Outcomes of an occupational therapy school-based consultation service for students with fine motor difficulties

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Key words

▪ Canadian Occupational Performance Measure ▪ Motor skills disorders ▪ Occupational therapy ▪ Outcome study ▪ School health services

Mots clés

▪ Mesure canadienne du rendement occupationnel ▪ Troubles de motricité ▪ Ergothérapie ▪ Étude sur les résultats ▪ Services de santé scolaires

Abstract

Purpose. *This paper reports on a study that was conducted to address the perceived occupational performance changes among school-aged children who received occupational therapy services for fine motor difficulties. It also addressed teacher awareness and the degree of implementation of occupational therapy recommendations by teachers.* **Methods.** *The study sample included 91 school-aged children referred for occupational therapy services for fine motor difficulties. The children were assessed, before and after intervention.. Outcome measures used were the Canadian Occupational Performance Measure (COPM) and the Teacher Awareness Scale (TAS).* **Results.** *Significant change scores in both scales of the COPM were (Performance = 1.50, $p < 0.001$; Satisfaction = 1.92, $p < 0.001$). Regression analyses showed that lower teacher ratings of the students' performance and satisfaction of performance on the initial COPM resulted in significantly greater COPM change scores in the students' performance and satisfaction of performance at reassessment. The greater the degree of implementation of occupational therapy strategies by the teacher, the greater the COPM performance and satisfaction change scores. The greater the degree of teacher awareness of students' special needs resulted in greater COPM performance change scores.* **Practice Implications.** *Teachers may benefit from more education regarding fine motor difficulties in children and how the implementation of occupational therapy strategies are helpful to improve children's fine motor difficulties.*

Résumé

But. *Cet article présente les résultats d'une étude qui a été menée pour examiner les changements occupationnels perçus chez des enfants d'âge scolaire ayant reçu des services d'ergothérapie pour des troubles de motricité fine. L'étude examinait également le degré selon lequel les enseignants étaient conscients des besoins particuliers de ces élèves et le degré selon lequel les recommandations ergothérapiques étaient mises en oeuvre par les enseignants.* **Méthodologie.** *L'échantillon de l'étude comprenait 91 enfants d'âge scolaire ayant été dirigés vers des services d'ergothérapie en raison de leurs troubles de motricité fine. Les enfants ont été évalués avant et après l'intervention. Les mesures des résultats utilisées étaient la Mesure canadienne du rendement occupationnel (MCRO) et la Teacher Awareness Scale (TAS).* **Résultats.** *Les scores de changement étaient significatifs dans les deux échelles de mesures de la MCRO (Rendement = 1,50, $p < 0,001$; Satisfaction = 1,92, $p < 0,001$). Les analyses de régression ont démontré que les scores plus faibles que les enseignants ont attribués au rendement des élèves et à la satisfaction face au rendement lors de l'évaluation initiale à l'aide de la MCRO ont entraîné des scores de changement beaucoup plus élevés pour le rendement des élèves et la satisfaction face au rendement lors de la deuxième évaluation à l'aide de la MCRO. Plus la mise en oeuvre des stratégies ergothérapiques par l'enseignant était importante et plus les scores de changement de la MCRO pour le rendement et la satisfaction étaient élevés. Plus les enseignants étaient conscients des besoins particuliers des élèves et plus les scores de changement de la MCRO étaient élevés.* **Conséquences pour la pratique.** *Les enseignants pourraient bénéficier d'un enseignement sur les troubles de motricité fine chez les enfants et sur l'utilité de mettre en oeuvre des stratégies ergothérapiques pour améliorer les habiletés de motricité fine chez les enfants.*

School-based occupational therapy is directed toward furthering educational goals considering all aspects of the students' function or occupational performance (CAOT, 1991). Traditionally, occupational therapy provided in the school setting has been direct treatment. In the early 1990's the consultative approach was gradually introduced to school-based practice. In 1996, occupational therapy school-based consultation (OTSBC) model was developed collaboratively between COTA Health and the Home Care Program for Metropolitan Toronto, the precursor of the Community

