

# Translating Transition: A Critical Review of the Diabetes Literature

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## ABSTRACT

**Effective transition to an adult diabetes care provider is a significant component of care in adolescents with diabetes mellitus. During this period adolescents are at risk of dropping out of medical follow-up, an action which may interfere with their future physical and psychological well-being. The purpose of this paper is to review the diabetes literature as it pertains to transition including the outcomes, methods and patients' perceptions of the transition period. The results of the studies examined demonstrate a decrease in diabetes care visits following transition and that improvement in clinic attendance may be achieved through: (1) implementing an educational transition program; (2) having a transition care coordinator; and (3) having a young adult transition clinic attended by both adult and pediatric physicians. Despite the recognized importance of successful transition for adolescents with diabetes, studies on the subject remain sparse, highlighting the need for further research to determine both the magnitude of the problem as well as the impact of interventions to improve the processes of transition.**

## KEY WORDS

diabetes mellitus, transition care, transfer of care

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## INTRODUCTION

Adolescence is a period of transition regardless of health status. During this time, the adolescent is establishing his/her own personal identity, sense of autonomy, and sexuality. For those with diabetes mellitus, this stage is further complicated by the daily demands of a chronic disease. As these changes are occurring, the adolescent is faced with the challenge of transferring from pediatric to adult diabetes care. The transition to adult medical care has been defined by the Society of Adolescent Medicine as 'the purposeful, planned movement of adolescents and young adults with chronic physical and medical conditions from child-centered to adult-oriented health care systems<sup>1</sup>. The goal of transition is to provide health-care that is coordinated, uninterrupted, developmentally appropriate and comprehensive<sup>1</sup>.

Effective transition to adult diabetes care is a significant component of an adolescent's care. It often occurs at a time when glycemic control tends to be suboptimal<sup>2-6</sup> due to a number of factors, including the physiological changes associated with puberty<sup>7</sup>, poor adherence to insulin regimens<sup>8</sup> and decreased clinic attendance. As demonstrated in several studies, irregular clinic attendance is associated with poor glycemic control and increased rates of diabetes-related complications<sup>9,10</sup>. Optimizing glycemic control leads to reductions in the development and progression of microvascular complications<sup>11</sup>. In addition, the benefits of early glycemic control may translate into persistent reductions in microvascular complications<sup>12</sup>. This further emphasizes the importance of uninterrupted care in maintaining or improving glycemic control, as well as in providing opportunities for the monitoring and prevention of diabetes-related complications.

During the transition process adolescents are at risk of dropping out of health care follow-up which may have negative results on both their future physical and psychological well-being. Despite these concerns and numerous discussions on transitional diabetes care, there are few studies on the subject. Our objective was to review the diabetes literature as it pertains to transition with a focus on the outcomes, methods and patients' perceptions of the transition period.

## METHODS

We performed a search of the literature using the key words 'diabetes mellitus', 'transition' or 'transfer' and 'move' or 'change' or 'discharge' limiting the search to 'adolescents' and 'humans'. The following article databases were used: Medline (1950-2007), CINAHL (Cumulative Index to Nursing & Allied Health, 1982-2007) and EMBASE (1980-2007). We used the SIGNS (Scottish Intercollegiate Guidelines Network) grading for cohort studies as a framework for assessing the quality of studies<sup>13</sup>.

## RESULTS

The articles collected from the search included 14 original articles, two abstracts, seven editorials or perspectives, five review articles and four articles that were not relevant to this review. We focused our review on the original articles and abstracts, which were categorized based on the main objectives of the study, including: (1) description of outcomes following transition including perceptions of the transition process; and (2) evaluation of the models of transition care. We were unable to assign a specific grade to the articles as most were not true cohort studies but rather case-series and descriptive reports.

