

# **Evaluation of a Home-Based Traction Program for Children with Congenital Dislocated Hips and Legg Perthes Disease**

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La traction à domicile est une solution de remplacement à la traction en hôpital pour les enfants atteints de luxation congénitale de la hanche et de la maladie de Perthes. Dans la présente étude qui porte sur vingt-quatre enfants et leurs parents, on a évalué comment le programme de traction à domicile est accepté et s'il est sûr, de même que la façon dont on s'y adapte psychologiquement et ce qu'il en coûte. Tous les parents ont trouvé le programme acceptable. Il n'y a pas eu de complications graves quant au traitement, bien que 12,5 % des enfants ont eu des irritations cutanées et étaient mal à l'aise. Il n'y a pas eu de difficulté importante pour ce qui concerne l'adaptation psychologique; les mères ont fait état de perturbations dans la famille ( $p = .007$ ), les pères ont rapporté des tensions dans leur relation de couple ( $p = .012$ ), et, globalement, les mères ont ressenti une détresse beaucoup plus grande que les pères ( $p = .051$ ). Tous coûts confondus (directs et indirects), on a découvert que le programme de traction à domicile coûte beaucoup moins cher que les soins classiques.

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Home-based traction (HBT) is an alternative to hospital traction for children with congenital dislocated hips and Legg Perthes disease. In this study, we evaluated the acceptability, safety, psychological adjustment, and costs of an HBT program for 24 children and their parents. All parents found the program acceptable. There were no major treatment complications of traction, although 12.5% of children experienced skin irritation and discomfort. There were no major problems in psychological adjustment; mothers reported disruption in family functioning ( $p = .007$ ), fathers reported stress in marital relationships ( $p = .012$ ), and there was significantly greater overall distress for mothers than fathers ( $p = .051$ ). The HBT program was found to be substantially less costly than conventional care when direct and indirect costs were considered.

Children diagnosed with congenital dislocated hips (CDH) and Legg Perthes disease (LPD) are traditionally hospitalized and placed in traction for approximately three weeks. The purpose of traction is to provide immobility for the affected joint or to prevent complications such as avascular necrosis of the hip or neurovascular problems to the legs (Dunst, 1990; Weiner & Hoyt, 1977). However, hospital treatment is costly and not always readily available, and it has been associated with adverse effects on family development, functioning, and financial stability (Hendrick & Inui, 1986; Koren, 1991; Marks, 1991). In the current economic climate in Canada, it is important that we establish a treatment approach that is acceptable, safe, and cost-effective for both health professionals and consumers.

Home-based traction (HBT) is an alternative to conventional hospital traction. The concept of HBT for children with orthopaedic conditions such as CDH and LPD has been generally supported by health-care professionals. However, widespread implementation of HBT programs has not occurred and research designed to evaluate the safety, effectiveness, and cost of such programs is limited in scope and rigour (Capasso & Maffulli, 1990; Chartrand, 1992; Joseph, MacEwan, & Boos, 1982; Mubarak, Beck, & Sutherland, 1986; Villalon & Smith, 1982; Vousinas, MacEwan, & Boos, 1984). The purpose of this study was to evaluate an HBT program for children with orthopaedic conditions, including its impact on their parents.

### Literature Review

CDH and LPD are orthopaedic conditions diagnosed in children. The incidence of CDH in Canada is approximately 58:10,000 births (Statistics Canada, 1991) and the incidence of LPD is approximately 1:20,000 in the general population but 1:35 in family members (Hospital for Sick Children, 1992). Traction is a common treatment for both conditions, traditionally in hospital. However, the efficacy of traction for

CDH has not been conclusively established (Fish, Herzenberg, & Hensinger, 1991) and the appropriateness and high cost of carrying out this treatment in hospital have been questioned.