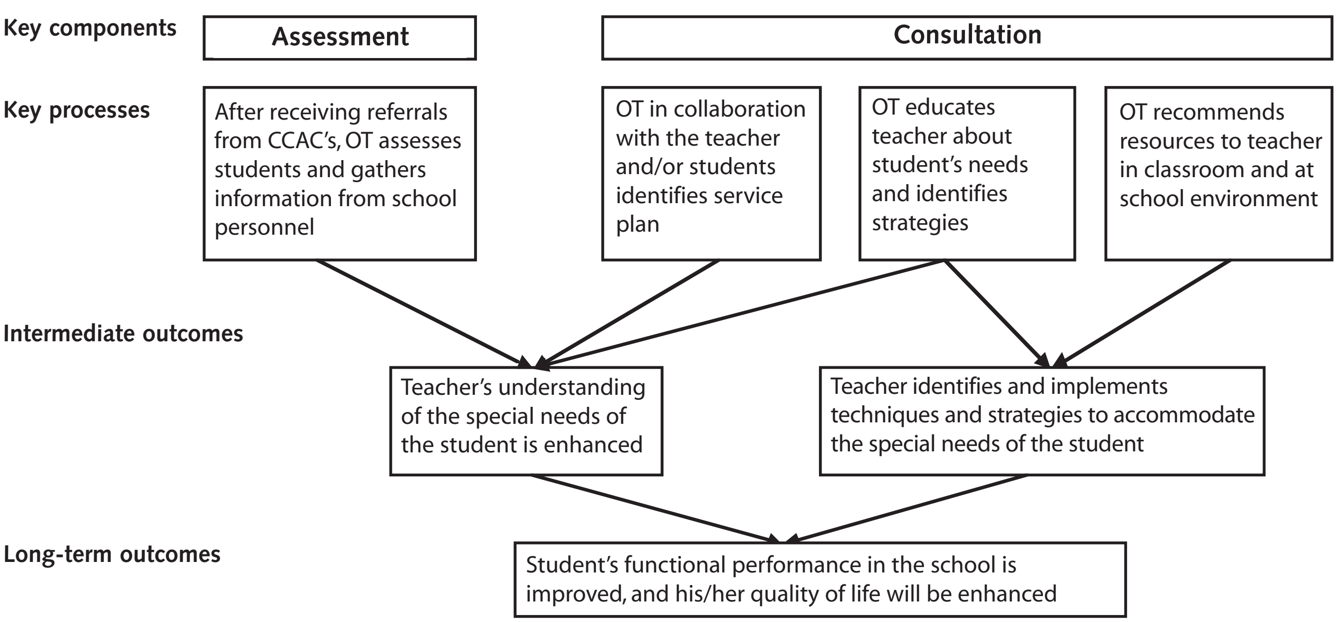
Care Access Centers (CCACs). The OTSBC model is designed to facilitate the developmental needs of students and enhance their occupational performance in school, with an ultimate aim of enhancing the quality of life of the students in their natural environment. Since its introduction, the model has been used to guide occupational therapy provided to school children with fine motor problems.

In the OTSBC model (Figure 1), key assessment processes include the use of observations, standardized instruments, functional assessments, and the input from school personnel, the family and other professionals. Next, a service plan is established by the occupational therapist using the Canadian Occupational Performance Measure (COPM) (Law et al., 1998) in collaboration with the teacher, parent, and/or student. Core interventions that are used to address the plan include educating teacher and parents, making recommendations or referrals, and assisting the implementation of the recommendations. In this model, it is proposed that the consultative interventions lead to an enhanced understanding of the student's special needs and improved capacity to implement occupational therapy strategies by the teachers and parents. These changes subsequently result in an improvement of the student's occupational performance in self-care, productivity and leisure in the school setting and in their quality of life.

Prior work about school-based occupational therapy showed that consultation is accepted by school teachers. In 1990, Dunn studied 14 students with developmental delay to compare direct service and consultation. She found similar goal achievements with each approach, but consultation resulted in more positive attitudes among the teachers (Dunn, 1990). In 1996, a survey of 321 American occupational therapists showed that consultation and integration had gained popularity in school-based practice (Case-Smith & Cable, 1996). In 1996, Kemmis and Dunn evaluated 10 therapist-teacher pairs and found collaborative efforts had positive impacts on goal achievements (Kemmis & Dunn, 1996). In 1999, a survey of 46 parents and 14 teachers of special needs students found that direct service and consultation was perceived as being similarly effective (Thress-Suchy, Roantee, & Pfeffer, 1999). In 2001, survey responses of 40 teachers showed that more collaborative efforts is associated with teachers' increased perceptions of occupational therapy contribution to student skill development (Barnes & Turner, 2001).

A similar shift of service model has been found in Canada. In 1993, Fairbairn and Knowles surveyed 103 school teachers in Ontario and found that they preferred occupational therapists to work in a consultative manner, and keep ing students in the classroom rather than removing them (Fairbairn & Knowles, 1993). In 1998, Pollock and Stewart explored the needs of 92 students with physical disabilities in Ontario. Mobility and written work were the most and least frequently identified needs respectively (Pollock & Stewart, 1998). In 1999, King et al. (1999) evaluated a school-based therapy program in Ontario. The program incorporated a mix of direct therapy, monitoring and collaborative consultation provided by a multidisciplinary team. Among the 50 participants, 52% had a diagnosis of Cerebral Palsy and 20% had fine motor difficulties. Based on their findings, the authors suggested that the services made a difference in how children with special needs function in the school setting.

FIGURE 1
The Occupational Therapy School-Based Consultation (OTSBC) Model



The only Canadian study that investigated school-based service effectiveness evaluated a mixed treatment approach provided by a multidisciplinary team rather than a consultative model provided by occupational therapy. Only about 20% of the sample included students with fine motor difficulties, and the service impact on this population was not investigated in depth. Students with fine motor difficulties, however, are the largest population receiving OTSBC services. Therefore, there is a critical need to document the OTSBC model and validate its effectiveness for students with special needs, particularly for the population with fine motor difficulties. Children who have fine motor coordination problems experience a wide range of functional difficulties at school. Most of them have problems with printing and writing. They have difficulty forming letters, writing on the line and keeping proper spacing between letters and words (Bonney, 1992; Case-Smith, 2002; Cornhill & Case-Smith, 1996). If intervention is not provided early, these children are at risk of motor difficulties that persist into adolescence and can lead to the development of secondary mental health and educational issues including poor social competence, academic problems, behavioural problems, and low self-esteem (Miller, Missiuna, Macnab, Mallo-Miller, & Polatajko, 2001).