### DESCRIPTION OF OUTCOMES FOLLOWING TRANSITION

We found nine studies describing the outcomes following transition with three describing multiple outcomes (Table 1). Among these studies, four

described physician visits following transition. All four found a decrease in physician visits for diabetes care. Through patients' self-report and verification by the adult attending physician, Frank<sup>14</sup> found that 24% (n = 10/41) of participants had less than one diabetes care visit per year 3-4 years after discharge from a pediatric diabetes clinic. When compared to the group with medical follow-ups, those lost to follow-up were more likely to have had worse metabolic control, have been hospitalized for a diabetes-related illness and have attended fewer clinic appointments in the year prior to transfer (2.6 visits vs 3.5 visits,  $p < 0.01$ )<sup>14</sup>. The lost to follow-up group was also less likely to have had post-secondary education ( $p < 0.01$ ). In telephone interviews with the patients who did not have medical follow-up, 70% reported that they believed that follow-up was unnecessary as they were feeling fine and 30% were not ready to comply with the physician's suggestions<sup>14</sup>. Through patient recall, Frank also found that the mean number of diabetes-related hospitalizations following transition was higher for the lost to follow-up group versus those with follow-up visits. Frank concluded that the possible risk factors for poor compliance upon transfer to adult care included those who were in poor glycemic control and those with fewer diabetes care visits in the year before transfer<sup>14</sup>.

Other studies have shown lower proportions of follow-up losses<sup>15,16</sup>. In two separate studies, Pacaud *et al.*<sup>15,16</sup> determined the proportion of patients who had regular diabetes adult care through administering a mail out survey in two different cities. Each city had slightly different methods of health care delivery. In one, diabetes care was delivered by a diabetes center for the pediatric age group and transfer was to either an adult endocrinologist or an adult diabetes clinic<sup>15</sup>. In the other city pediatric diabetes care was shared between a family physician and a pediatric endocrinologist<sup>16</sup>. As adults, the diabetes care was shared between the patient's family physician and an adult endocrinologist. Patients were not necessarily transferred to an adult diabetes center<sup>16</sup>. In each of these studies by Pacaud *et al.*, the proportion of patients lost to follow-up, defined as a delay of >12 months during the transition between

pediatric and adult care, was 11% in the first city and 13% in the second<sup>15,16</sup>. As the proportions of patients lost to follow-up were similar between the two cities, the authors concluded that poor compliance with medical follow-up was due to patient characteristics rather than the characteristics of the health care delivery models.

Three studies describe the HbA<sub>1c</sub> levels following transition<sup>17-19</sup>. Despite decreases in clinic visits after transition, two studies found that HbA<sub>1c</sub> levels did not significantly change<sup>17,18</sup>, while the other found that HbA<sub>1c</sub> levels improved<sup>19</sup>. However, the studies were limited by their small sample sizes and were prone to selection biases<sup>17,18</sup>. In one, only the participants who had at least one visit after transition to a young adults' clinic were included in the analysis<sup>17</sup>. As well, the authors did not determine the participants' glycemic control when they were ultimately transferred to adult care<sup>17</sup>.

We found five studies within the transition care literature which described patients' perceptions of the transition process including their suggestions of what would be the most appropriate transition model<sup>15,16,18,20,21</sup>. Through a participatory research project, time constraints were identified as the main reason for participants' lack of attendance at adult clinics in the report by Scott *et al.*<sup>20</sup>. Participants suggested that adult clinics should have more flexible hours and shorter waiting times at appointments to accommodate the demands associated with their part-time jobs and schooling<sup>20</sup>. As well, evenings were chosen as the best time for clinics to take place among 36% of the participants. When asked about their experience with the transition process, participants felt a sense of abandonment by the pediatric team, with some feeling "lost in the shuffle" as they had not received notifications or reminders regarding appointments with the adult centers. Participants suggested that for a smoother transition process to occur that they would have preferred longer initial meetings with the adult diabetes team or to have had visits with the adult team prior to being transferred to adult care. When asked about their 'ideal' diabetes center patients suggested that it should not be in a hospital setting and that staff should be approachable and understand the issues faced by young adults. Participants also suggested that the 'ideal' diabetes center

should target young adults ('mid-teens to age 30') offering opportunities to meet other young adults with diabetes mellitus.