Several reports of HBT programs have been published over the past two decades, primarily retrospective descriptions of the frequency and nature of treatment complications and direct costs of HBT. Joseph, MacEwan, and Boos (1982) described their six-year experience with 66 children (37 in HBT and 29 in hospital traction). No differences were found between the two groups in follow-up radiology reports or in the incidence of avascular necrosis, infections, skin problems, or psychiatric disorders. Similarly, Holmes, Sedgwick, and Scobie (1983) reported on a 15-year review of 140 children in traction (40 in an HBT program). No significant complications were reported in either group. A cost benefit was realized for home management as reported from third-party payees and families.

Vousinas, MacEwan, and Boos (1984) compared the effectiveness of traction and the incidence of severe complications for 60 children with CDH treated with HBT and 30 children hospitalized for pre-reduction traction. Treatment was reported to be equally effective in the two groups, but the incidence and severity of avascular necrosis was inexplicably higher in the hospital group. Mubarak, Beck, and Sutherland (1986) described the HBT experience, over two years, of 14 children with CDH. Indirect cost savings of US\$5,000 per child and the absence of avascular necrosis of the hip and neurovascular problems in the legs were reported. Decreased psychological stress to the child and family was noted; however, the method of assessing this stress was not specified.

Chartrand (1992) reported on four years' experience with HBT for 54 children with CDH and two children with fractured femur, at the Hospital for Sick Children in Toronto. Skin breakdown, replacement of tapes, and chest infections were described in five of the 54 children. A significant cost saving of CAN\$21,000 per child was reported. Not included, however, were costs of professional services and direct and indirect costs incurred by parents.

In summary, published reports support the safety of HBT as well as actual or potential cost savings; however, acceptability to parents, psychological and social adjustment of the child and parents, and indirect costs have not been adequately assessed. A conceptual framework for evaluating the HBT experience has not been developed. Such a framework could be used to describe the relationships amongst the impact of

the child's illness on the child and parents, the incidence of complications, direct cost implications, the shift in patient care responsibility from health professionals to parents, and the collaboration between health-care professionals and consumers.

### Conceptual Framework

A hospital/community system-linked model was developed to describe, implement, and evaluate HBT as an innovation or alternative to conventional care (Stockwell et al., 1994). This model had been proposed because a search of the literature failed to provide a theory incorporating the elements of hospital/community-linked care wherein systems of education and support are available to caregivers. Major concepts from models of innovation (Zaltman, Duncan, & Holbeck, 1973); health utilization (Browne, Arpin, Corey, Fitch, & Gafni, 1990); determinants of health (Evans & Stoddart, 1990); self-efficacy (Bandura, 1977); stress, coping, and appraisal (Lazarus & Folkman, 1984); problem-solving (D'Zurilla, 1986); and systems theory (Pallister & Browne, 1986) were combined in creating this model. The central processes are collaboration, reframing, and overcoming obstacles when a critical event, such as the illness of a child, occurs. The outcome of these processes is an innovative alternative to conventional treatment (i.e., HBT).

In the hospital/community system-linked model, HBT is seen as an opportunity as opposed to a stressor. This reconceptualization or reframing can take the form of a question: How can the therapeutic goals be met in an alternative way in order to minimize the negative impact on the child, the parents, and the health-care system? Legitimizing the HBT alternative allows parents to make a more optimistic appraisal of their total situation. We hypothesized that the reconceptualization of the stressor, plus the support of coordinated educational and in-home services, would assist parents, home-care nurses, and hospital nurses in implementing the HBT program in a way that is safe for the child and acceptable to all stakeholders. We further hypothesized that this innovation would result in the psychological well-being of the child and parents and in decreased costs to the health-care system. This model provides a basis for evaluating the HBT alternative in terms of acceptability, safety, psychological impact on the child and parents, and cost effectiveness. A more detailed description of the model can be found in Stockwell et al. (1994).

## **Methods**

### ***Design and Research Questions***

A prospective quasi experimental repeated-measures design was used to answer the research questions:

1. Is the HBT program acceptable to parents? Why/Why not?
2. Is the HBT program safe? What are the nature and frequency of untoward effects (complications) for the child and the parents?
3. What are the psychological and social consequences of the HBT program for the child and the parents?
4. What are the direct and indirect costs of HBT?