In the Province of Ontario in Canada, the School Health Support Services (SHSS) program was introduced in 1984 with a mandate to provide health care services to students with special needs who otherwise would be unable to attend school or whose education would be disrupted by having to leave the school setting to receive health services. Throughout Ontario, a variety of service delivery models are being used in the provision of school-based services. For example, the York Region CCAC offers a direct treatment model, the Peel Region CCAC offers a combination of direct treatment and consultation, and the five CCACs in Toronto offer a consultation model.

In the City of Toronto in Ontario, the organization providing the majority of occupational therapy school-based services is COTA Health. Students at both the elementary and secondary school level can be referred for occupational therapy. Between April 1, 2000 to March 31, 2001, COTA Health received 1,505 SHSS program referrals for occupational therapy from the 6 Toronto CCACs, and the number of referrals ranged from 87 to 363 in each of them (COTA Health, 2001). Referrals are initiated by the school to the CCAC and if the referral meets the eligibility requirements of the CCAC it is then sent to COTA Health. The majority of students seen are between ages four and eight, with more male than female students.

Over 80% of the referrals made from the CCACs are for children with fine motor skill development problems (COTA Health, 2001). In September 2000, the SHSS program in Toronto was expanded to include students in the private school system. At this time it is difficult to determine the demand for service that will result from this expansion of the program. However, continued growth in the demand for service is anticipated. Other factors that contribute to the growth in referrals include increased awareness of the program by school personnel, increased knowledge of school personnel regarding identifying students appropriate to refer for service, reduced resources within the school system, and previous positive experiences of teachers working with occupational therapists.

This paper describes a two-year study that evaluated the OTSBC services. This paper reports on phase one of the study. There were three objectives in phase one of the study:

1. Identify and describe current functional problems of students referred for OTSBC services for fine motor problems and measure changes in functional abilities after service delivery.
2. Identify factors that influence outcomes of OTSBC from multiple perspectives including teachers, service funders, occupational therapists, students and their parents.
3. Determine how satisfied the teachers of these students are regarding the OTSBC service delivery process.

Method

Design

We used a pretest-posttest design to identify and describe the perceived changes in students' functional ability and teachers' awareness of student problems after receiving the OTSBC services. In the pretest-posttest design, a change in outcome scores cannot be confidently ascribed to the intervention, but the change scores are useful for describing the changes following intervention (DePoy & Gitlin, 1998).

Study Participants

Recruitment began when new SHSS referrals were received at COTA Health in August 2001 and onwards. Referrals were received from six CCACs (recently merged into five CCACs), including the CCACs for the City of York, East York, Etobicoke, North York, Scarborough, and Toronto. We used a stratified sampling method to make sure the CCACs with fewer referrals were adequately represented (Frankel, 1983). Each CCAC formed one stratum. Three strata had over 19 participants. One had 14 participants and the two others had eight and nine participants. The number of eligible participants from each stratum varied depending on the CCAC, but each stratum recruited 50% and over the number of participants from those who provided consent. The number of participants per stratum reflected the population size of their CCACs.

Inclusion criterion was that students referred to COTA Health with a primary CCAC referral diagnosis of either fine motor delay, fine motor deficit, fine and gross motor delay, or fine and gross motor deficit. A total of 452 students eligible for the study were identified between August 2001 and February 2002. A letter was sent to parents of these students to invite them to participate in the study. Among them, 168 parents agreed to have their children participate in the study. We excluded the following students: a) referrals for assessments only because they did not apply the OTSBC model, b) referrals for only short- term services such as anticipated transfer to another school, equipment prescription, c) referrals with a diagnosis of pervasive development disorder, a physical disability or developmental delay in addition to fine motor problems, and d) the COPM was not completed within the first four visits because of reasons such as not able to set up a meeting with the school teacher. Among the 168 students who had parental consent, 77 students were excluded and 91 students participated in this study. The demographic characteristics of the 91 participants are found in Table 1.

Measurement Instruments

The COPM was used to measure the primary outcome of the OTSBC services and to identify problem areas and measure performance changes. The COPM was designed as an outcome measure to evaluate changes in perceived occupational performance and satisfaction with performance in identified problem areas. Results of a number of studies show that the COPM demonstrates good test-retest reliability and content validity. Evidence of criterion and construct validity and responsiveness of the COPM also exist (Law et al., 1998).

