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Original Research

## Impact of Socio-economic Status on Utilization of Diabetes Educators and Diabetes Control: A Canadian Experience

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## ABSTRACT

**Objective:** To determine if there is an association between lower socio-economic status (SES) and decreased utilization of diabetes educators or inferior diabetes control as measured by both glycated hemoglobin (A1C) and number of diabetes-related hospitalizations.

**Patients and Methods:** Our cohort consisted of all children aged <18 years in a clinic database in Montreal, Canada who were diagnosed with type 1 diabetes mellitus for at least 12 months (n=353). Subjects needed 12 months of follow up in the calendar year 2008 with at least 2 A1C measurements. Diabetes educators logged all interactions with patients with diabetes in the database, including A1C and hospital admissions. SES was measured using validated area-based deprivation indices. Multivariable regression modelling was used to adjust for potential confounders, such as gender, age, diabetes duration, body mass index and treatment modality.

**Results:** There were 2500 contacts made by 353 children (mean age 12.3 years, mean diabetes duration 5.4 years, mean A1C 8.8%). Even though the number of educator contacts was a significant negative predictor of A1C (coefficient, -0.010, 95% confidence interval [CI] -0.199 to -0.001), there was no association between the number of contacts and SES even after adjustment for multiple potential confounders (material centile deprivation coefficient 0.003, 95% CI -0.001 to 0.008; social deprivation centile coefficient -0.001, 95% CI -0.0006 to 0.004). Nor was there an association between SES and diabetes control even after adjustment.

**Conclusions:** Lower SES was not associated with reduced utilization of educator services, implying that outpatient resources are used equitably when available. Moreover those of lower SES did not experience inferior control or more frequent hospitalizations.

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## R É S U M É

## Mots clés:

HbA1c

ACD

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diabète sucré de type 1

**Objectifs :** Déterminer si un lien existe entre un statut socio-économique (SSÉ) plus faible, et un moindre recours aux éducateurs spécialisés en diabète ou une maîtrise inférieure du diabète selon l'hémoglobine glyquée (HbA1c) et le nombre d'hospitalisations liées au diabète.

**Patients et méthodes :** Notre cohorte comportait tous les enfants < 18 ans inscrits dans une base de données clinique de Montréal, au Canada, qui avaient reçu un diagnostic de diabète sucré de type 1 depuis au moins 12 mois (n = 353). Les sujets ont nécessité un suivi de 12 mois au cours de l'année civile 2008 incluant au moins 2 mesures de l'HbA1c. Les éducateurs spécialisés en diabète ont recensé toutes les interactions des patients ayant le diabète dans la base de données, incluant l'HbA1c et les admissions à l'hôpital. Le SSÉ a été mesuré en utilisant la validation des indices de défavorisation selon la région. Le modèle de régression multiple a été utilisé pour ajuster les facteurs de confusion potentiels tels que le sexe, l'âge, la durée du diabète, l'indice de masse corporelle et la modalité de traitement.

**Résultats :** Il y a eu 2500 contacts composés de 353 enfants (âge moyen de 12,3 ans, durée moyenne du diabète de 5,4 ans, HbA1c moyenne de 8,8 %). Même si le nombre de contacts avec un éducateur était un prédicteur négatif significatif de l'HbA1c (coefficient, -0,010, intervalle de confiance [IC] à 95 %, -0,199 à -0,001), il n'existait aucun lien entre le nombre de contacts et le SSÉ même après l'ajustement des multiples facteurs de confusion potentiels (centile de défavorisation matérielle, 0,003, IC à 95 % -0,001 à

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0,008; centile de défavorisation sociale,  $-0,001$ , IC à 95 %,  $-0,0006$  à  $0,004$ ). Il n'existait pas non plus de lien entre le SSÉ et la maîtrise du diabète même après l'ajustement.

**Conclusions :** Un plus faible SSÉ n'était pas associé à une diminution de l'utilisation des services d'un éducateur, ce qui signifie que les ressources externes sont utilisées équitablement lorsqu'elles sont disponibles. De plus, ceux ayant un plus faible SSÉ n'expérimentaient pas une maîtrise inférieure ou de plus fréquentes hospitalisations.

