Children with hemiplegic cerebral palsy (CP) present with weakness, poor selective motor control, spasticity, sensory impairments and disuse of the impaired limb. Research involving constraint-induced movement therapy (CIMT) and bimanual intensive therapy (BIM) has shown improvements in upper extremity function in children with hemiplegic CP (Novak et al., 2013). In a systematic review, Novak (2013) used the Oxford Levels of Evidence and the Evidence Alert Traffic Light and found CIMT and BIM were “green light” interventions with high levels of evidence supporting their use for children with hemiplegic CP. CIMT focuses on unilateral hand function and is a therapy involving restraint of the unaffected limb with concurrent provision of repetitive intensive practice of the impaired limb to improve spontaneous use (Gordon, 2011). BIM focuses on bilateral hand function and was introduced by Gordon (2011) to address the limitations of CIMT while maintaining intensive training of the impaired limb.

Translating evidence into practice can be challenging, prompting researchers to identify the evidence to practice gap (Grohl & Grimshaw, 2003). This paper describes how Holland Bloorview Kids Rehabilitation Hospital (HBKR) and the Children’s Developmental Rehabilitation Program (CDRP) used the Knowledge To Action (KTA) framework (Graham et al., 2006) to implement these therapies into practice. The KTA framework (see Figure 1) describes the relationship between knowledge creation (the inner circle) and the activities required for knowledge application (the outer action cycle) (Canadian Institutes of Health Research, 2014).

Knowledge creation

In this step, we focused on knowledge synthesis by synthesizing the best available evidence for use in practice. Critical review of the literature and evidence was pursued. CIMT was originally used in the adult stroke population to overcome learned non-use of the impaired limb (Taub, 1994). Children with hemiplegic CP also ignore the impaired limb in daily life, as using the unimpaired limb is more efficient and effective. DeLuca, Case-Smith, Stevenson, and Ramey (2012) described this phenomenon as developmental disregard. CIMT was later adopted for children with hemiplegic CP, and both the type of restraint and intensity of CIMT were modified to make this approach more child-friendly (Charles, Wolf, Schneider, & Gordon, 2006; Eliasson, Krumlinde-Sundholm, Shaw, & Wang, 2005). Studies comparing CIMT and BIM found that children receiving CIMT do better on unilateral tasks, while children receiving BIM do better on bilateral tasks. Recently, a combined serial approach of CIMT and BIM has been recommended (Dong et al., 2013).

Action cycle

The action cycle describes the process of knowledge implementation and includes seven phases (Graham et al., 2006).

Identify the problem.
Both centres (HBKR and CDRP) were receiving requests from families for CIMT. To be client-centred and employ best evidence in practice, a decision was made to engage in a process of integrating these therapies.
Adapt knowledge to local context.
Given the evidence and the local context, the occupational therapists examined the available resources and considered the time required to create, deliver and sustain CIMT and BIM (including staff, space and materials), as well as the experience and skills of present staff and the relevance of these therapies to the local client population.

Assess barriers to knowledge use.
Barriers to implementing CIMT included how to implement practical aspects of CIMT (e.g., how to restrain the unaffected limb and how to provide developmentally appropriate programs for children of different ages).
From a family and client perspective, barriers to participating in these programs included client frustration, safety, commitment (e.g., wearing the restraint, attending assessment visits, implementing home programs) and the timeliness of the intensive therapy (including its potential interference with school).

Select, tailor and implement intervention.
To decrease the knowledge-to-practice gap, the development of CIMT as an emerging best practice was presented by an occupational therapist to the senior management team at HBKR. The physician director and the occupational therapist submitted an article reviewing the evidence to CanChild Centre for Childhood Disability Research, a research and educational centre located at McMaster University in Hamilton, Ontario (Lam-Danjii & Fehlings, 2006).
To overcome the above noted barriers, occupational therapists engaged in self-directed learning by reviewing the literature, attending journal club meetings with the physician director and management, and attending focus groups and local and international conferences to increase knowledge of CIMT and BIM. At HBKR, the occupational therapists presented on CIMT and BIM to staff, fellows and colleagues to share information and increase awareness of these evidence-informed therapies. A business plan was developed and presented to management detailing required resources and costs. To overcome client-reported barriers, developmentally appropriate programs and a variety of protocols were established.
At CDRP, the occupational therapists also reviewed the literature and attended focus groups and conferences. However, being a considerably smaller centre, the occupational therapists only needed to discuss their ideas directly with the medical director prior to formalizing their protocols.