### ***Sample and Settings***

Children from the outpatient paediatric units at two university-affiliated metropolitan hospitals were eligible to participate in the study if they (a) had recently been diagnosed with CDH or LPD, (b) had no additional complicating health problems, (c) were under 16 years of age, (d) had primary caretakers willing to take responsibility for daily care, (e) lived with their primary caretakers at home, and (f) had primary caretakers who spoke and understood English.

During a two-year period, all parents of eligible children who were approached consented to participate in the study and were admitted to the HBT program. Two children diagnosed with CDH did not meet the eligibility criteria (i.e., parents or other family members were unable to take on the primary caretaker role at home). Fifteen of the participating children were diagnosed with CDH and nine with LPD. The mean age of children with CDH was 7.5 months (range 1.5-26 months,  $SD=4.8$ ), with LPD 6.5 years (range 5-8 years,  $SD=1.3$ ). Four of the CDH children were male and 11 were female; eight of the LPD children were male and one was female. Although the sample was small, it was representative of the usual gender distributions for these two orthopaedic conditions.

The mean age of mothers was 31.2 years (range 19-42,  $SD=4.1$ ) and of fathers 32.2 (range 23-44,  $SD=6.3$ ). Family income ranged from \$9,000 to >\$60,000 with the median being \$44,500. Twenty-three of the children came from two-parent families and one child lived with his mother only. There were other children in the home in 18 of the families. In 12 families a parent was at home full-time, and in eight families a parent was at home part-time (i.e., worked part-time outside the home).



### *The HBT Program*

Children in the HBT program are first admitted to the hospital paediatric unit for approximately two days. While hospitalized, children with CDH are placed in a portable traction unit designed to fit cribs at home. Children with LPD are placed in a skin-traction apparatus adjusted to fit the child's bed at home. The child is initially placed in traction by the orthopaedic surgeon or resident. The traction is adjusted for each child and for the crib or bed at home. Parents are then taught by the project coordinator how to place in and remove their child from the traction apparatus, how to manage the traction apparatus, and how to observe their child for any problems, using information packages developed by the project nurse (Stockwell et al., 1994). The child is discharged from hospital when he/she has adjusted to the traction, the parents are knowledgeable about traction care, and collaboration has been established between hospital and community services.

Collaboration between parents and health professionals from the hospital and the community is viewed as a key component in implementation of the HBT program. The program is administered by a project coordinator, who is an experienced paediatric nurse employed by the hospital. The primary responsibilities of the project coordinator are to enrol eligible children and parents in the HBT program, coordinate hospital care for the child, provide teaching for the parents, and coordinate hospital and home-care nursing services prior to discharge. The project coordinator and a home-care nurse visit the child and parents on the day of discharge or the day after. The home-care nurse is employed by a community nursing agency such as the regional public health department, the Victorian Order of Nurses, or St. Elizabeth's Nurses. The community agency attempts to have the same nurse consistently visit each family. The home-care nurse is not consistent across families, as participants are spread throughout a wide geographic area serviced by several nursing agencies. The home-care nurse continues to visit the child and parents as required (an average of once to twice per week). Parents are encouraged to contact the home-care nurse, orthopaedic surgeon, family physician, or project coordinator, or to return the child to the hospital ward or emergency room if they have any concerns or if any untoward events occur. Follow-up of the child's orthopaedic condition and traction treatment is carried out by the orthopaedic surgeon at the orthopaedic outpatient clinic following completion of HBT or during rehospitalization if surgical treatment of the CDH or LPD is deemed necessary. A more detailed description of the HBT program is summarized in Stockwell et al. (1994).

### Data Collection Procedure

Ethics approval was received for the HBT study from the two participating hospitals. Eligible children were identified by the orthopaedic surgeons and consent was obtained from the parent(s) by the project coordinator. Data were collected, by the project coordinator, from parents during the hospital stay (Time 1), at the end of the home stay (Time 2), and two to three weeks following completion of the HBT program (Time 3). The outcomes, the source of data, the data collection method, and the measures used are summarized in Table 1.

