



Risk of Psychiatric Disorders and Suicide Attempts in Emerging Adults With Diabetes

Marie-Eve Robinson,^{1,2,3} Marc Simard,⁴
Isabelle Larocque,⁴ Jai Shah,^{5,6}
Meranda Nakhla,^{3,7} and Elham Rahme^{7,8}

Diabetes Care 2020;43:484–486 | <https://doi.org/10.2337/dc19-1487>

OBJECTIVE

To determine the longitudinal risks of psychiatric disorders in adolescents and emerging adults with versus without diabetes.

RESEARCH DESIGN AND METHODS

We conducted a retrospective cohort study in Quebec, Canada, using linked health administrative databases of adolescents (age 15 years) with and without diabetes and without prior psychiatric disorders between 1997 and 2015, followed to age 25 years.

RESULTS

Our cohort included 3,544 individuals with diabetes and 1,388,397 without diabetes. Individuals with diabetes were more likely to suffer from a mood disorder (diagnosed in the emergency department or hospital) (adjusted hazard ratio 1.33 [95% CI 1.19–1.50]), attempt suicide (3.25 [1.79–5.88]), visit a psychiatrist (1.82 [1.67–1.98]), and experience any type of psychiatric disorder (1.29 [1.21–1.37]) compared with their peers without diabetes.

CONCLUSIONS

Between the ages of 15 and 25 years, the risks of psychiatric disorders and suicide attempts were substantially higher in adolescents and emerging adults with versus without diabetes.

Adolescence and emerging adulthood (ages 18–30 years) constitute a challenging developmental period wherein individuals are establishing their autonomy and personal identity and making vocational and educational choices. For the adolescent with type 1 diabetes (T1D), this stage is further complicated by the daily demands of the disease as well as the transfer to adult diabetes care.

Higher risks of psychiatric disorders in individuals with (versus without) T1D have previously been reported, but the risk of psychiatric disorders from adolescence to emerging adulthood has not been assessed (1–3). Children and adolescents (ages ≤18 years) with T1D are twice as likely to have a mood disorder and almost twice as likely to attempt suicide compared with those without T1D (3). Psychiatric disorders are associated with both suboptimal glycemic control and increased risks of diabetic ketoacidosis and hypoglycemia (1). As such, we aimed to determine the longitudinal risks of new-onset psychiatric disorders and suicide attempts in adolescents and emerging adults (ages 15–25 years) with diabetes compared with their same-aged peers without diabetes.

¹Children's Hospital of Eastern Ontario Research Institute, Ottawa, Ontario, Canada

²Division of Endocrinology, Department of Pediatrics, University of Ottawa, Ottawa, Ontario, Canada

³Division of Endocrinology, Department of Pediatrics, McGill University Health Centre, Montreal, Quebec, Canada

⁴Institut National de Santé Publique du Québec, Quebec City, Quebec, Canada

⁵Douglas Mental Health University Institute, McGill University, Montreal, Quebec, Canada

⁶Department of Psychiatry, McGill University, Montreal, Quebec, Canada

⁷Research Institute of the McGill University Health Centre, Montreal, Quebec, Canada

⁸Division of Clinical Epidemiology, Department of Medicine, McGill University, Montreal, Quebec, Canada

Corresponding author: Elham Rahme, elham.rahme@mcgill.ca

Received 26 July 2019 and accepted 15 November 2019

This article contains Supplementary Data online at <http://care.diabetesjournals.org/lookup/suppl/doi:10.2337/dc19-1487/-/DC1>.

E.R. and M.N. share senior authorship.

© 2019 by the American Diabetes Association. Readers may use this article as long as the work is properly cited, the use is educational and not for profit, and the work is not altered. More information is available at <http://www.diabetesjournals.org/content/license>.

RESEARCH DESIGN AND METHODS

Study Design and Data Sources

We conducted a retrospective cohort study of adolescents and emerging adults living in Quebec, Canada, using the Quebec Integrated Chronic Disease Surveillance System (QICDSS) database maintained at Institut National de Santé Publique du Québec (INSPQ) (4). Our study was approved by the McGill University Health Center Research Ethic Board.