The Teacher Awareness Scale (TAS) was used to measure the intermediate outcomes of the OTSBC services by assessing the degree of teacher awareness of each student's problems and the degree of teacher implementation of the strategies recommended by the occupational therapist. The TAS was designed specifically for this study. The conceptual basis

TABLE 1.
Demographics, clinical, and service utilization profiles

Student characteristics		Statistics (Total = 91)
Age		Mean: 7.6 SD: 1.8
Gender	Male	70(77%)
	Female	21 (23%)
Grade	Kindergarten	10 (11%)
	Grade 1	13 (14%)
	Grade 2	15 (16%)
	Grade 3	12 (13%)
	Grade 4	21 (23%)
	Grade 5	20 (22%)
Type of school	Public school	67 (74%)
	Separate school	24 (26%)
Type of classroom	Regular without withdrawal	43 (47%)
	Regular with withdrawal	35 (39%)
	Special education without integration	4 (4%)
	Special education with integration	8 (9%)
	Other	1 (1%)
Classroom assistance	None	43 (47%)
	Remedial programming	25 (28%)
	Education assistant	9 (10%)
	Other	14 (15%)
Home language of students	English	82 (90%)
	English and Other	4 (4%)
	Other	5 (6%)
Home language of parents	English	77 (85%)
	English and Other	5 (5%)
	Other	8 (9%)
	Unknown	1 (1%)
Other special services received	Yes (including social work, medication or , psychological assessment, speech language pathologist)	23 (25%)
	No	68 (75%)
Length of time between pre- and post-test		Mean: 150 days SD: 59 days

for the scale was guided by the OTSBC Model, which proposes that teachers (the learner) learn from the occupational therapist (the educator) to develop an understanding of the student's problems and the skills to intervene. These skills are subsequently applied with the students to improve their occupational performance.

The TAS includes two subscales: Teacher Awareness (TA) and Teacher Implementation (TI). The TA subscale is a 4-point scale that measures the level of awareness and understanding the teacher had regarding the student. The occupational therapist rated the TA subscale twice, once before and once after intervention. The TI subscale is a 6-point scale for the occupational therapist to rate the teacher's degree of implementation of strategies and recommendations after occupational therapy consultation. Both subscales demonstrated good test-retest reliability. Three sets of test retest observations were obtained: 20 pairs of initial TA subscale scores, 20 pairs of reassessment TA subscale scores, and 20 pairs of TI subscale scores. The Kappa coefficients of the 60 pairs of observations were .90, .77 and .88 respectively ($p < 0.001$).

The Client Feedback Questionnaire (CFQ), was used to measure how satisfied the teachers and parents/caregivers were with the OTSBC services. The CFQ was designed by COTA Health to obtain clients' feedback about service delivery processes. It has been pre-tested and used in the COTA Health annual Client Feedback Survey since 1998 and has demonstrated its usefulness in identifying areas of strength of the service and opportunities for changes in the service delivery processes (Chiu, 2002).

Sociodemographic and clinical data such as diagnosis, intervention strategies, and type of school were provided by occupational therapists at the beginning and end of the school year using the Background Information Form. Utilization data such as length of service, number of visits, and source of referrals were extracted from the administrative database at COTA Health.

Data Collection Procedures

The students who were recruited for this study could be seen by any of the occupational therapists providing SHSS at COTA Health. Each occupational therapist was trained to ensure that the COPM (Law et al., 1998) and the Teacher Awareness Scale (TAS) (Reid, Chiu, Wehrmann & Sinclair, 2003) were administered according to a standardized protocol. We used a combination of training methods including demonstration, role-play, case studies, and discussion.

At each student's school, the occupational therapist administered the COPM in two separate interviews (initial assessment and reassessment) with the teacher. During each interview, the teacher was asked to identify classroom related tasks with which the student had difficulty and to rate the importance of each problem. This approach was taken since consultation was provided to the teachers and their perception of changes was needed in this study in order to evaluate the consultation model. It was expected that teachers would identify problems with which they were concerned. For each identified problem the teacher rated the student's performance and their satisfaction with his/her performance. In this study, the initial assessment was completed on average at the third visit in the 2001-2002 school year.

The COPM score was based on the perceptions of the teachers. Therefore, the COPM reassessments were administered with the same teacher and conducted before the end of the school term in spring of 2002. To reduce any potential bias in scoring, the initial COPM scores were not given to the occupational therapist and teacher at the time of reassessment, and the time between assessments was long enough for memory to not be a factor. In situations where service goals were achieved before the end of the school term and the student was discharged from the service, a reassessment was conducted at the time of discharge. Before the reassessment at the end of the 2002 school year, we conducted a second training session for all occupational therapists. This training session ensured that guidelines for re-administering the outcome measures were followed according to standardized procedures. The occupational therapist completed the TAS following the administration of COPM at initial assessment and reassessment. Also at this time, a Client Feedback Questionnaire (CFQ) was mailed to the teacher and parent/caregiver of each student participant. To increase the response rate, a stamped return-addressed envelope was enclosed, and a second mailing followed to non-respondents.

Data Analysis

Descriptive statistics were calculated for sociodemographic, clinical data, occupational therapy interventions, CFQ and COPM problems using SPSS version 11 Statistical Software. Simple t-tests were conducted for COPM and TAS to determine the probability of the means being different from zero, adjusted for multiple comparisons using the Bonferroni procedure.

Univariate analyses were conducted to select independent variables that statistically significantly contributed to the COPM Performance/Satisfaction change scores. The selected variables were included in backward multiple regressions to determine the final explanatory model of service outcomes. Confounding effects such as correlation between the visit numbers and length of stay on outcomes were tested and addressed when applicable (Hosmer & Lemeshow, 1989; Rosner 1999).

