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Original Research

The Relationship between Diabetes Care Quality and Diabetes-Related Hospitalizations and the Modifying Role of Comorbidity

Yelena Petrosyan MD [a], Yu Qing Bai MSc [a], Anna J. Koné Pefoyo PhD [a,b], Andrea Gruneir PhD [a,c,d,e], Kednapa Thavorn PhD [c,f,g], Colleen J. Maxwell PhD [c,h], Susan E. Bronskill PhD [a,c], Walter P. Wodchis PhD [a,c,i,*]

[a] *Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto, Ontario, Canada*
[b] *Cancer Care Ontario, Toronto, Ontario, Canada*
[c] *Institute for Clinical Evaluative Sciences, Toronto, Ontario, Canada*
[d] *Women's College Research Institute, Women's College Hospital, Toronto, Ontario, Canada*
[e] *Department of Family Medicine, University of Alberta, Edmonton, Alberta, Canada*
[f] *Ottawa Hospital Research Institute, The Ottawa Hospital, Ottawa, Ontario, Canada*
[g] *School of Epidemiology, Public Health and Preventive Medicine, University of Ottawa, Ottawa, Ontario, Canada*
[h] *Schools of Pharmacy and Public Health & Health Systems, University of Waterloo, Ontario, Canada*
[i] *Toronto Rehabilitation Institute, Toronto, Ontario, Canada*

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ABSTRACT

Objectives: To evaluate the impact of comorbidity on diabetes care quality and diabetes-related hospitalizations and to examine whether associations between the likelihood of diabetes-related hospitalizations and compliance with diabetes testing are modified by type of comorbidity.
Methods: A population-based cohort study of 861 354 adults with diabetes was conducted in Ontario, Canada. The diabetes cohort was categorized into 4 groups defined by their comorbidity statuses: no comorbidity, diabetes-concordant only, diabetes-discordant only, and both concordant and discordant. Outcome variables were defined as having had at least 1 hospitalization for diabetes-related short- or long-term complications between 2009 and 2011. Diabetes-care quality measures included testing for glycated hemoglobin (A1C) and low-density lipoprotein-cholesterol levels and eye examinations between 2007 and 2009. Multivariable logistic regression models were performed to examine the associations between diabetes testing and diabetes-related hospitalizations and the modifying role of comorbidity type.
Results: Compliance with all 3 monitoring tests by patients with diabetes had a strong positive impact on reducing hospitalizations for diabetes-related long-term complications, especially in patients with diabetes-concordant conditions. The highest levels of adherence to all 3 diabetes monitoring tests were observed in patients with diabetes-concordant conditions only and in patients with diabetes-discordant conditions. The highest odds of hospitalizations for diabetes-related short-term complications were observed in patients having both discordant and concordant conditions.
Conclusions: Meeting diabetes testing goals has the potential to reduce hospitalizations for diabetes-related complications; however, this depends on types of coexisting chronic conditions and diabetes-related complications in patients with diabetes.

Mots clés :
diabète
type de comorbidité
tests de surveillance du diabète
hospitalisations liées au diabète
complications liées au diabète

RÉSUMÉ

Objectifs : Évaluer les conséquences de la comorbidité sur la qualité des soins aux diabétiques et les hospitalisations liées au diabète, et examiner si les associations entre la probabilité des hospitalisations liées au diabète et le respect des épreuves liées au diabète sont modifiées selon le type de comorbidité.
Méthodes : Une étude de cohorte populationnelle a été menée auprès de 861 354 adultes diabétiques de l'Ontario, au Canada. La cohorte de diabétiques a été classifiée en 4 groupes définis selon leurs états comorbides : aucune comorbidité; en concordance avec le diabète seulement; en non-concordance avec le diabète seulement; en concordance et en non-concordance avec le diabète. Les variables dépendantes

* Address for correspondence: Walter P. Wodchis, PhD, Institute of Health Policy, Management and Evaluation, University of Toronto, 155 College Street, Toronto, Ontario M5T 3MS, Canada.
E-mail address: walter.wodchis@utoronto.ca

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ont été définies par la présence d'au moins 1 hospitalisation à la suite de complications à court ou à long terme liées au diabète entre 2009 et 2011. Les mesures de la qualité des soins aux diabétiques comprennent les épreuves qui mesurent les concentrations de l'hémoglobine glyquée (A1c) et du cholestérol à lipoprotéines de faible densité, ainsi que les examens ophtalmologiques effectués entre 2007 et 2009. Les modèles de régression logistique multivariée ont été réalisés pour examiner les associations entre les épreuves liées au diabète, les hospitalisations liées au diabète et le rôle modificateur du type de comorbidité.
Résultats : Le fait que les patients diabétiques respectent les 3 épreuves de surveillance a des répercussions positives importantes sur la réduction des hospitalisations à la suite de complications à long terme liées au diabète, particulièrement chez les patients ayant des affections qui concordent avec le diabète. Les plus hauts niveaux de respect des 3 épreuves de surveillance ont été observés chez les patients dont les affections concordent avec le diabète seulement et chez les patients dont les affections ne concordent pas avec le diabète. Les cotes exprimant le risque d'une hospitalisation à la suite de complications à court terme liées au diabète ont été observées chez les patients dont les affections concordent et ne concordent pas.
Conclusions : L'atteinte des objectifs des épreuves liées au diabète a le potentiel de réduire les hospitalisations à la suite de complications liées au diabète. Cependant, ceci dépend des types d'affections chroniques coexistantes et de complications liées au diabète chez les patients diabétiques.