Study Cohort

Using the QICDSS database, we identified all individuals born between 1 April 1982 and 31 December 1998. Exposed individuals were those diagnosed with diabetes between ages 1 and 15 years from April 1997 to December 2013. Diabetes status was identified according to the validated definition of the Canadian Chronic Disease Surveillance System (one hospitalization or two physician claims for diabetes within a 2-year period) (4,5).

All individuals 1–15 years old, identified from the QICDSS database, who did not have diabetes from April 1997 to December 2013 formed the unexposed group. Exposed and unexposed individuals were included into the cohort at age 15 years (cohort entry date) and were followed until 31 March 2015, age 25 years, death, or migration out of the province. Our follow-up period included the period of transfer from pediatric to adult care that generally occurs in Quebec at age 18 years (6).

Exposed individuals were required to have at least one additional medical encounter for diabetes (outpatient or inpatient) following their diagnosis date. To decrease the possibility of capturing ongoing psychiatric events that started before and were unrelated to the unique developmental stage of adolescence and emerging adulthood, we excluded those with a diagnosis (International Classification of Diseases [ICD]-9 and -10 codes) of psychiatric disorders except attention deficit hyperactivity disorder (ADHD) and autism spectrum disorder in the 2 years preceding the cohort entry date. Included individuals were required to have at least 6 months of data after their cohort entry date.

Outcomes

Our primary outcomes (ICD-9 and ICD-10 codes in Supplementary Data Appendix 1) were 1) mood disorders diagnosed in the emergency department (ED) or hospital, 2)

hospitalization for a suicide attempt, and 3) deaths by suicide, and our secondary outcomes were 1) mood disorders diagnosed exclusively in the outpatient clinic and 2) any visit to a psychiatrist. We also examined the combined outcome of any psychiatric disorders (Supplementary Data Appendix 2) excluding ADHD and autism spectrum disorder, identified according to methods adopted by the QICDSS (7).

Baseline Individual Characteristics

We assessed the following individual characteristics at the cohort entry date: social deprivation, material deprivation, sex, rural residency, and year of birth. Material and social deprivation indices were developed by the INSPQ based on employment status, income, education level, proportion of individuals living alone, and proportions of single families (8). Rural residency was determined based on the census metropolitan area and census agglomeration influenced zones developed by Statistics Canada (4,9,10).

Data Analysis

Incidence rates were calculated per 100 person-years for all outcomes. Multivariate Cox proportional hazards models were used to compare time to mood disorders diagnosed in the ED or in hospital in individuals with versus without diabetes. The model was adjusted for all baseline individual characteristics. We used similar models to compare all other outcomes between those with versus without diabetes.

Results were reported as adjusted hazard ratios (aHRs) and 95% CIs. Statistical analyses were performed using SAS 9.4 (SAS Institute, Cary, NC). Statistical tests were two sided, with significance assigned at P value <0.05 . Supplemental analyses were performed (Supplementary Data Appendix 3).

RESULTS

We identified 3,544 individuals with and 1,388,397 individuals without diabetes. Baseline individual characteristics are shown in Supplementary Data Appendix 4. The crude incidence rate of each outcome is shown in Table 1. Individuals with (versus without) diabetes were more likely to have a mood disorder (diagnosed in the ED or in hospital) (aHR 1.33 [95% CI 1.19–1.50]), be admitted to hospital for a suicide attempt (3.24 [1.79–5.88]), visit a psychiatrist (1.82 [1.67–1.98]), or have any

psychiatric disorders (1.29 [1.21–1.37]) (Table 1). The risk of mood disorders diagnosed in the outpatient clinic and the risk of schizophrenia did not vary based on diabetes status.

CONCLUSIONS

Psychiatric risk in individuals with diabetes from adolescence to emerging adulthood has not previously been described. We found that adolescents and emerging adults with diabetes were at increased risk for psychiatric disorders compared with those without diabetes. To our knowledge, our study fills an important gap in the literature, as it is the only one to date that longitudinally assessed psychiatric disorders among adolescents and emerging adults with diabetes. Previous studies have reported increased prevalence of depressive symptoms with age (11–25 years) (1), more common mental health referrals during emerging adulthood, and a higher prevalence of self-reported psychiatric disorders toward late emerging adulthood (11).