Integrating CIMT and BIM into practice.
Individual programming: For the individual CIMT and BIM programs, resources presently required include occupational therapists, orthotists and occupational therapy assistants (OTAs). The OTA implements the CIMT and BIM programs under the guidance of the occupational therapist. The client attends once-weekly sessions with the OTA over a 12-week period, working on activities to target unilateral motor control, strength, speed and efficiency, as well as bimanual hand skills. Selection of the restraint is based on factors such as safety, comfort, climate, fabrics and hygiene (Eliasson et al., 2014). Other factors include the client’s upper limb motor control, mobility and balance, ease of frustration and participation level, and the client’s environment(s). Each client chooses between wearing a removable restraint for two to four hours during the day over several weeks or a non-removable restraint for three weeks. Home programs are provided. Children are followed to determine the need for repeated CIMT. Individual CIMT and BIM programs are now available throughout the year at both facilities.

Summer camp: For camps, resources include occupational therapists, OTAs, volunteers, social workers, music therapists, dance therapists, magicians and aquatic lifeguards. Social workers provide client and parent support, and disability awareness intervention. Participants attend the camp for four hours per day. For one week before camp, the participants wear a non-removable cast. This cast is bivalved on the first day of camp and made into a removable restraint. The removable restraint is worn for three hours daily for the first week of camp, which has a focus on the development of unilateral skills. For the second week of camp, the children wear the removable restraint for one hour daily and the focus is on integrating the unilateral skills into bimanual activities. Camp activities are developed using the model of motor learning and are embedded within an activity-based framework. As the participants progress through the camp, the activities are graded using task analysis, while ensuring a “just right” challenge. Camps are offered annually in the summer.
Assessments for both individual and camp programming are completed before the intervention and again one week and six months after the intervention. These include assessment of motor impairment (e.g., the Quality of Upper Extremity Skills Test [DeMatteo et al., 1993; Thorley, Lannin, Cusick, Novak, & Boyd, 2012], the AQCUIREc Motor Activity Log [DeLuca, Echols, & Ramey, 2007] and the Jebsen-Taylor Hand Function Test [Sears & Chung, 2010]), and assessment of participation (e.g., the Assisting Hand Assessment [Krumlinde-Sundholm, Holmefur, Kottorp, & Eliasson, 2007], the Canadian Occupational Performance Measure [Law et al., 1990] or the Children’s Hand Use Evaluation Questionnaire [Sköld, Hermansson, Krumlinde-Sundholm, & Eliasson, 2011]). More recently at HBKR, assessments have also included a sensory evaluation (e.g., Semmes Weinstein Filament Test, Two Point Discrimination Test, Stereognosis [Auld, Ware, Boyd, Moseley, & Johnston, 2012]).

Monitor knowledge use.
Occupational therapists continue to review current evidence and participate in education opportunities. Findings have been disseminated at various local, national and international conferences and focus groups about best practices. Requests are received from centres that are members of the Ontario Association of Children’s Rehabilitation Services to consult on how to start a CIMT and BIM program and to share our resources.

Evaluate outcomes.
Findings from standardized assessments help to inform practice. Positive trends have been noted in upper extremity skill development with improvements in daily activities following CIMT/BIM interventions that persist to six months after the intervention. Client and caregiver questionnaires are also used to
gather camp feedback. Feedback received indicates that families would welcome more CIMT and BIM camps and would like the camps to be longer than four hours per day with sessions longer than two weeks.

Sustain knowledge use.
At HBKR, a Constraint and Bimanual Therapy Handbook for home programming will soon become available on the HBKR website for easy access and sharing with community partners. The creation of this handbook has helped to continue to develop occupational therapists’ skills in these therapies and it is hoped the handbook will build capacity in the system. Occupational therapists from both sites continue to collaborate with the Bloorview Research Institute to further investigate the efficacy of CIMT and BIM.

Conclusion
The KTA framework has been a useful tool to help implement CIMT and BIM into practice in a way that is evidence-based, meets the needs of our clients and enables the occupational therapists to systematically evaluate the evolving evidence to ensure these therapies continue to be based on best evidence. The KTA framework will be continue to be a useful tool for the occupational therapists to apply to other evidence-based treatments in narrowing the gap from knowledge to practice.

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