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## Introduction

Numerous reports outline various barriers to optimal type 1 diabetes mellitus outcomes (1–6). These encompass several large themes, including family (single parent status, lack of parental knowledge—especially maternal—and immigrant status), individual (age, gender) and socio-economic status (lower) (1–9). Socio-economic status (SES) has been determined by both area- and individual-based assessments and reported from many jurisdictions, including the United States, the United Kingdom, Germany, Argentina and New Zealand (1,10–14). In general, lower SES has been associated with higher glycated hemoglobin (A1C) (poorer control) and with more hospitalizations for diabetic ketoacidosis (DKA) and hyperglycemia (1,10–14).

Recent publications cite specific factors as to why those with lower SES fare less well, including inability to purchase diabetes supplies, suboptimal initial teaching, irregular follow up and nonspecialist care (1,4,15,16). Lack of outpatient support for families was also felt to be a significant barrier resulting in more hospitalizations (1,4). Importantly, diabetes educators provide key outpatient resources; their care has been credited with  $\sim 1\%$  drop in A1C across all ages, and their membership in the diabetes team is endorsed by international diabetes organizations (17–20). Moreover, they are a potentially modifiable resource. Nevertheless, there have been no studies to date to assess whether families access this care equitably. A priori we hypothesized that families of lower SES engaged diabetes educators less frequently than families with higher SES given the general observation of poorer diabetes outcomes associated with lower SES. To place these findings in context, we also examined the relations between SES and A1C/hospitalizations. Important confounders (lack of supplies and health insurance) were mitigated, because our province is unique in Canada in having both universal health and prescription insurance. This allowed us to focus more clearly on the association between SES and diabetes outpatient resource utilization using observational cohort data from a proprietary diabetes clinic database and validated, Canadian, area-based deprivation indices.

## Methods

### Study population

The diabetes clinic at the Montreal Children's Hospital is representative of pediatric diabetes centres across Canada, where pediatric diabetes care is largely centred in specialized university-based tertiary care hospitals, each with a large multidisciplinary diabetes team. The composition of the teams typically follows Canadian Diabetes Association guidelines (18). Data from the 2008 calendar year was used; all contacts between January 1 and December 31 2008 were included.

### Diabetes diagnosis and inclusion criteria

Type 1 diabetes was diagnosed according to standard definition (18). We included children age 17 years or less, who had had type 1 diabetes for at least 12 months duration as of January 1, 2008

(to reduce the “honeymoon” effect). A 12-month follow up during 2008 was also required, with at least 2 A1C measurements during that time. Assignment of each child's insulin regimen (standard vs. multiple daily injections [MDI] vs. continuous subcutaneous insulin infusion pump [CSII]) was based on the modality used for  $>9$  months during the 2008 calendar year, treated as a nonordinal categorical variable. All children met this criterion. We excluded children with other types of diabetes, such as maturity onset diabetes of youth or type 2 diabetes, and those who were not residents in Canada (i.e. no Canadian postal code).

### Power calculation

A priori power calculations were used to assess the adequacy of sample size in the design phase of the study, after calculating our total number of eligible children but prior to any detailed analyses. Taking either A1C or the number of contacts with the diabetes educator as the outcome variable, the SAS multiple linear regression power calculator was used to calculate power in terms of the partial correlation between the outcome and the 2 deprivation indices (centiles). Having assumed on clinical grounds that the minimum effect of interest is a squared partial correlation of at least 10% (i.e. the 2 deprivation indices together explain at least 10% of the observed variance in A1C), the power was determined to be  $>95\%$  with an alpha of 0.05 and using our sample of  $n=353$ .

### Database

The Montreal Children's Hospital utilizes a customized Microsoft Access (Seattle, WA) database to document all contacts with the children, parents and allied caregivers (e.g., schools). For medicolegal reasons, diabetes educators document all contacts including telephone calls, office visits, e-mails or faxes. Printed copies are then added to the hospital chart. In total, there are 2 educators dealing with children using CSII and 2 for children using other modalities. Admissions, reason for admissions, and location of admission if outside of our centre, height, weight and A1C concentrations are recorded at all clinic visits.

### Outcomes: Contacts, A1C, and admissions

All contacts with the diabetes educators were extracted from the database using Structured Query Language. A1C was measured using point-of-care technology (DCA2000+ Siemens/Bayer, with a CV  $<3\%$ ) (21). The A1C arithmetic mean, number of measurements and standard deviation (SD) were calculated for each child. All admissions for poor control or DKA were obtained from the database and verified by review of the hospital chart; all other admissions were not included in the study for analyses. Admissions were grouped as a binary variable in the analyses.

### Covariates

Age was calculated at study initiation on January 1, 2008; duration of diabetes was calculated from time of diagnosis to January 1, 2008. Standard hospital scale and stadiometer were used

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