Other studies have found that adolescents felt it would be helpful to have written information describing the process of transition<sup>21</sup> and about the new physician before being transferred<sup>18</sup>. The survey by Pacaud *et al.*<sup>16</sup> found that some patients felt that the transition process was abrupt, with a lack of coordination among the multi-disciplinary team and, as in the study by Scott *et al.*<sup>20</sup>, found that lengthy waiting times at the time of the appointment were an issue with the transition process<sup>16</sup>.

The studies presented describe patient outcomes upon discharge from a pediatric diabetes clinic, particularly in three domains: patient compliance with diabetes care visits, glycemic control, and perception of the transition process. The studies reviewed are limited by their small sample sizes<sup>14-19</sup>, and are prone to both selection<sup>15-17</sup> and information biases<sup>14-17</sup>. Despite these limitations, they do demonstrate a decrease in diabetes care visits following transition and that factors such as poor glycemic control, presence of diabetes-related hospitalizations and poor clinic attendance in the year prior to transfer appear to be good predictors of poor clinic attendance after transfer. The impact of these outcomes on glycemic control and diabetes-related complications has not been studied, but would be expected to be poor based on our knowledge of the relationship between control and complications<sup>11,12</sup>.

#### EVALUATION OF MODELS OF TRANSITION CARE

Multiple methods of transition care in diabetes have been described in the literature; however, there are few studies evaluating their impact. We identified four studies and two abstracts (Table 2). Kipps *et al.*<sup>22</sup> systematically evaluated differing transition care models within four health districts in the Oxford (UK) region: (1) direct transfer to an adult clinic; (2) transfer to a young adult clinic in a different hospital; (3) transfer to a young adult clinic within the same hospital with introductions to the adult physician prior to transfer; and (4) transfer to an adolescent clinic run jointly by

**TABLE 1**

Summary and main findings of studies describing outcomes following transition

Reference	Study design	No. of patients	Follow-up time	Outcomes measured	Primary results	Associations with outcome	Study limitations
Salmi <i>et al.</i> <sup>19</sup>	Quasi-experimental study	61	1 year	HbA <sub>1c</sub> 1 yr pre- and post-transfer	Improved HbA <sub>1c</sub> (11.2 ± 2.2 vs 9.9 ± 1.7%)	No associations measured	Small sample size Selection bias
Frank <sup>14</sup>	Retrospective Cohort Study	41 (31 compliant; 10 non-compliant)	3-4 years	(1) Losses to follow-up after discharge from pediatric care (2) Predictors of losses to follow-up	24% loss to follow-up for diabetes care Increased mean number of diabetes-related hospitalizations compared to the group with regular follow-up (1.4 vs 0.6 respectively, p <0.01) Total number hospitalizations for diabetes-related complications not significantly different between the groups	Year prior to discharge: ↑ hospitalizations (60 vs 19%, p <0.05) ↑ HbA <sub>1c</sub> (10.6 vs 9%, p <0.05) ↓ clinic attendance (2.6 vs 3.5 visits, p <0.01)	Small sample size Observation times for follow-up were variable among patients Ascertainment of hospitalizations based on patients' recall introducing information bias
Pacaud <i>et al.</i> <sup>15</sup>	Survey	135	2-4 years	(1) Losses to follow-up after discharge from pediatric care (2) Comparison of two pediatric diabetes clinics	Overall 13% loss to follow-up for diabetes care	No difference in outcomes detected between two pediatric diabetes clinics in Montreal, Canada	Response rate 36% prone to selection bias Outcome ascertainment based on self-reports (recall bias) Confounders (i.e. socio-economic status) not measured
Pacaud <i>et al.</i> <sup>16</sup>	Survey	81	2-4 years	(1) Losses to follow-up after discharge from pediatric care (2) Rates compared between two cities with differing health care deliveries	Overall 11% loss to follow-up for diabetes care	No differences in outcomes detected between two differing health care models	Outcome ascertainment based on self-reports (recall bias) Survey method prone to selection bias