<b>Table 1</b> <i>Data Collection Procedures for Study Outcomes</i>				
<b>Outcomes</b>	<b>Time</b>	<b>Measure</b>	<b>Method</b>	<b>Source</b>
Acceptability	T3	2 Open-Ended Questions	Interview	Mother Father
Untoward Effects	T1, T2		Diary Chart Clinical Assessment X-Rays	Parents Nurse Orthopaedic Surgeon
Psychologic Adjustment to Illness	T1, T3	PAIS (Derogatis & Lopez, 1993) CBCL (Achenbach & Eldebrook, 1983)	Questionnaire	Mother Father
Costs Direct/ Indirect	T1, T2	Health Services Utilization Questionnaire (Browne et al., 1990)	Questionnaire	Parents' Diary

### Measures

**Acceptability of the HBT program.** Acceptability was assessed by asking the parents two open-ended questions during a structured interview at Time 3. These were: Was the HBT program acceptable to you? Why or why not?

**Safety of the HBT program.** Safety was assessed by describing the nature and frequency of major and minor complications of HBT for the child and parents. Data on safety were collected throughout the hospital and home stay from the child's medical record and a diary that the parents were asked to keep. The orthopaedic surgeons assessed the children for major complications, including avascular necrosis of the hip and neurovascular problems to the legs, at Time 1 and Time 2, by clinical assessment and x-ray.

***Psychological adjustment to the HBT program.*** The Psychological Adjustment to Illness Scale (PAIS) (Derogatis & Lopez, 1983) was administered to each parent by the project coordinator to assess psychological adjustment to their child's illness and HBT treatment at times 1 and 3. The PAIS was designed to measure the individual's ability to cope with a medical event (i.e., the child's illness and treatment) in relation to health utilization, vocational and domestic environment, relationships with spouse and extended family, and social and psychiatric distress.

The PAIS is a structured 46-item interview, with each item rated on a four-point scale. The internal consistency ( $r=.81$ ), inter-rater reliability ( $r=.86$ ), and construct validity (judged by factor analysis and reported to be moderate to good) were established by Derogatis and Lopez (1983). Convergent validity, established by correlating the PAIS Total Adjustment Score with the Global Adjustment to Illness Scale, was  $r=.81$  (Derogatis & Lopez). Interrelationship among domains averaged  $r=.31$ , reflecting the breadth and sensitivity of the measure (Derogatis & Lopez).

The Child Behavior Checklist (CBCL) (Achenbach & Edelbrock, 1983) was administered to each parent by the project coordinator, to assess their perception of the psychological consequences of HBT on the child, at times 1 and 3. Different versions of the measure were used for parents of two- to three-year-olds and for four- to 16-year-olds. The CBCL was not deemed appropriate for children under two years of age. For the children with LPD who ranged in age from five to eight, the Behavior Profile, with 20 social competence items, was also completed by parents. These items, scored on a three-point scale, included parental report of the extent and quality of the child's participation in sports, hobbies, games, activities, organizations, jobs, chores and friendships; how the child got along with others, played and worked alone, and functioned in school. The total social competence score and the behavioural-problem scores provided global indices of the child's competencies and problems. This instrument is reported to have good evidence of content and construct ( $r=.62-.87$ ) validity and test-retest reliability ( $r=.72-.97$ ) (Achenbach & Edelbrock, 1983).

***Direct and indirect costs of HBT.*** The Health Services Utilization Questionnaire (HSUQ) (Browne et al., 1990) was developed from the measure by Spitzer, Roberts, and Delmore (1976) and utilized to assess the direct cost of health-care service plus the parents' direct costs (travel, telephone, babysitting, and child entertainment) and indirect



costs (time off work, sick time). Parents were asked to record, in a diary, all costs incurred throughout the HBT program. Each set of parents self-administered the HSUQ, which included questions about the respondent's use of 12 categories of health services at Time 1 and Time 2. Interrater reliability (72-99%) and content validity for this questionnaire have been reported as good (Browne et al).