Introduction

Diabetes mellitus occurs commonly in conjunction with other chronic conditions. Of adults with diabetes, 85% have at least 1 comorbid condition, and as many as 40% have 3 or more (1,2). Diabetes is a prototype of an ambulatory care-sensitive condition because its management relies on outpatient services, and diabetes-related hospitalizations are potentially preventable in patients receiving good ambulatory care (3). Management of diabetes presents additional challenges for patients who have other comorbid chronic conditions, and primary care physicians face difficulties in addressing their many complex needs (1,4).

In the literature, *comorbidity* is defined as the "existence or occurrence of any distinct additional entity during the clinical course of a patient who has the index disease under study" (5). Comorbid conditions in people with diabetes can be categorized into diabetes-concordant and diabetes-discordant conditions (1). Diabetes-concordant conditions are related to diabetes in terms of sharing the underlying predisposing factors and a common management plan. In contrast, diabetes-discordant conditions are not directly related to diabetes in their pathogeneses and are more likely to add to the complexity of clinical decision making in the management of diabetes (1).

There is conflicting evidence that the presence of different types of comorbid conditions among people with diabetes leads to differences in the quality of diabetes care (6–8). Quality of diabetes care is commonly assessed by receipt of evidence-based monitoring tests for diabetes care, including A1C levels low-density lipoprotein (LDL-C) tests and eye examinations (6,8,9). Some studies have found that the presence of diabetes-concordant conditions is associated with better quality of diabetes care (6–8), whereas the presence of diabetes-discordant conditions is associated with both better (8) and worse (6) patient compliance with recommended diabetes testing.

Over time, people with diabetes are at increased risk for developing a number of serious health problems as a result of diabetes-related complications, and they add to the costs and burdens associated with this disease (10,11). Research indicates that about 40% of patients with newly diagnosed diabetes visit emergency departments and are admitted to hospital inpatient care for diabetes-related short-term complications, including hyperglycemia and severe hypoglycemia (12). Uncontrolled diabetes can contribute to significant long-term microvascular complications affecting the kidneys, eyes and nerves, as well as an increased risk for foot complications and cardiovascular diseases (13). The presence of comorbid conditions in individuals with diabetes has been shown to be associated with higher rates of hospitalizations and visits to emergency departments, especially by those with both concordant and discordant conditions (14,15).

There is equivocal evidence that monitoring tests and examinations for diabetes care predicts patient outcomes (16). Most existing studies fail to take into account the impacts of differing types of comorbid conditions on the relationship between meeting the optimal diabetes testing goals and diabetes-related complications that result in subsequent hospitalizations.

The present study aimed to 1) describe the prevalence and type of comorbid conditions, diabetes testing goals achievement, and hospitalizations for diabetes-related complications among patients with diabetes; 2) examine the associations between the likelihood of diabetes-related hospitalizations and diabetes testing goals achievement and 3) test the modifying effects of comorbidity type on the associations between the likelihood of diabetes-related hospitalizations and meeting diabetes testing goals. We hypothesized that patients with diabetes who are comorbid with diabetes-concordant conditions would have better achievement on diabetes testing goals and fewer hospitalizations for diabetes-related complications compared to those with diabetes-discordant conditions.

Methods

Study design and data sources

This population-based retrospective cohort study was conducted in Ontario, Canada. The study observation period extended from April 1, 2007, to March 31, 2011. Multiple healthcare administrative databases were linked anonymously for the purpose of this study. The Ontario Diabetes Database (ODD) was used to assemble the cohort of individuals diagnosed with diabetes (17,18). The ODD is a validated database that identifies all adults aged 20 years and older with diabetes in Ontario from April 1, 1991 (17,18). The use of the ODD provided high-level sensitivity (86%) and specificity (95%) in identifying individuals in whom diabetes was reported in primary care charts (17). Patients were considered to have diabetes if diagnosed with the International Classification of Diseases (ICD-10) code of E10 to E14. Individuals were included if they had either 1 hospital admission or 2 Ontario Health Insurance Plan (OHIP) claims with a diagnosis of diabetes within 2 years (17).

Other data sources included the Canadian Institute for Health Information (CIHI) Discharge Abstract Database, which consists of data on all hospital discharges in Ontario; the OHIP database, which contains information on patient contact with physicians in both ambulatory and hospital settings; the Registered Persons Database, which contains information regarding the demographics of persons eligible for healthcare coverage in Ontario; and the Client Agency Program Enrolment database, which identifies patients belonging to the primary care models. Canada census data were also used to