature.

## *Limitations*

Although all studies reported on indicators of transfer for CO-OP, it should be noted that transfer was not reported for all measures in all cases; in some cases, the same measures that were reported to demonstrate transfer were reported to not demonstrate transfer in others (Chan, 2007; Dawson et al., 2009; Gharebaghy et al., 2015; Green et al., 2008; Ng et al., 2013; Poulin et al., 2017; Thornton et al., 2015). It is possible that, by chance, when the measures indicated transfer, they involved skills that were more similar to the trained skills than when they did not. Unfortunately, at present, there is no accepted way of evaluating transfer from this perspective. This is a topic worthy of investigation. In addition, several studies were conducted by the same investigator group and a large proportion involved the same author. This could affect the generalizability of findings.

## Conclusion

This review suggests that transfer is an achievable outcome for different ages and populations following training with the CO-OP Approach™. A greater number of indicators of transfer were reported in all comparisons of CO-OP treatment with control interventions. Nonetheless, there were some inconsistencies in findings across studies. These may be a result of the differences in the measures used, definitions of transfer, and the approaches to evaluating transfer. Transfer is a critical outcome for supporting independence in daily life and enabling occupational performance in the client's own environment. Future research should promote the use of a clear definition of transfer and the outcomes acceptable for the evaluation of transfer. A greater understanding of transfer will serve to contribute to the literature in the enabling of occupational performance.

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