Orr <i>et al.</i> <sup>17</sup>	Convenience Sample	82	1 year	(1) Mean HbA <sub>1c</sub> 1 yr before and after transfer to young adult (adolescent) diabetes clinic	No change in mean HbA <sub>1c</sub> (9.9% vs 10.2%, p = 0.125)	No associations measured	Only patients with ≥ one visit post-transition included in analysis (selection bias) Ultimate question of what happens to glycemic control upon transfer to adult care not determined
Busse <i>et al.</i> <sup>18</sup>	Retrospective Cohort Study	101 (44 HbA <sub>1c</sub> )	1-3 years	(1) Physician visits 1 yr pre- and post-transfer (2) Mean HbA <sub>1c</sub> pre- and post-transfer (3) Patients' perceptions	Physician visits pre-transfer 8.5 ± 2.3/year and 6.7 ± 3.2/year (p < 0.001) HbA <sub>1c</sub> 8.5 ± 1.5% vs 8.3 ± 1.6% (p = 0.441)	No association between clinic attendance and HbA <sub>1c</sub> levels (p = 0.65)	Small sample size

**TABLE 2**

Summary and main findings of studies evaluating methods of transition care

Reference	Study design	No. of patients	Transition method	Follow-up time	Main outcome measures	Results	Limitations
Frank <sup>24</sup>	Case-series	76	Anticipatory guidance through formal and informal workshops	2-4 years	Losses to follow-up after discharge from pediatric care	7% lost to follow-up compared to 24% in previously published study	Preliminary results Characteristics of historic comparison group not compared to study cohort
Kipps <i>et al.</i> <sup>22</sup>	Retrospective cohort study	229	(A) Direct to an adult clinic (B) To a young adult clinic in a separate hospital from pediatric clinic (C) To young adult clinic with introductions to adult physician prior to transfer (D) To adolescent clinic jointly run with adult and pediatric physicians	2 years	(1) Proportion with regular follow-up 2 yr post-transfer (2) Inter-district comparison of HbA <sub>1c</sub> 2 yr post-transfer	(1) Proportion with regular clinic attendance fell from 98% to 61% post-transfer; with largest declines in districts A and B (2) No inter-district difference in HbA <sub>1c</sub> found	↑ number of patients lost to follow-up in districts A and B resulting in exclusion in final analysis introducing information bias Not possible to soundly compare HbA <sub>1c</sub> levels between districts with high losses to follow-up in two out of the four
Johnston <i>et al.</i> <sup>23</sup>	Case-series	33	Patients initially followed in young adult clinics (16-25 yr) Transferred to either a Saturday morning clinic or weekday clinic for adult care	15-18 months after transfer	(1) Attendance rates and HbA <sub>1c</sub> before and after transfer (2) Associations with non-attendance	(1) 18% loss to follow-up after transfer to adult clinics (2) Attendance twice as likely to be better in Saturday clinics compared to weekday clinics (not statistically significant)	Comparison of pre- and post- HbA <sub>1c</sub> levels not performed Significance testing not reported on associations of frequency of clinic visits and HbA <sub>1c</sub> levels
Vidal <i>et al.</i> <sup>25</sup>	Convenience sample	72	Anticipatory guidance formal and informal workshops Meeting with adult staff monthly for first 3-6 mo after transfer	12 months after transfer	Comparison pre- and post- transfer: (1) HbA <sub>1c</sub> (2) Diabetes knowledge (3) Insulin self-adjustment	(1) Improved HbA <sub>1c</sub> (exact values not given, p <0.001) (2) Improved diabetes self-knowledge (3) ↑ proportion self-adjusting insulin (13% vs 48%, p <0.001)	Lack of comparison group

