

**cities  
changing  
diabetes**



# URBAN DIABETES

UNDERSTANDING THE  
CHALLENGES AND  
OPPORTUNITIES



[citieschangingdiabetes.com](http://citieschangingdiabetes.com)



# CITIES CHANGING DIABETES

THE CHALLENGE IS COMPLEX BUT, WHEN ACTION IS TAKEN, THE POTENTIAL HUMAN, SOCIETAL AND ECONOMIC REWARDS ARE IMMENSE.

Cities concentrate people, opportunities and services, including those for health. When cities are planned, managed and governed well, life flourishes and health outcomes can surpass those seen in rural areas. But cities can also concentrate risks and hazards to health – this is evident in the case of type 2 diabetes. Two-thirds of the 415 million people with diabetes live in and around cities. The number of people with diabetes is set to rise to more than 640 million by 2040 and with this the number of people with diabetes living in cities.

The form and composition of cities – their size, density, diversity and complexity – provide tremendous opportunity for understanding the drivers behind type 2 diabetes, thus making cities a focal point for developing interventions that can break the rising curve of diabetes. However, not enough is currently known about how societal factors and individual behaviour associated with urban living influence

an individual's risk of developing type 2 diabetes and impact the health outcomes of those who already have diabetes.

The Cities Changing Diabetes programme is a commitment to advocating for urgent action against diabetes on a global scale. The aim is to map the challenge, share solutions and act on the growing challenge of diabetes in some of the world's great cities. We believe that when businesses, city leaders and planners, healthcare professionals, academics and community leaders work together, we can transform our cities into healthier places to live, work and play and bring down the risk of diabetes in cities.

The programme is currently active in five cities: Mexico City, Copenhagen, Houston, Tianjin and Shanghai. In each city, partners with different expertise and knowledge are collaborating on the programme.



| MEXICO CITY                                   | COPENHAGEN                                            | HOUSTON                                                | TIANJIN                                                    | SHANGHAI                                                     |
|-----------------------------------------------|-------------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------|
| Government of Mexico City                     | City of Copenhagen                                    | American Diabetes Association, Houston                 | Tianjin Human Resource and Social Security Bureau          | Shanghai Diabetes Institute                                  |
| Ministry of Health, Government of Mexico City | Danish Diabetes Association                           | City of Houston Department of HR and Benefits          | Tianjin Medical Association                                | Shanghai Municipal Center for Disease Control and Prevention |
| National Institute of Public Health of Mexico | Steno Diabetes Center                                 | Clinton Health Matters Initiative                      | Tianjin Medical University                                 | Shanghai Municipal Commission of Health and Family Planning  |
|                                               | University of Copenhagen, Department of Public Health | Gateway to Care                                        |                                                            |                                                              |
|                                               |                                                       | Harris County Medical Society                          | Tianjin Municipal Commission of Health and Family Planning |                                                              |
|                                               |                                                       | Harris County Public Health and Environmental Services |                                                            |                                                              |
|                                               |                                                       | Houston Business Coalition on Health                   |                                                            |                                                              |
|                                               |                                                       | Houston Health Department                              |                                                            |                                                              |
|                                               |                                                       | The Fountain of Praise                                 |                                                            |                                                              |
|                                               |                                                       | The University of Texas, School of Public Health       |                                                            |                                                              |

Cities appear according to date of programme launch, and city partners are listed alphabetically.



# THE PROGRAMME STRUCTURE

The programme is structured to understand the driving factors behind the rise of diabetes in urban areas, and to share that knowledge and apply it to real-world solutions. The programme has three interconnected elements:

## MAPPING

We have set out to map the challenge in a number of 'study cities' across the world and generate a body of collective knowledge about diabetes in cities.