A chart abstraction sheet (CAS) was developed to record data on sociodemographic and disease variables obtained during a structure interview with the parent(s) at Time 1. All measures were pilot-tested with the first three sets of parents. As only minor changes in wording were made to a few questions, these parents were included in the study sample.

### *Data Reduction and Management*

All data were recorded directly on the data collection measures and stored in a locked drawer in the project coordinator's office. Confidentiality was maintained through the use of numerical codes. A master list of codes and names of participants was stored in the office of the principal investigator and destroyed at the end of the study. The quantitative data from the PAIS, CBCL, HSUQ, and CAS were coded and entered on the SPSS:PC software program by a trained data-entry clerk and reduced to summary and subscale scores on the computer.

Qualitative data from the questions on acceptability and safety were subjected to interpretive content analyses. Responses to the open-ended questions were transcribed by an experienced transcriber and categorized. These categories were determined by two of the co-investigators, based on the conceptual framework and literature review. When disagreements arose, the category was discussed until consensus was reached. Percentages on the frequency of occurrence of responses were calculated for each category.

### *Data Analyses*

Data were analyzed using (a) descriptive statistics (means, median, and standard deviations) to describe the study sample and the frequency of untoward effects, and (b) parametric statistics (paired and unpaired t-tests) to detect significant differences in psychosocial impact and costs. Data on acceptability and safety were categorized (i.e., Yes/No) and subjected to interpretive content analyses.

## Results

### *Acceptability of the HBT Program*

At Time 3, all of the parents of eligible children stated that the HBT program was acceptable. When asked "Why?" parents stated that the choice of returning to hospital, if necessary, was the most important factor in their initial acceptance of the program (75%). Other major reasons for choosing the HBT program were the instruction provided during the initial hospitalization (60%), and the ongoing availability of support from the visiting home nurse and the family physician (56%). Parents also reported that they chose HBT to enhance family unity (46%), the child's well-being (43%), and financial stability (35%).

### *Safety of HBT*

There were no major medical or treatment complications, as determined by clinical assessment by the orthopaedic surgeon and x-ray of the 24 children in the HBT program. When queried, the orthopaedic surgeons said they considered that the treatment objectives were met equally well in the group of children receiving HBT and in those traditionally hospitalized in traction. The minor complications of skin irritation and slight irritability/pain were each reported in three children. Although no data were available for direct comparison, health professionals considered these minor complications comparable to those experienced by children receiving conventional hospital treatment.

Organizational problems within the hospital, home-care, and follow-up systems were also reported by parents as "complications." These problems included changes in post-traction surgical bookings ( $n=4$ ), unclear follow-up plans and appointments ( $n=8$ ), and delays in the initial referral to the HBT program ( $n=3$ ). These problems decreased in frequency as the program became established.

### *Psychological Adjustment to the Child's Illness and HBT*

*Parents.* The PAIS was completed by 23/24 mothers and 11/23 fathers. One mother decided not to complete the PAIS due to time constraints. Ten fathers declined to complete the PAIS after reviewing the measure, stating that they were not involved or were only minimally involved in their child's care at home. Data were analyzed to detect between-subject differences (i.e., between mothers and fathers of each illness group [CDH and LPD], separately and combined) and within-subject differences (i.e., among the mothers, fathers, and mother/father pairs).

A summary of (a) PAIS scores for mothers at times 1 and 3, (b) PAIS scores for mother/father pairs at times 1 and 3, and (c) significant results are presented in tables 2, 3, and 4, respectively.