Results

COPM Problems and their Importance

The COPM problem categories are summarized in Table 2. The teacher of each student identified a maximum of five problems. Across the 91 students, 365 problems were identified with an average of four problems per student. We summarized the problems into 17 categories. The most frequently identified categories were:

1. Writing or printing (e.g., illegible writing and printing, inability to stay on the line, letter reversals, mastering the sequence and direction of strokes in cursive writing),
2. Organization skills (e.g., keeping materials in order, remembering the sequence of tasks, completing homework, keeping the work area tidy),
3. Desk skills (e.g., using rulers, scissors, applying glue, folding paper, stabilizing paper, rolling clay).

Other COPM problems identified by the teachers included attention problems, being unable to work independently, incorrect pencil grasp, and social skills problems.

The teacher also rated each COPM problem using a 10-point importance scale, with a higher score reflecting greater importance (Table 2). The average importance score across the 365 problems was eight, showing that the problems identified by teachers were of high importance and were perceived as affecting the daily performance of the students at school. The majority of the problems the teacher identified were productivity problems.

Occupational Therapy Interventions Provided

In this study, a total of 31 occupational therapists were involved in providing the OTSBC services. Following the initial assessment visit(s), the average number of intervention visits between the initial assessment and reassessment was 13 visits for students who were still receiving services at the end of the school year and 12 visits for students who were discharged prior to or at the reassessment visits. The visit range was 2 to 18.

The results showed that the occupational therapists provided education to 89% of the children's key school personnel (teacher, special education teacher), 26% of other school personnel (teaching assistant), and 65% of parents/caregivers involved with the student. Teachers and caregivers received the majority of interventions. The occupational therapists provided education to the teachers in the use of specialized approaches such as the multi-sensory and biomechanical/postural approaches. The occupational therapists also taught teachers how to carry out task analyses of fine motor tasks and how to use alternative written communication.

The most frequently used adaptive strategy provided by occupational therapists was the modification of printing and writing tasks in the classroom (25%). Occupational therapists recommended resources for the teachers to use to help the students to print and write (15%), including teacher manuals and student workbooks, pencil grips, handouts of specialized techniques, and fine motor and writing worksheets. The occupational therapists also educated the teachers in the use of specialized techniques such as the multi-sensory approach, methods to improve organizational skills of the student, and strategies to ensure proper positioning. The teachers were taught how to break down fine motor tasks into smaller steps and help the student to use alternative written communication.

Outcomes and Satisfaction of OTSBC Service

The outcome of the OTSBC service was measured using the two scales of COPM: performance and satisfaction. The

TABLE 2
COPM problem categories and importance score

COPM problem categories	Number of problems identified	Percentage of total problems (N=365)	Mean COPM importance score
1 Writing/printing	128	35%	7.3
2 Organizational skills	46	13%	8.3
3 Desk skills	35	10%	7.5
4 Attention	27	7%	8.6
5 Independent work	20	5%	7.7
6 Pencil grasps	15	4%	8.6
7 Social skills	13	4%	8.5
8 Gym	11	3%	7.8
9 Copying	9	2%	6.2
10 Behaviour	8	2%	8.3
11 Drawings	6	2%	6.2
12 Self-care	6	2%	8.7
13 Follow instructions	5	1%	8.5
14 Rushing through work	4	1%	7.3
15 Colouring	4	1%	7.8
16 Elaborate when writing	3	1%	9.0
17 Other	25	7%	8.4
Total:	365	100%	8.0

COPM performance initial mean score was 3.80 (SD = 1.27), and the mean reassessment score was 5.30 (SD = 1.72). The mean change score, calculated by subtracting the initial score from the reassessment score, was 1.50 (SD = 1.63, t-test = 8.76, df = 90, $p < .001$; range: -2.0 to 6.0). The COPM satisfaction initial mean score was 3.79 (SD = 1.66) and the mean reassessment score was 5.71 (SD = 2.19). The mean change score was 1.92 (SD = 2.38, t-test = 7.68, df = 90, $p < .001$; range: -2.8 to 9.0).

Teacher awareness, a key intermediate outcome, was measured using the TAS. The pretest-posttest ratings of the TA subscale showed that the occupational therapists' ratings of the teachers' awareness of the students' special needs had changed in a positive direction, however the change was not statistically significant. The TI subscale rating showed that 80.0% of the teachers implemented or transferred the knowledge they acquired from the occupational therapists to other students in their class with similar issues and/or shared this knowledge with other teachers with moderate to complete success.

The mean CFQ Teacher subscale score was 3.28 (SD: 0.57) and CFQ Parent subscale score was 3.39 (SD: 0.64), indicating a high level of satisfaction by both teachers and parents with the OTSBC services. The results showed that 84.4% of the teachers rated the service as excellent or good, 10.3% rated fair or poor, with 5.0% unknown. Parents were also mostly satisfied, with 81.1% rating excellent or good, 11.3% fair or poor, and 7.5% unknown. Teachers identified nine high satisfaction areas (where more than 90.0% of respondents indicated satisfaction in the CFQ) with the service: caring and friendly manner, being on time, having appointments kept as scheduled, understanding problems and feelings, using words that can be understood, being sensitive to special needs, explaining services at the beginning, listening to them closely, and agreeing on goals. The parents had high satisfaction in three areas: using words that can be understood, explaining services at the beginning, and receiving services in chosen language. Both teachers and parents indicated that they were pleased with the service because the occupational therapists were caring and professional, the respondents benefited from the services, and that they had good communication and relationships with the occupational therapists.