Holmes-Walker <i>et al.</i> <sup>26</sup>	Retrospective cohort study	191	Transition care coordinator After hours phone support service	5 years	Comparison pre- and post-participation in program: (1) HbA <sub>1c</sub> (2) Hospital admission rates for DKA	(1) ↓ HbA <sub>1c</sub> 0.13% per visit over 1 <sup>st</sup> 4 visits (2) 2/3 ↓ DKA admission rates (incidence density ratio 0.62, p <0.05)	Lack of comparison group Decrease in DKA admissions attributed to implementation of transition program without accounting for confounders
Van Wallegem <i>et al.</i> <sup>27,28</sup>	Convenience Sample	101	Transition care coordinator Educational group events	1 years	Comparison pre- and post involvement in program: (1) Number of medical visits (2) Number of diabetes educator visits	(1) Proportion with 0 medical visits ↓ after involvement in program (40.6% vs 26.7%) (2) Proportion with 0 diabetes educator visits ↓ after involvement in program (74.3% vs 58.4%)	Preliminary results Statistical significance not presented

DKA = diabetic ketoacidosis.

pediatric and adult physicians. Overall, the proportion of patients attending clinic at least twice per year dropped from 98% in the 2 years pre-transfer to 61% in the 2 years post-transfer. The greatest declines in clinic attendance were noted among the patients who were either transferred to a young adult clinic in a different hospital or among those directly transferred to adult care. However, this may be a reflection of the larger proportion of patients (particularly in one district) who were ultimately transferred to their general practitioners by the second year post-transfer. The follow-up visits for this sub-group were not ascertained. Nevertheless, among those in the other two districts, a larger proportion was satisfied with their transfer. As well, the group that was directly transferred to adult care was the most dissatisfied with their transfer in comparison to the other three groups (47% of patients;  $p = 0.004$ ). Consistent with other studies<sup>14</sup>, patients lost to follow-up had higher mean HbA<sub>1c</sub> levels during the 2 years before transition. No inter-district difference in post-transfer HbA<sub>1c</sub> levels was seen; however, this was only measured among patients still attending hospital clinics. Of note, confounders such as socio-economic status and geographic factors were not included in the analysis comparing the transfer outcomes between districts. The authors conclude that transition to a young adult clinic is preferable to direct transfer to an adult clinic, and meeting with staff from the adult team prior to transfer may result in improved outcomes.

Another study demonstrated that despite having a young adult Saturday morning clinic (for those in the 16-25 year age group), a significant proportion of patients (18%) failed to attend their appointments during the 2 years after transfer from the Saturday clinics<sup>23</sup>. No association between clinic attendance and glycemic control was found.

The remaining studies on transition methods examined the impact of either the presence of transition care coordinators or the implementation of various transition educational programs. In follow-up to Frank's outcome study<sup>14</sup>, in which 24% of their patients were lost to follow up after discharge, a transition education program was established at the Toronto center<sup>24</sup>. The program consisted of workshops providing preparatory

guidance regarding transfer to adult care, as well as support for both parents and adolescents during the transition process. Through the implementation of the program the proportion of patients lost to follow-up decreased significantly to 7%. Again, those lost to follow up had poorer glycemic control, more hospitalizations and more evidence of early diabetes-related complications in the year prior to transfer.

A center in Spain evaluated their transition education program which consisted of informal and formal preparatory workshops, as well as monthly visits with the adult staff for 3-6 months<sup>25</sup>. As in the Toronto study, patients were transferred directly to adult care. The study reported improvements in outcomes: lower HbA<sub>1c</sub> levels, improved knowledge of diabetes management and a higher proportion of patients capable of adjusting their own insulin doses ( $p < 0.001$ ).

Other studies have demonstrated an improvement in glycemic control and clinic attendance rate with a transition care coordinator<sup>26-28</sup>. One center in Australia had a transition coordinator who arranged the booking and rebooking of appointments, including reminder notices, for a young adults' clinic (for 15-25 year olds) and provided an after-hours phone support service<sup>26</sup>. The HbA<sub>1c</sub> levels dropped 0.13% per visit in the first four visits to the young adults' clinic. Preliminary evidence from another center in Canada demonstrated improved clinic attendance with a program involving a transition care coordinator as well as educational group events<sup>27,28</sup>. In the year prior to the implementation of the program 40.6% of participants had 0 visits/year after discharge. In the year after implementation, the proportion of patients with 0 visits/year dropped to 26.7%. The statistical significance of this finding was not presented.