<b>Table 2 PAIS Scores for Mothers</b>				
PAIS subscale Score	Mothers (CDH, <i>n</i> =14)		Mothers (LPD, <i>n</i> =9)	
	Time 1	Time 3	Time 1	Time 3
Health Utilization (SD)	3.65 (2.59)	3.85 (3.06)	5.86 (3.34)	7.14 (2.91)
Vocational (SD)	3.25 (3.08)	4.42 (4.08)	5.00 (2.37)	6.16 (2.40)
Family (SD)	3.00 (1.57)	4.14 (3.70)	7.43 (3.05)	11.29 (6.04)
Sexual (SD)	3.53 (2.99)	3.53 (3.57)	5.50 (3.78)	6.33 (3.72)
Extended Family (SD)	2.57 (2.20)	2.50 (3.00)	3.71 (2.87)	3.71 (2.56)
Social (SD)	7.64 (5.15)	6.92 (4.93)	8.29 (3.54)	9.14 (4.77)
Psychiatric Distress (SD)	6.92 (3.03)	6.00 (2.83)	8.57 (3.26)	10.00 (3.51)
Total (SD)	29.85 (9.26)	30.50 (18.62)	41.14 (15.99)	51.00 (21.23)

<b>Table 3 PAIS Scores for Mother/Father Pairs</b>				
PAIS subscale Score	Mothers ( <i>n</i> =10)		Fathers ( <i>n</i> =10)	
	Time 1	Time 3	Time 1	Time 3
Health Utilization (SD)	5.00 (2.76)	5.70 (3.06)	4.64 (2.87)	5.10 (3.57)
Vocational (SD)	4.67 (2.69)	5.66 (3.63)	3.33 (2.29)	3.88 (2.42)
Family (SD)	6.18 (3.37)	8.40 (6.02)	5.45 (3.14)	5.30 (2.83)
Sexual (SD)	4.30 (2.66)	6.22 (3.96)	3.40 (3.80)	2.55 (2.74)
Extended Family (SD)	2.91 (2.77)	4.30 (3.26)	2.18 (2.04)	3.00 (1.49)
Social (SD)	8.09 (4.20)	9.50 (3.34)	7.45 (3.80)	7.60 (4.94)
Psychiatric Distress (SD)	8.55 (2.11)	9.10 (2.84)	7.54 (2.02)	5.3 (1.89)
Total (SD)	37.36 (9.76)	47.00 (19.07)	34.64 (10.79)	32.60 (11.37)

**Table 4*****Psychosocial Effects of HBT on Parents as Assessed Using the PAIS***

<b>Time</b>	<b>Rater</b>	<b>Results</b>
BETWEEN-SUBJECT DIFFERENCES		
T1	Mothers & Fathers (CDH & LPD)	No significant differences between groups
T3	Mothers (CDH & LPD)	Distress in family functioning
T3	Fathers (CDH & LPD)	No significant differences between groups
WITHIN-SUBJECT DIFFERENCES		
T1 & T3	Mothers (LPD)	Distress in health utilization Distress in family functioning
MOTHER/FATHER PAIRS		
T1		No significant differences between mothers and fathers
T3	Mother	Psychiatric distress
T3	Father	Distress in sexual relationships
T3	Mother	Significant difference in total psychological adjustment of mothers versus fathers

There were no significant between-subject differences in psychological adjustment in mothers and fathers of children with either orthopaedic condition at Time 1. At Time 3, mothers of both CDH and LPD children reported significantly greater distress than fathers in family functioning ( $t = -2.75$ ,  $df\ 20$ ,  $p = .012$ ). Mothers of children with LPD (who were older) described their children as difficult to entertain and resentful of being suddenly immobilized and separated from their peers, and reported significant distress in both health utilization ( $t = 3.06$ ,  $df\ 6$ ,  $p = .022$ ) and family functioning ( $t = -2.59$ ,  $df\ 6$ ,  $p = .041$ ).

Examination of mother/father pairs (combined CDH and LPD) at Time 1 showed no significant differences. At Time 3, mothers showed increased distress in the psychiatric subscale (increased anxiety and tension) ( $t = 3.51$ ,  $df\ 9$ ,  $p = .007$ ) and fathers showed increased distress in the sexual relationship subscale ( $t = 3.21$ ,  $df\ 8$ ,  $p = .012$ ). There was also a significant difference between mothers and fathers in the Global PAIS score at Time 3, with mothers having higher overall scores than fathers ( $t = 2.26$ ,  $df\ 9$ ,  $p = .051$ ).