The survey also collected feedback on areas of dissatisfaction and suggestions for improvement. The results showed that both parents and teachers had high dissatisfaction (more than 20% of the respondents were dissatisfied) in three areas: the wait for service to begin, visit frequency (wishing to have more visits and more frequent visits), and linkage to other community services. Suggestions for improvement were an increase of the number of visits and the frequency of visits, a decrease in waiting time before service begins, and more contact and written communication.

Univariate analyses were conducted to test which independent variables contributed significantly to the COPM Performance Change scores. The variables tested included the TA subscale change score, the TI subscale score, CFQ Teacher subscale score, CFQ Parent subscale score, age, gender, initial COPM score, school type, strategies used, resources recommended, length of service, number of visits, and other services such as physiotherapy (PT) and medication. Seven statistically significant variables ($p < 0.05$) were identified and selected for further analysis. They were initial COPM Performance score, TA subscale change score, TI subscale score, CFQ Teacher subscale score, pencil grip recommended to school personnel, pencil grip recommended to parents, and school type.

A backward multiple regression was conducted using the variables that were found to be significant through the univariate analysis, and potential confounding effects were tested (Hosmer & Lemeshow, 1989). Because the CFQ Teacher subscale score and the TI subscale score showed confounding effects and the TI subscale score explained a larger variance than the CFQ Teacher subscale score in the multiple regression, the CFQ Teacher subscale score was excluded from the final multiple regression model. The final multiple regression model shown in Table 3 included the initial COPM Performance score, TA subscale change score, TI subscale score, and school type. Through this model, we found that:

TABLE 3
Multiple Regression Models of COPM Change Scores

Independent variables	Beta Coefficients	Standard Error	Significance
Regression Model of COPM Performance Change Score R-square = 0.264			
Initial COPM Performance score	-0.429	0.120	0.001
TA subscale change score	0.503	0.237	0.037
TI subscale score	0.751	0.319	0.021
School type	0.696	0.346	0.047
Regression Model of COPM Satisfaction Change Score R-square = 0.315			
Initial COPM Satisfaction score	-0.686	0.127	<0.001
TI subscale score	1.539	0.421	<0.001

- The lower the initial COPM performance score, the greater the change in COPM performance score,
- The greater the change in teacher awareness (TA subscale change score), the greater the change in COPM performance score,
- The greater the degree of implementation of OT strategies (TI subscale score), the greater the change in COPM performance score, and
- Students attending public schools had a greater change in COPM performance score than those attending separate schools.

The same procedure was repeated to analyze the COPM Satisfaction score. The univariate analysis resulted in the selection of nine statistically significant ($p < 0.05$) independent variables to be included in the multiple regression analysis. The variables tested included the TA subscale change score, the TI subscale score, CFQ Teacher subscale score, CFQ Parent subscale score, age, gender, initial COPM score, school type, strategies used, resources recommended, length of service, number of visits, and other services (PT, SLP). Eight statistically significant variables ($p < 0.05$) were selected for further analysis. They were initial COPM Satisfaction score, TI subscale score, age, CFQ Teacher subscale score, other services received, pencil grip recommended to school personnel, handouts recommended to school personnel, and school grade. The CFQ Teacher subscale score was excluded from the final multiple regression model for the same reason described above in the analysis of COPM performance change score. The final multiple regression model shown in Table 3 included the initial COPM satisfaction score and TI subscale score. The results showed that:

- The lower the initial COPM satisfaction score, the greater the change in COPM satisfaction score.
- The greater the degree of implementation of OT strategies (TI subscale score), the greater the change in COPM satisfaction score.

Discussion

This study has its limitations. The first is a lack of a control group. Without a control group, the effectiveness cannot be inferred. The design used in this study made it impossible to control for maturation factors and regression towards mean. Second, the data collection was limited to a single organization serving a group of children with fine motor problems. The generalizability of the results is limited to COTA Health and the children it serves in the Greater Toronto Area. Third, one of the measurement tools, the TAS, was developed for this study and was only evaluated for test retest reliability, not other psychometric properties.

A final limitation of this study is that the mean COPM change scores were 1.50 (performance score) and 1.92 (satisfaction score). The authors of the COPM indicate that changes of two or more points are clinically important based on studies with adults and older adults who received direct services (Law et al., 1998). In a review of minimal clinically important difference (MCID), Beaton and colleagues (2002) argued that instead of a fixed number, MCID is a context-specific value. The context of this study is different from that of the MCID studies of COPM in several aspects including: the COPM was rated by the school teacher instead of the client, the study population was children instead of adults, and the intervention was a consultative approach instead of direct service. Hence, it is unclear if the recommended magnitude of MCID, 2 units of change score, are applicable to the context of this study. A change score less than 2 in this study may not necessarily mean that the change was clinically insignificant in a school-based consultation context. As a MCID value of an instrument is unlikely to be applicable across all contexts; the measurement and interpretation of the MCID of the COPM in a school-based consultation context requires further research (Beaton et al., 2002).