Although there is no consensus on the most appropriate method of transition, strategies that may improve clinic attendance rates include: implementing an educational transition program; a transition coordinator to aid in the transition process; and young adult clinics and adolescent transition clinics attended by both adult and pediatric physicians. Further studies are required to determine whether these methods of transition translate to improved diabetes-related clinical outcomes.

## CONCLUSIONS

Transition to adult care is a critical time for adolescents with diabetes mellitus. Poor transition places them at risk for falling out of the health care system and for the development or progression of preventable diabetes-related complications. Strong evidence-based data are still lacking on the association of transition care to clinical outcomes such as acute or chronic diabetes-related complications and to glycemic control. We found the studies on transition care limited by their small sample sizes and by both selection and information biases. Lack of evidence and study limitations are mirrored in the literature on transition care across medical conditions<sup>29</sup>. Despite the limitations in the studies we reviewed, they identify an important issue in the period around transition, namely that losses to follow-up are significant. These losses to follow-ups may be related to factors intrinsic to the stage of adolescence; however, there are some suggestions in the literature that certain models of transitional care may be effective in improving health care processes and outcomes. The lack of evidence and small sample sizes highlight the need for collaboration and knowledge sharing in evaluating best practices.

## REFERENCES

1. Blum RW, Garell D, Hodgman CH, Jorissen TW, Okinow NA, Orr DP, Slap GB. Transition from child-centered to adult health-care systems for adolescents with chronic conditions. A position paper of the Society for Adolescent Medicine. *J Adolesc Health* 1993; 14: 570-576.
2. Mortensen HB, Hougaard P. Comparison of metabolic control in a cross-sectional study of 2,873 children and adolescents with IDDM from 18 countries. The Hvidøre Study Group on Childhood Diabetes. *Diabetes Care* 1997; 20: 714-720.
3. Urbach SL, LaFranchi S, Lambert L, Lapidus JA, Daneman D, and Becker TM. Predictors of glucose control in children and adolescents with type 1 diabetes mellitus. *Pediatr Diabetes* 2005; 6: 69-74.
4. Pound N, Sturrock ND, Jeffcoate WJ. Age related changes in glycated haemoglobin in patients with insulin-dependent diabetes mellitus. *Diabet Med* 1996; 13: 510-513.
5. Amiel SA, Sherwin RS, Simonson DC, Lauritano AA, Tamborlane WV. Impaired insulin action in puberty. A contributing factor to poor glycemic control in adolescents with diabetes. *N Engl J Med* 1986; 315: 215-219.
6. Bryden KS, Peveler RC, Stein A, Neil A, Mayou RA, Dunger DB. Clinical and psychological course of diabetes from adolescence to young adulthood: a longitudinal cohort study. *Diabetes Care* 2001; 24: 1536-1540.
7. Ball GD, Huang TT, Gower BA, Cruz ML, Shaibi GQ, Weigensberg MJ, Goran MI. Longitudinal changes in insulin sensitivity, insulin secretion, and beta-cell function during puberty. *J Pediatr* 2006; 148: 16-22.
8. Morris AD, Boyle DI, McMahon AD, Greene SA, MacDonald TM, Newton RW. Adherence to insulin treatment, glycaemic control, and ketoacidosis in insulin-dependent diabetes mellitus. The DARTS/MEMO Collaboration. Diabetes Audit and Research in Tayside Scotland. Medicines Monitoring Unit. *Lancet* 1997; 350: 1505-1510.
9. Jacobson AM, Hauser ST, Willett J, Wolfsdorf JJ, Herman L. Consequences of irregular versus continuous medical follow-up in children and adolescents with insulin-dependent diabetes mellitus. *J Pediatr* 1997; 131: 727-733.
10. Goyder EC, Spiers N, McNally PG, Drucquer M, Botha JL. Do diabetes clinic attendees stay out of hospital? A matched case-control study. *Diabet Med* 1999; 16: 687-691.
11. The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. The Diabetes Control and Complications Trial Research Group. *N Engl J Med* 1993; 329: 977-986.
12. Retinopathy and nephropathy in patients with type 1 diabetes four years after a trial of intensive therapy. The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Research Group. *N Engl J Med* 2000; 342: 381-389.
13. Harbour R, Miller J. A new system for grading recommendations in evidence based guidelines. *BMJ* 2001; 323: 334-336.
14. Frank M. Factors associated with non-compliance with a medical follow-up regimen after discharge from a pediatric diabetes clinic. *Can J Diabetes Care* 1996; 20: 13-20.
15. Pcaud D, et al. Transition from pediatric care to adult care for insulin-dependent diabetes patients. *Can J Diabetes Care* 1996; 20: 14-20.
16. Pcaud D, et al. Problems in transition from pediatric care to adult care for individuals with diabetes. *Can J Diabetes Care* 2005; 20: 13-18.
17. Orr DP, Fineberg NS, Gray DL. Glycemic control and transfer of health care among adolescents with insulin dependent diabetes mellitus. *J Adolesc Health* 1996; 18: 44-47.
18. Busse FP, Hiermann P, Galler A, Stumvoll M, Wiessner T, Kiess W, Kapellen TM. Evaluation of