## SHARING

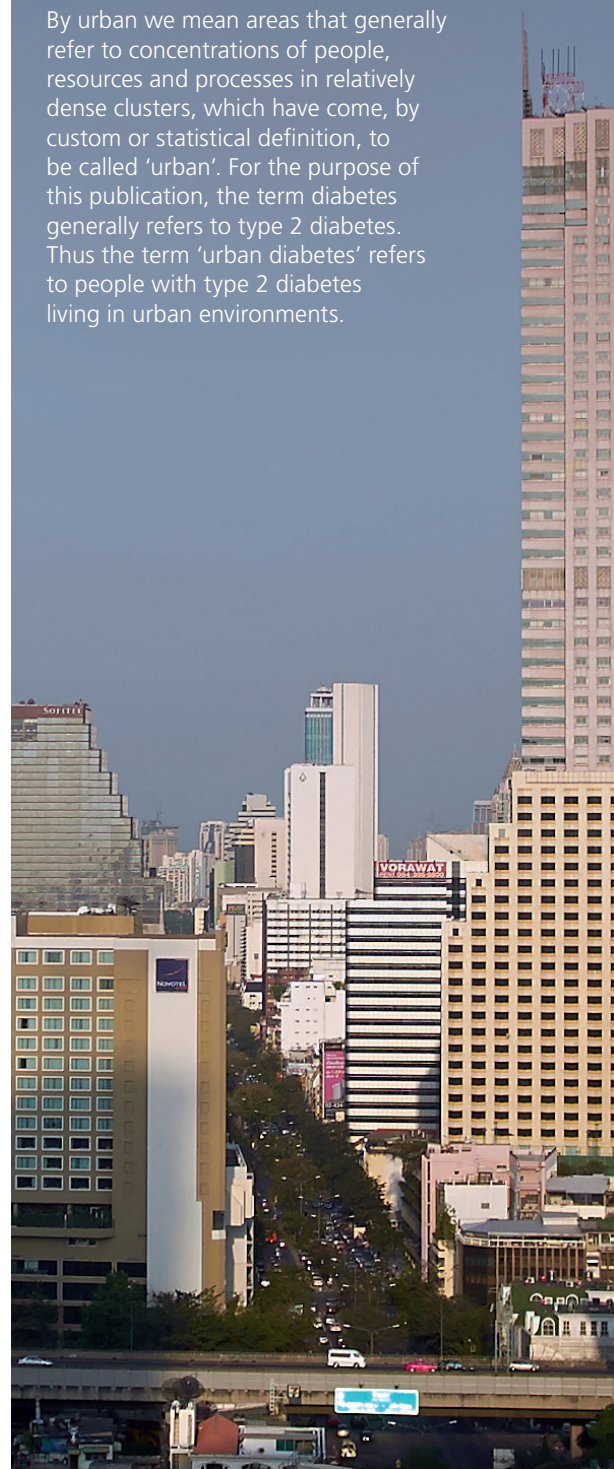
We will continuously share what is learnt, and join up the dots between cities so that everyone can gain from the experience and knowledge of others – and thereby create solutions for their own local needs. We will use our influence and global networks to drive the challenge of diabetes up the urbanisation agenda worldwide.

## ACTION

We will work with partners to identify and scale up solutions to tackle diabetes in cities. The programme will enable us to catalyse action. And across the world, the knowledge we have gained will equip a broad range of partners to take concerted and focused action on the ground in cities through health promotion and urban design.

# URBAN DIABETES

By urban we mean areas that generally refer to concentrations of people, resources and processes in relatively dense clusters, which have come, by custom or statistical definition, to be called 'urban'. For the purpose of this publication, the term diabetes generally refers to type 2 diabetes. Thus the term 'urban diabetes' refers to people with type 2 diabetes living in urban environments.



## NOVO NORDISK

Novo Nordisk is at the forefront of one of today's great health challenges: diabetes. As specialists in diabetes treatment, we are committed to finding the next generation of medicines through long-term investment in innovation. Our key contribution is to discover and develop these medicines, manufacture them to scale and make them accessible wherever they are needed. But living with chronic disease is about more than getting the right medicine. That is why we are working on helping people to receive the right treatment and achieve the right outcomes. We are committed to playing our part in the global fight against diabetes, and Cities Changing Diabetes is at the heart of this commitment.

*"Novo Nordisk is the leading company in the provision of pharmaceuticals for the treatment of diabetes. As such, it's our obligation to articulate the problem, wherever it is."*

Lars Rebien Sørensen, CEO, Novo Nordisk

For more information, visit [novonordisk.com](http://novonordisk.com)

## UNIVERSITY COLLEGE LONDON

Over the last few years, University College London (UCL) has put its weight behind understanding the impacts of urbanisation. Under the banner of its 'Grand Challenge' commitments to Global Health, Sustainable Cities, Intercultural Interaction and Human Wellbeing, a cross-disciplinary group has sought to contribute to urban sustainability by identifying health vulnerabilities and addressing the modifiable risk factors that can reduce the impact of NCDs globally. Applied researchers at UCL are delighted to bring their expertise to bear through supporting innovative work with global partners that will underpin Cities Changing Diabetes. More than that, their approach is aimed at making an impact that is sustainable into the future, giving new momentum to this global initiative.