Findings indicated that 35% of COPM problems identified by the teachers were related to writing or printing (Table 2). This result supports evidence in the literature indicating that the majority of work occupational therapists provide in the schools is remedial handwriting (CAOT, 1990; Cornhill & Case-Smith, 1996; Madill et al., 1990). Other major problems were organization and desk skills. All the above problems were perceived by the teachers as highly important to the students' occupational performance in the school.

In a consultative model, occupational therapy interventions focus on the education of the teacher and/or parents, provision of recommendations, and introduction of resources. The OTSBC model asserts that the success of the intermediate outcomes, teacher awareness and implementation of occupational therapy strategies, is critical to the achievement of the long-term outcomes: the improvement of occupational performance of the students and their quality of life. This study has provided some evidence of the relationship of the consultative process and service outcomes described in this model. First, occupational therapy consultation to teachers was followed by changes in students' performance and satisfaction rated by their school teachers. Second, increases in teacher knowledge and implementation of occupational therapy strategies were seen following consultation. Third, increased COPM scores were related to increases in teacher knowledge and implementation of occupational therapy recommendations, which indicates, as the model suggests, that this relationship may be an important intermediate step in improving occupational performance problems of the students.

A number of other factors influenced students' occupational performance besides the level of teacher awareness and implementation of strategies. One of these factors was the level of teacher satisfaction with the service delivery process. Teacher satisfaction level was associated with a greater positive change in the student's occupational performance. The results showed that teachers became more satisfied when they and their students benefited from services, when they had good communication with the occupational therapists, and when they received professional services. The correlation between the TI subscale score and CSQ Teacher subscale score indicated that teachers who had more success with implementation of occupational therapy strategies were more likely to be satisfied with the OTSBC services.

Another interesting finding in the regression analysis was that the students in the public school board (74% of the sample) showed a greater change in the teacher's perception of performance on the COPM than those in the separate school board (26% of the sample). This variable was included for analysis because clinical experiences show that the referral procedures and the available special education support for the students are different between the two school boards. Yet, why there was a difference between the two school systems in the findings requires further investigation.

There is some evidence that the OTSBC model represents a viable and effective model for providing services in the school for children who face occupational performance challenges. The OTSBC model, designed and developed based on practice, emphasizes a collaborative approach among the students, teachers, parents, occupational therapists, and referrers. This paper reports on the evaluation results of the OTSBC model and provides some evidence of the benefits of the OTSBC service. The results contribute to the understanding of the importance of teachers' awareness of the occupational performance of students with fine motor problems on the resolution of occupational performance issues.

Acknowledgements

This study was funded by the Hospital for Sick Children Foundation. We would like to acknowledge the support from the CCACs for City of York, East York, Etobicoke, North York, Scarborough, and Toronto and thank the Toronto District School Board, Toronto Catholic District School Board and its school principals who agreed to participate in the study. Special thanks go to the parents, students, teachers, CCAC case managers, and occupational therapists who participated in the study and made this study possible.

References

American Psychiatric Association [APA] (1994). Motor skill disorder 315.40 developmental coordination disorder. In APA (Ed.), *Diagnostic and statistical manual of mental disorder (DSM IV)* (pp. 53-55). Washington, DC: APA.

Ayres, A. J. (1972). Types of sensory integrative dysfunction among disabled learners. *The American Journal of Occupational Therapy, 26,* 13-18.

Bairstow, P. J., & Lasszlo, J. I. (1989). Deficits in the planning control and recall of hand movements in children with perceptuo-motor dysfunction. *British Journal of Developmental Psychology, 7,* 251-253.

Barnes, K. J., & Turner, K. D. (2001). Team collaborative practices between teachers and occupational therapists. *American Journal of Occupational Therapy, 55,* 83-89.

Beaton, D.E., Boers, M., & Wells, G.A. (2002). Many faces of the clinically important difference (MCID): A literature review and directions for future research. *Current Opinions in Rheumatology, 2,* 109-14.

Blondis, T. A., Snow, J. H., Roisen, N. J., & Accardo, P. J. (1993). Early maturation of motor delayed children at school age. *Journal of Child Neurology, 8,* 323-329.

Bonney, M. (1992). Understanding and assessing handwriting difficulty: perspectives from the literature. *The Australian Occupational Therapy Journal, 39,* 7-15.

Bouffard, M., & Wall, A. E. (1990). A problem solving approach to movement skill acquisition: Implications for special populations. In G.Reid (Ed.), *Problems in movement control.* (pp. 107-130) North-Holland: Elsevier.

Canadian Association of Occupational Therapists. (1990). Position paper on occupational therapy in schools. Toronto, ON: Author.

Canadian Association of Occupational Therapists (1991). *Occupational therapy guidelines for client-centred practice.* Toronto, ON: CAOT publications ACE.

Canadian Association of Occupational Therapists (1997). *Enabling Occupation.* Ottawa, ON: CAOT Publications ACE.

Case-Smith, J., & Cable, J. (1996). Perceptions of occupational therapy regarding service delivery models in school-based practice. *The Occupational Therapy Journal of Research, 16,* 23-44.