- patients' opinion and metabolic control after transfer of young adults with type 1 diabetes from a pediatric diabetes clinic to adult care. *Horm Res* 2007; 67: 132-138.
19. Salmi J, Huupponen T, Oksa H, Oksala H, Koivula T, Raita P. Metabolic control in adolescent insulin-dependent diabetics referred from pediatric to adult clinic. *Ann Clin Res* 1986; 18: 84-87.
  20. Scott L, et al. Transition of care: researching the needs of young adults with type 1 diabetes. *Can J Diabetes* 2005; 29: 203-210.
  21. Visentin K, Koch T, Kralik D. Adolescents with type 1 diabetes: transition between diabetes services. *J Clin Nurs* 2006; 15: 761-769.
  22. Kipps S, Bahu T, Ong K, Ackland FM, Brown RS, Fox CT, Griffin NK, Knight AH, Mann NP, Neil HA, Simpson H, Edge JA, Dunger DB. Current methods of transfer of young people with type 1 diabetes to adult services. *Diabet Med* 2002; 19: 649-654.
  23. Johnston P, et al. Audit of young people with type 1 diabetes transferring from paediatric to adult diabetic services. *Practical Diabetes Int* 2006; 23: 106-108.
  24. Frank M. Evaluation of a transition from pediatrics to adult diabetes care program. *Can J Diabetes* 2002; 26 (Suppl 1): 253 (Abst).
  25. Vidal M, et al. Impact of a special therapeutic education programme in patients transferred from a paediatric to an adult diabetes unit. *Eur Diabetes Nursing* 2004; 1: 23-27.
  26. Holmes-Walker DJ, Llewellyn AC, Farrell K. A transition care programme which improves diabetes control and reduces hospital admission rates in young adults with type 1 diabetes aged 15-25 years. *Diabet Med* 2007; 24: 764-769.
  27. Van Wallegghem N, et al. Does an administrative model for systems navigation and support during the transition from pediatric to adult diabetes care improve diabetes surveillance? CDA 2006; Abst.
  28. Van Wallegghem N, MacDonald CA, Dean HJ. Building connections for young adults with type 1 diabetes mellitus in Manitoba: feasibility and acceptability of a transition initiative. *Chronic Dis Can* 2006; 27: 130-134.
  29. Freed GL, Hudson EJ. Transitioning children with chronic diseases to adult care: current knowledge, practices, and directions. *J Pediatr* 2006; 148: 824-827.