**Children.** No statistically significant psychological consequences were seen from Time 1 to Time 3 with the children, as assessed by the

Achenbach CBCL (Achenbach & Edelbrock, 1983). All scores were within the normal range. For the nine children with LPD, six parents completed the Behavioural Profile, but since this number was small no analyses were completed on these data.

Unchanged CBCL scores from Time 1 to Time 3 is understandable considering the small time span of the program. Informal comments from parents suggested that older children exhibited reactions to hospitalization such as crying and clinging behaviours. These behaviours disappeared when the child returned home but were replaced by an increase in worried behaviour and decreased cooperativeness.

### *Direct and Indirect Costs of HBT*

The economic analysis of the HBT program was based on both direct and indirect costs for hospital and home care. The major components of this analysis were direct costs in hospital, indirect costs to the family (in hospital and at home), and direct costs for community care. Direct costs of HBT in hospital included hospital costs (1990) multiplied by the number of days in hospital. Hospital costs were calculated as (a) the ward per diem rate of CAN\$326.86 (including volunteer costs [\$4.83] and food [\$29.59]), and (b) one-time fees (including admitting [\$81.75] and medical records [\$389.39]). Direct hospital costs were added to the indirect costs incurred by the family (in hospital and at home), the HBT program costs, and the community-care costs for the days at home. Data on the specific components comprising the costs of the HBT program are summarized in Table 5.

**Table 5**

*Direct and Indirect Costs Involved in Cost Analysis for 1990\**

Direct Costs in Hospital	Indirect Costs to Family	Direct Costs for Community Care
Rate	* Family expenses	* No. of nursing visits
* Ward per diem	* Child care	* No. of physio visits
— × no. of days	* Sick time	* No. of homemaker hrs
— × no. of volunteers	* No. of hours work lost	* Family doctor visits
* Food	* Travel	* Clinic visits
One-time fees	* Parking	* Supplies
* Admitting	* Telephone	* Equipment
* Medical Records	* Miscellaneous (food, entertainment)	* Project coordinator
* All costs are in Canadian dollars		



Costs for conventional hospital treatment were also estimated. Direct hospital costs were based on direct hospital costs (1990) multiplied by the average length of stay for conventional hospital treatment. The average length of stay was determined from a three-year retrospective study of children with CDH or LPT admitted to the two hospitals. The results of the retrospective analyses indicate that an average 21-day hospital stay was needed for conventional management of CDH or LPD. Therefore, the direct hospital costs were calculated by multiplying the daily hospital costs by 21 days and adding the one-time fee. Indirect costs could not be added to direct costs for conventional hospital treatment, as it was impossible to collect this data retrospectively and there was no comparison group for this study. However, it was hypothesized that, if the indirect costs were not included in the costs of conventional care, the cost savings could be considered an underestimate of actual costs and, therefore, conservative. A comparison of the estimated costs of an average 21-day conventional hospital course of treatment (direct hospital costs only) versus the actual direct and indirect costs of maintaining the 24 patients in the HBT program is summarized in Table 6. Even using this conservative approach for the economic analysis, HBT was found to be much less costly than conventional hospital treatment for these children and their parents.

**Table 6**

*Comparison of Direct Cost for 21-Day Conventional Hospital Treatment (CHT) versus Actual Direct and Indirect Cost of Home-Based Traction (HBT)*

Group	CHT Direct Cost	HBT Direct & Indirect Costs	Difference CHT & HBT
LPD (n=9)	\$ 72,522.18	\$ 29,343.82	\$ 43,178.36
CDH (n=15)	120,870.30	39,544.46	81,325.84
Total (n=24)	\$ 193,392.48	\$ 68,888.28	\$ 124,504.20

### Discussion

The HBT program was developed as an alternative to institutional care for the child requiring traction. The hospital/community system-linked model of innovation (Stockwell et al., 1994) was used as the conceptual basis for the evaluation of an innovation, the HBT program. Collaboration (between health-care providers and consumers), reframing, and overcoming obstacles associated with the illness of a child (the condition and HBT treatment) were hypothesized to influence the acceptability, safety, psychological impact, and cost-effectiveness of this model.