Case-Smith, J. (2002). Effectiveness of school based OT intervention on handwriting. *American Journal of Occupational Therapy,* 56, 17-25.

Chiu, T. (2002). Learning from evidence: service outcomes and client satisfaction with occupational therapy home-based services. *American Journal of Occupational Therapy, 56,* 217-220.

Cornhill, H., & Case-Smith, J. (1996). Factors that relate to good and poor handwriting. *American Journal of Occupational Therapy, 50,* 732-739.

COTA Comprehensive Rehabilitation and Mental Health Services [COTA]. (2000). Number of School-based Clients served in the past 5 years. [Unpublished Work]

COTA Health (2001). Statistics of OT School-based Services: 2000 to 2001. [Unpublished Work]

Cratty, B. J. (1994). *Clumsy child syndrome: Description, evaluation and remediation.* Chur, Switzerland: Harwood Academic Publishers.

DePoy, E., & Gitlin, L. (1998). *Introduction to Research Understanding and Applying Multiple Strategies, (2nd ed).* St Louis: Mosby.

Dunn, W. (1990). A comparison of service provision models in school-based occupational therapy services: a pilot study. *The Occupational Therapy Journal of Research, 10,* 300-320.

Fairbairn, M. L., & Knowles, I. F. W. (1993). Teachers' perceptions of the role and effectiveness of occupational therapists in schools. *Canadian Journal of Occupational Therapy, 60,* 185-191.

Frankel, M. (1983). Sampling Theory. In P.H.Rossi, J. D. Wright, & A. B. Anderson (Eds.), *Handbook of Survey Research.* New York: Academic Press, Inc.

Goodgold-Edwards, S. A., & Cermak, S. A. (1990). Integrating motor control and motor learning concepts with neuropsychological perspectives on apraxia and developmental dyspraxia. *American Journal of Occupational Therapy, 44,* 314-439.

Gubbay, S. (1978). The management of developmental apraxia. *Developmental Medicine and Child Neurology, 20,* 643-646.

Hosmer, D. W., & Lemeshow, S. (1989). *Applied Logistic Regression.* New York: John Wiley & Sons.

Kadesjo, B., & Gillberg, C. (1998). Attention deficits and clumsiness in Swedish 7-year-old children. *Developmental Medicine and Child Neurology, 40,* 796-804.

Kemmis, B. L., & Dunn, W. (1996). Collaborative consultation: the efficacy of remedial and compensatory interventions in school contexts. *American Journal of Occupational Therapy, 50,* 709-717.

King, G. A., McDougall, J., Tucker, M. A., Gritzan J., Malloy-Miller T., Alambets, P., et al. (1999). An evaluation of functional, school-based therapy services for children with special needs. *Physical & Occupational Therapy in Pediatrics, 19,* 5-68.

Law, M., Baptiste, S., Carswell, A., McColl, M., Polatajko, H., & Pollock, N. (1998). *Canadian Occupational Performance Measure.* (3rd ed.) Ottawa ON: CAOT Publications ACE.

Lazure, D. (1978). *Commission on Emotional and Learning Disorders in Children.* Toronto, ON: Crainford.

Madill, H., Tirrul-Jones, A., & Magill-Evans, J. (1990). The application of the client-centred approach to school-based occupational therapy practice. *Canadian Journal of Occupational Therapy, 52,* 102-108.

Mandich, A., Buckolz, E., & Polatajko, H. (2002). On the ability of children with developmental coordination disorder (DCD) to inhibit response initiation: The Simon Effect. *Brain and Cognition, 50,* 150-162. doi.org/10.1016/S0278-2626(02)00020-9

Miller, L. T., Missiuna, C. A., Macnab, J. J., Mallo-Miller, T., & Polatajko, H. J. (2001). Clinical description of children with Developmental Coordination Disorder. *Canadian Journal of Occupational Therapy, 68,* 5-15.

Ministry of Education and Training. (7-19-1984). Memorandum 81. Available from the Ontario Ministry of Education and Training 2nd Floor, 880 Bay Street, Toronto,Ontario, M7A 1N3.

Pollock, N., & Stewart, D. (1998). Occupational performance needs of school aged children with physical disabilities in the community. *Physical and Occupational Therapy in Pediatrics, 18,* 55-68.

Reid, D., Chiu, T., Wehrmann, S., & Sinclair, G. (2003 July). An evaluation of school-based OT consultation services for children with fine motor problems, Paper presented at the annual AOTA Conference, Washington, DC.

Rosner, B. (1999). *Fundamentals of biostatistics, 5th ed.* Belmont, CA: Duxbury Press.

Smyth, T. R. (1996). Clumsiness: Kinesthetic perception and translation. *Child Care, Health and Development, 22,* 1-9.

Thress-Suchy, L., Roantee, E., & Pfeffer, N. (1999). Mothers', fathers', and teachers' perceptions of direct and consultative occupational services. *School System Special Interest Section Quarterly, 6,* 1-2.

Wehrmann, S., Chiu, T., Reid, D., & Sinclair, G. (2006). Evaluation of occupational therapy school-based consultation service for students with fine motor difficulties *Canadian Journal of Occupational Therapy, 73, 225-235.*

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This paper was accepted under the editorship of Fern Swedlove.