Our findings may be explained by several factors. First, adolescents and emerging adults with diabetes face numerous challenges related to diabetes management when other social, educational, and financial competing priorities inherent to emerging adulthood occur. During this critical period, the transition to adult diabetes care may further exacerbate the risk of psychiatric disorders where underlying factors such as change in diabetes care providers, new treatment facilities, increased level of responsibility, and differences in disease management might contribute to this risk. Second, limited access to psychosocial services may contribute to the increased risk of psychiatric disorders, as adult endocrinologists rarely receive a patient's psychosocial summary as part of their referral documents from their pediatric colleagues (12), and only a minority (42%) have access to mental health services for their emerging adult patients with diabetes (13).

Our observations have substantial implications for adolescents and emerging adults with diabetes. Psychiatric disorders are associated with serious adverse diabetes-related outcomes among emerging adults with diabetes, such as more frequent and longer admissions to hospital, higher frequency of diabetic ketoacidosis, more frequent and more severe hypoglycemic episodes, and worsening glycemic

Table 1—Adjusted Cox proportional hazards ratios and incidence rate for all mental health outcomes in adolescents and emerging adults with diabetes compared with those without diabetes

	Primary outcomes		Secondary outcomes			Combined outcomes
	Mood disorders, ED or hospital	Suicide attempts	Mood disorders, outpatient clinic	Visit to a psychiatrist	Schizophrenia	Any psychiatric disorder
DM (vs. no DM)	1.33 (1.19–1.50)	3.25 (1.79–5.88)	0.99 (0.91–1.08)	1.82 (1.67–1.98)	0.81 (0.49–1.32)	1.29 (1.21–1.37)
DM duration (vs. no DM), years*						
0–2	1.46 (1.23–1.74)	4.25 (1.77–10.23)	1.08 (0.94–1.24)	2.03 (1.79–2.30)	1.03 (0.53–1.98)	1.37 (1.24–1.51)
2–5	1.30 (1.06–1.58)	1.83 (0.46–7.32)	0.87 (0.73–1.02)	1.69 (1.45–1.97)	1.07 (0.51–2.25)	1.24 (1.11–1.39)
≥5	1.18 (0.93–1.49)	3.58 (1.34–9.56)	1.01 (0.85–1.20)	1.66 (1.40–1.97)	N/A****	1.23 (1.09–1.39)
Social depr (most vs. least deprived)**	1.31 (1.29–1.34)	1.50 (1.25–1.80)	1.05 (1.04–1.07)	1.27 (1.25–1.29)	1.53 (1.43–1.63)	1.17 (1.16–1.18)
Material depr (most vs. least deprived)**	1.40 (1.37–1.43)	1.88 (1.55–2.29)	0.89 (0.87–0.90)	1.05 (1.03–1.07)	1.34 (1.25–1.44)	1.04 (1.03–1.05)
Females (vs. males)	1.26 (1.25–1.28)	1.59 (1.42–1.77)	1.78 (1.76–1.79)	1.15 (1.13–1.16)	0.41 (0.39–0.43)	1.59 (1.58–1.60)
Rural residency (vs. urban)***	1.13 (1.11–1.15)	1.31 (1.14–1.51)	0.85 (0.84–0.86)	0.93 (0.92–0.94)	0.87 (0.82–0.92)	0.95 (0.95–0.96)
Birth year	1.06 (1.06–1.07)	1.18 (1.16–1.20)	1.06 (1.06–1.06)	1.08 (1.08–1.08)	0.98 (0.98–0.99)	1.01 (1.01–1.01)
Individuals with DM, N (IR)	296 (1.25)	17 (0.07)	474 (2.01)	536 (2.27)	16 (0.07)	947 (4.01)
Individuals without DM, N (IR)	101,940 (0.96)	2,981 (0.03)	231,721 (2.19)	129,808 (1.23)	9,200 (0.09)	342,597 (3.23)

Data are aHR (95% CI) unless otherwise indicated. depr, deprivation; DM, diabetes mellitus; IR, incidence rate per 100 person-years; N/A, not applicable. The model was adjusted for social deprivation, material deprivation, sex, rural residency, and birth year using Cox proportional hazards regression analysis. Cox proportional hazards regression analyses to examine deaths by suicide were not completed because fewer than five suicides were observed in the group with diabetes. Rural residency and material and social deprivation indices were determined at study entry using the individual's postal code. *These estimates were derived from a separate multivariate Cox proportional hazards regression analysis adjusted for diabetes duration (instead of diabetes status), social deprivation, material deprivation, sex, rural residency, and birth year. **The material deprivation index is based on employment, income, and education level. The social deprivation index is based on the proportion of individuals living alone (single, separated, or widowed) and the proportion of single-parent families. Material and social deprivation indices were categorized into quintiles (1 = least deprived, 5 = most deprived). ***Rural residency: rural population refers to population <10,000. Urban population refers to population >10,000. ****Fewer than five individuals had schizophrenia and a diabetes duration of >5 years.

control (1). A history of a psychiatric referral has been associated with death from acute events in individuals (ages <40 years) with T1D (14).

