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Public Health

journal homepage: www.elsevier.com/puhe

Original Research

Projected diabetes prevalence and related costs in three North American urban centres (2015–2040)

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ARTICLE INFO

Article history:
Received 6 September 2017
Received in revised form
17 December 2017
Accepted 22 December 2017

Keywords:
Diabetes
Projection
Prevalence
Cost
City
Urban

ABSTRACT

Objectives: To explore the future implications of diabetes for urban centres, we projected the prevalence and cost of diabetes from 2015 to 2040 in three very different North American cities: Houston, Mexico City and Vancouver.

Study design: We use a simple demographic transition model using existing sources to project future prevalence and financial burden of diabetes.

Methods: Based on data from each individual city, projections of the diabetes prevalence and financial burden were created through a three-stage transition model where the likelihood of moving across stages is based on incidence rates for age and gender groups.

Results: According to our projections from 2015 to 2040, diabetes prevalence will approximately double in Houston to 1,051,900 people and in Vancouver to 379,778 people and increase by >1 million to 3,080,013 people in Mexico City. Prevalence rates will increase from 8.5% to 11.7% in Houston, from 9.1% to 11.9% in Mexico City and from 7.2% to 11.3% in Vancouver. Associated costs will rise 1.9-fold to $11.5 billion (in US dollars) in Houston, 1.6-fold to $2.8 billion in Mexico City and 2.1-fold to $2.6 billion in Vancouver.

Conclusions: Unless actions are taken to decrease its incidence, diabetes is expected to increasingly contribute to the societal and financial burden, particularly for urban areas. Resources and policy actions are needed immediately to promote healthy lifestyles and to implement secondary prevention of diabetes complications.

Introduction

Diabetes is considered a worldwide epidemic.[1,2] The International Diabetes Federation (IDF) estimates that, globally, 415 million people had diabetes in 2015.[2] The diabetes burden is high on a personal level and financially to healthcare systems.

Managing diabetes requires extensive lifestyle adjustments of the person with diabetes and, often, also for the family members. Undiagnosed and inadequately controlled

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https://doi.org/10.1016/j.puhe.2017.12.023
0033-3506/

diabetes can lead to serious, costly and life-threatening complications such as cardiovascular or kidney disease.[3] From 1990 to 2013, diabetes advanced from being the 10th to 7th leading cause of disability, globally.[4] At the same time, worldwide diabetes-related mortality increased by 89.7%,[5] with nearly half (46.6%) of diabetes-related deaths occurring in people younger than 60 years.[2]

In 2014, the estimated global health expenditures for the treatment of diabetes ranged between 612 and 1099 billion US dollars, with the highest annual *per capita* expenditures (7984 US dollars) reported for the region comprising North America and the Caribbean.[6] Diabetes-related costs amounted to nearly 14% of the total healthcare budget of this region and accounted for over half (an estimated 51.7%) of the global healthcare expenditures for diabetes.[2] Of note, a large proportion of diabetes-related expenditures were attributable to the treatment of potentially avoidable diabetes complications.[7]

Today, more than half (54%) of the world's population lives in cities, and the urban population is projected to increase to 66% (6.4 billion people) by 2050.[8] With this expected growth of urban centres and a progressively ageing and overweight/obese population, diabetes will become increasingly present in the cities of this world.[2] According to IDF global estimates, 208 million more people with diabetes (74% of the global population) will live in urban centres by 2040.[2] Urban areas have become increasingly important to economic growth, generating over 70% of the world's gross domestic product.[9] Thus, the combination of high healthcare expenditures for diabetes, the long-term need for support by people with diabetes and associated losses in productivity and disability may drain both financial and human resources, particularly in cities, and pose a serious impediment to their economic development.[1,10]

In the 1990s, decision-making power increasingly shifted from national to local authorities, strengthening the control of local and city governments over urban planning and development.[11] The Organisation for Economic Co-operation and Development has even suggested that cities may have the most effective level of governance today, with shorter response times to address challenges than national governments and sufficient economic and political powers to realise the needed change.[12] Therefore, urban developers and decision-makers can significantly contribute to the quality of life of city dwellers—for example, through easier access to employment, healthy food and clean water, quality health care, diverse education and cultural activities—and address lifestyle-related diseases (including obesity and diabetes), air and noise pollution or social inequalities.[11] The suggestion that the living environment is similarly important to health as healthcare services has become increasingly accepted. Today, cities can use their influence to develop healthy urban centres that promote well-being and good health through policies affecting the health of both, city dwellers and their nations.

In this article, we quantitatively project the development of diabetes in three North American cities: Houston in the United States, Vancouver in Canada and Mexico City in Mexico, which are three socioculturally and geographically different cities. These cities are all part of the Cities Changing Diabetes programme and the first three cities in the Healthy Cities Research Hub led by the University of Texas focussing on social and environmental conditions that impact health in urban settings throughout North America. We focus on North America because it is one of the most urbanised regions in the world, with 82% of the population living in urban areas.[8]

Houston has been one of the fastest growing metropolitan areas in the United States, with a population of nearly 6.5 million.[13,14] Three million people in the city commute to work every day, with more than 80% by car.[15] Mexico City is a megacity with a population of approximately 21 million.[8] It is also the largest city in Mexico where diabetes is the number one cause of mortality, with four times the number of life years lost due to diabetes in Mexico (1301.4 per 100,000) than in the United States (310.0 per 100,000).[16] In 2016, diabetes (as the first non-infectious disease) was declared a national health emergency in Mexico.[17] With a much smaller population of 2.5 million,[18] Vancouver strives to become the greenest city in the world by 2020, with 10 defined goals and 15 measurable targets such as creating a food scrap collection programme and more green jobs.[19]

With our research, we hope to provide the scientific community, city governments, public health officials and other policymakers with a common understanding of the future diabetes challenges in urban contexts.

Methods

We projected the development of the diabetes burden, for both type 1 and 2, in the three cities in the period from 2015 to 2040 in a simple demographic transition model based on existing data sources (see Supplementary Tables 1–3) with three possible stages: diabetes free, prevalent diabetes or dead. When necessary, we applied relevant foreign sources and made linear extrapolations or interpolations to fit existing source data to our model setup. The timeframe for the period of analysis is similar to that of the IDF, in the Diabetes Atlas 7th edition, to ensure relevant and comparable results.

Data sources

Data were included for seven indicators for each city. These include population size and growth, diabetes prevalence and incidence, mortality in general population, excess mortality in diabetes population and the cost of diabetes. The data sources compiled information on type 1 and type 2 diabetes, and we therefore do not distinguish between the two. The sources used for each city are included in the Supplementary appendix.

Diabetes prevalence

Baseline diabetes prevalence for each city individually was calculated in three steps:

1. The general population and the diabetes population were divided into age groups (0–19 years, 20–29 years, 30–39 years, …, 70–79 years and 80 years and older) and gender groups (men and women).
2. The baseline diabetes prevalence (expressed as the number of people with diabetes) in 2015 was estimated by multiplying the diabetes prevalence in percent (%) in each