Parents unanimously accepted the HBT program. All families chose it over conventional hospital treatment and the 24 children remained at home throughout their course of treatment. Parents reported that they chose home-based care for a variety of reasons. Initially, mothers said the most important factor was the option of returning the child to hospital in the event of problems. However, as time went on mothers stated that their real reasons for wanting to have the child at home had to do with family unity, the child's well-being, and financial stability.

Mothers were the primary caregivers in the home. They stated that they preferred caring for their child at home and were willing to rearrange their commitments to accommodate the needs of the child. However, they were distressed by the constant burden of responsibility and lack of sufficient support from fathers and health professionals. This distress is a symptom of the human cost of the shift in responsibility for medical care from the health professional to the consumer. Although mothers may be willing to take on this responsibility, it is at the expense of their employment, leisure time, and vacations. This human cost has been described by mothers who take on the care of children with chronic illnesses (Leonard, Brust, & Nelson, 1993; Wills, 1983). Parents of chronically ill children have been reported to experience psychological distress (Breslau, Staruch, & Mortimer, 1982); however, quantitative research on this group has been minimal.

In order to minimize this cost, parents and health-care professionals must develop a partnership. Sanctioned parental responsibility by health-care professionals is not enough. Collaboration with health professionals in caring for their child can provide parents with the opportunity to gain confidence. They can learn how to anticipate and recognize problems with their child and his/her treatment, and can become more knowledgeable about existing resources and how to access them.

A decrease in resources often precipitates the reframing of conventional practice and the legitimizing of professional and institutional services to the consumer. Consumers can feel empowered by an optimistic and manageable appraisal of their situation, and by a coordinated response to their circumstances, including the treatment of a child's illness. Families, and particularly mothers, will require support from extended family, homemakers, and other professionals in accommodating this shift in care. Mothers working outside the home may also need assistance in requesting a leave of absence or a financial subsidy.

Couples may require marital support to alleviate the distress in family functioning (reported by mothers) and disruptions in marital relationships (reported by fathers). In this study, both mothers and

fathers confirmed that although the HBT program produced some temporary distress they were able to cope better with the home-traction experience than with a three-week hospital stay.

In addition to reducing the psychological impact of a child's illness on the family, an HBT program has the potential to significantly reduce the direct costs of hospitalization, free up hospital beds, and increase the efficiency of care delivery. The efficiency of the HBT program is an important consideration in the present fiscal environment. However, an efficient program must also satisfy consumers while meeting the goals of medical treatment without additional risk to the child. The HBT program was shown to be as safe as conventional hospital treatment and substantially less costly when both direct and indirect costs were considered.

The HBT program was initiated approximately six years ago. It continues to exist on the paediatric units where it was developed, with children being hospitalized an average of one to two days prior to being discharged home. It is considered a success for both families and the institution, as it is comparable to or better than conventional treatment in many respects and is less costly. In the current economic environment of diminished resources, a "win-win" program is the only way to improve service to consumers.

Evaluation of the HBT program was limited by the small sample size and lack of a control group. It was impossible to assess the psychological adjustment of children under the age of two years because of the lack of an appropriate measure. The short follow-up time also prevented identification of long-term psychological and social consequences of the critical event.

Evaluation of the HBT program provides information for decision-making regarding children with CDH and LPD. Future research endeavours addressing the impact on parents of taking on caregiving responsibilities and the impact on children of having a parent care for them at home should be encouraged. More sophisticated research designs incorporating larger samples from a variety of sites must be undertaken. The development and evaluation of the HBT program may serve as a model for treating other paediatric illnesses in the community. This concept should be of interest to policy-makers as well as practitioners.

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