In summary, the risk of developing psychiatric disorders is increased between the ages of 15 and 25 years in individuals with diabetes versus those without. Our observations highlight the importance of identifying psychiatric disorders and increasing access to mental health services during this vulnerable transition period.

Funding. M.-E.R. obtained a Research Institute of the McGill University Health Centre Studentship and Fellowship award. J.S. and M.N. are funded by Chercheur-boursier clinicien from Fonds de Recherche du Québec – Santé and Ministère de la Santé et des Services Sociaux du Québec.

Duality of Interest. No potential conflicts of interest relevant to this article were reported.

References

1. Plener PL, Molz E, Berger G, et al. Depression, metabolic control, and antidepressant medication

in young patients with type 1 diabetes. *Pediatr Diabetes* 2015;16:58–66

2. Northam EA, Lin A, Finch S, Werther GA, Cameron FJ. Psychosocial well-being and functional outcomes in youth with type 1 diabetes 12 years after disease onset. *Diabetes Care* 2010;33:1430–1437

3. Butwicka A, Frisén L, Almqvist C, Zethelius B, Lichtenstein P. Risks of psychiatric disorders and suicide attempts in children and adolescents with type 1 diabetes: a population-based cohort study. *Diabetes Care* 2015;38:453–459

4. Robinson ME, Li P, Rahme E, Simard M, Larocque I, Nakhla MM. Increasing prevalence of diabetic ketoacidosis at diabetes diagnosis among children in Quebec: a population-based retrospective cohort study. *CMAJ Open* 2019;7:E300–E305

5. Dart AB, Martens PJ, Sellers EA, Brownell MD, Rigatto C, Dean HJ. Validation of a pediatric diabetes case definition using administrative health data in Manitoba, Canada. *Diabetes Care* 2011;34:898–903

6. Nakhla M, Bell LE, Wafa S, Dasgupta K. Improving the transition from pediatric to adult diabetes care: the pediatric care provider's perspective in Quebec, Canada. *BMJ Open Diabetes Res Care* 2017;5:e000390

7. Blais C, Jean S, Sirois C, et al. Quebec Integrated Chronic Disease Surveillance System (QICDSS), an innovative approach. *Chronic Dis Inj Can* 2014;34:226–235

8. Pampalon R, Hamel D, Gamache P, Philibert MD, Raymond G, Simpson A. An area-based material and social deprivation index for public health in Québec and Canada. *Can J Public Health* 2012;103(Suppl. 2):S17–S22

9. Statistical Area Classification (SAC) [Internet], 2015. Available from <https://www150.statcan.gc.ca/n1/pub/92-195-x/2011001/other-autre/sac-css/sac-css-eng.htm>. Accessed 5 June 2019

10. Pampalon R, Martinez J, Hamel D. Does living in rural areas make a difference for health in Québec? *Health Place* 2006;12:421–435

11. Bryden KS, Dunger DB, Mayou RA, Peveler RC, Neil HA. Poor prognosis of young adults with type 1 diabetes: a longitudinal study. *Diabetes Care* 2003;26:1052–1057

12. Michaud S, Dasgupta K, Bell L, et al. Adult care providers' perspectives on the transition to adult care for emerging adults with type 1 diabetes: a cross-sectional survey. *Diabet Med* 2018;35:846–854

13. Garvey KC, Telo GH, Needleman JS, Forbes P, Finkelstein JA, Laffel LM. Health care transition in young adults with type 1 diabetes: perspectives of adult endocrinologists in the U.S. *Diabetes Care* 2016;39:190–197

14. Laing SP, Jones ME, Swerdlow AJ, Burden AC, Gatling W. Psychosocial and socioeconomic risk factors for premature death in young people with type 1 diabetes. *Diabetes Care* 2005;28:1618–1623