*"Understanding the social and cultural factors that shape what is feasible and desirable for people in urban environments is critical to understanding diabetes and how we address it."*

Prof David Napier, University College London

For more information, visit [ucl.ac.uk](http://ucl.ac.uk)

## STENO DIABETES CENTER

Steno Diabetes Center is a world leading institution in diabetes care and prevention, with a focus on the early stages of the disease. Established in 1932, Steno is a not-for-profit organisation working in partnership with the Danish healthcare system. Steno currently provides care for 5,600 people with diabetes. As a partner in Cities Changing Diabetes, Steno draws on its expertise both in the clinical epidemiology of diabetes in Denmark and in creating innovative and sustainable approaches to managing diabetes at community level. Steno staff train healthcare professionals in cities across the world and are experts in providing care in Copenhagen. Steno can make a significant contribution to the understanding and future management of urban diabetes.

*"We're conducting a serious investigation into the diabetes problem in each city to discover the contemporary profile in each location rather than basing plans on general assumptions. The Cities Changing Diabetes programme can contribute to making cities a better place in which to live – for all of us."*

Prof John Nolan, CEO, Steno Diabetes Center

For more information, visit [steno.dk](http://steno.dk)

## CITY PARTNERS

Taking on a challenge as immense as urban diabetes requires a collaborative effort at all levels. The success of the Cities Changing Diabetes programme will be determined by our ability to work together and contribute with our knowledge and capabilities within our respective areas of expertise. The programme has the best local partners on board from each of the five cities to build new knowledge about urban diabetes and identify appropriate strategies for acting on this global health challenge.

For more information, visit [citieschangingdiabetes.com](http://citieschangingdiabetes.com)





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# FOREWORD

THE RISE OF DIABETES IS ONE OF TODAY'S GREAT HEALTH CHALLENGES AND CITIES HAVE BECOME THE FRONTLINE IN THE FIGHT AGAINST THE DISEASE.

Urban environments are now home to more than half the world's population, and two-thirds of people with diabetes live in urban areas. This calls for action. In early 2014 we launched Cities Changing Diabetes and, since then, Mexico City, Copenhagen, Houston, Tianjin and Shanghai have all joined the programme.

These are five important cities with a combined population of almost 60 million people. They represent the characteristics of rapidly growing cities of emerging economies and more mature cities of the developed world: all of them faced with the challenge of a growing number of people with diabetes resulting in a growing economic burden for society.

Solutions to the growing urban diabetes challenge will have to be found in partnerships. A collaborative venture with the city and health authorities and a network of top-class academic institutions in the five locations has made it possible to design this unique study: all of us coming together in common cause.

We decided to focus the research on the social factors and cultural determinants; that in itself is significant. To date, the vast majority of diabetes research focuses on biomedical factors. Yet, for people at increased risk of developing type 2 diabetes or living with the disease, the great majority of the problem is socially and culturally mediated.

In each of the five cities we have measured the burden of diabetes, and teams of researchers in each city have spent time in people's lives and homes to understand vulnerability to developing diabetes and its complications. These approaches give us a richer understanding of the social factors and cultural determinants of the disease, and the barriers to achieving successful outcomes for those living with the disease. We present what has been learned so far, and bring alive what the researchers have found in each city.

It is true that every city is different in many specific ways. Yet it is also clear that the insights will be highly relevant to other urban environments and can provide the basis for developing locally applicable solutions elsewhere.

The picture that emerges demonstrates that if we are to change the trajectory of the disease, a clinical response is essential but not enough. We need to look at the problem differently. We have to turn more of our collective resource, effort and imagination towards social factors and cultural determinants which put people at risk in the first place, and understand why good outcomes are so hard to achieve. We need to bring new combinations of people and perspectives together to design new and different interventions.

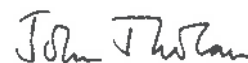
That is why, as we share this research and mark a renewed opportunity to act on diabetes, we remain resolute in our ambition: to put urban diabetes at the top of the healthcare agenda and put it on the agenda of those designing and managing cities for the future.



Lars Rebieen Sørensen,  
CEO, Novo Nordisk



Prof David Napier,  
University College London



Prof John Nolan,  
CEO, Steno Diabetes Center

# EXECUTIVE SUMMARY

Diabetes impacts individuals, communities, cities and countries across all regions of the world. The most recent estimates from the International Diabetes Federation (IDF) put the global prevalence of diabetes at 8.8% of the adult population. This translates to 415 million people living with diabetes, which is an increase of 28 million people since the last estimates in 2014.

Type 2 diabetes accounts for up to 95% of the global diabetes burden. The number of people with type 2 diabetes is growing rapidly worldwide, and this is expected to push the total number of people with diabetes to 640 million by 2040. This rise can be associated with economic development, ageing populations, dietary changes and reduced physical activity – all of which can, to some extent, be linked to increasing urbanisation.

## RISE OF THE CITY

Already today, 54% of all people live in urban areas. Cities have been growing fast in recent years and are set to continue growing – by 2050, 66% of the world's population will be living in urban areas.

Urbanisation has transformed the way we live. Cities have inherent advantages and generally offer more opportunities that often translate into improved health, but this is not always the case. Urban areas can also mean increased exposure to many health risks. Urban living impacts how people live and is associated, among other factors, with changes in food habits, physical activity and work patterns. All of which, in turn, can influence the risk of disease and people's ability to manage it.

## RISE OF DIABETES

Today, two-thirds of all people with diabetes live in urban areas. Although it is not entirely understood why some people develop type 2 diabetes while others do not, it is clear that there are a number of factors that increase the risk of developing it. With increasing general prosperity, two global health themes have emerged – one is that people are living longer and the other is increasing levels of overweight and obesity. Both are prevalent in cities.

As we age, our risk for developing type 2 diabetes increases. Besides becoming more urban, the global population is also growing older. In fact, the percentage of the world's population over the age of 65 is expected to double from 8% in 2010 to 16% by 2050.

The other major driving factor behind the type 2 diabetes pandemic is increasing levels of overweight and obesity. Being overweight or having obesity probably accounts for 80–90% of all cases of type 2 diabetes. Worldwide, obesity levels have more than doubled since the 1980s, with some countries having more people who are overweight or who have obesity than people of 'normal' weight.

The convenience of urban transport, the reduced physical labour required to provide food and changes in what and how much people eat have collectively contributed to the formation of cities that promote high risk for type 2 diabetes.

However, urban environments not only impact people's risk of developing type 2 diabetes; they can also influence people's ability to manage it effectively. Diabetes is associated with a number of costly long-term complications. Although these complications can be avoided or at least delayed through careful management and care, very few people with diabetes actually manage to achieve optimal treatment outcomes. It is estimated that, on a global scale, just over 6% of people with diabetes achieve desired outcomes.

In 2015, the total global health expenditure for diabetes is estimated at 673 billion US dollars. This excludes costs associated with lost productivity due to illness and premature mortality.

The size, density, diversity and complexity of cities offer an opportunity to turn the rising tide of diabetes. However, this requires a better understanding of the cultural determinants and social factors that influence behaviour and health.

## RETHINKING DIABETES

Social factors (eg financial, geographic, time and resource factors) and cultural determinants (eg traditional and conventional factors, common shared perception of health, illness and body size) are increasingly recognised as having a significant role in the diabetes pandemic as well as providing opportunities to counter it. Yet little is known about their role when it comes to diabetes.

The Cities Changing Diabetes programme has been working with a number of global and national partners across five cities to assess the diabetes situation and identify the social factors and cultural determinants behind urban diabetes. Understanding these factors can help provide an understanding of vulnerability to diabetes and its complications.

- What are the social factors for urban diabetes? Which ones are modifiable?
- What are the cultural determinants of urban diabetes? Which ones are modifiable?
- Who is most vulnerable because of these social factors and cultural determinants of diabetes? How can they become less vulnerable?

## TALE OF FIVE CITIES

The five cities – Mexico City, Copenhagen, Houston, Tianjin and Shanghai – all vary in terms of population, culture, setting and size. They have localised their research approach and have uncovered new knowledge about the social factors and cultural determinants behind urban diabetes.



The preliminary findings presented in this book serve as an indication of the research approach taken in each of the cities. What is interesting to note, is that while there are commonalities between the cities, the findings are as diverse as the cities themselves. This highlights the complex and multifaceted nature of urban diabetes.

**IN MEXICO CITY**, one of the world's largest cities, the research highlights that socioeconomic vulnerabilities are exacerbated when people cannot engage with healthcare services. It also highlights some of the barriers to care, which include lack of resources, lack of understanding and lack of trust in institutions.

**IN COPENHAGEN**, despite a free healthcare system, inequalities in health and diabetes risk across city districts persist. The research highlights the complexity of vulnerability and points towards lack of energy, living alone and diabetes not being the highest in the hierarchy of everyday issues.

**IN HOUSTON**, the fastest-growing city in the US, the research reveals that vulnerability does not equal disadvantage. New knowledge has emerged about who is vulnerable to type 2 diabetes and which areas of Houston they live in. One of these groups has previously never been a target for health intervention. Some key insights are related to food as a 'nourishing tradition' and how perception of body size is influenced by the appearance of one's peers.

**IN TIANJIN**, a rapidly expanding megacity, the research reveals that vulnerability is embedded in cultural beliefs, impacting perceptions of risk and management of diabetes. Low literacy, education levels and socioeconomic challenges also significantly impact people's access to information about diabetes and their ability to manage the disease.

**IN SHANGHAI**, a fast-rising global metropolis, the research illuminates how diabetes impacts families, and how family behaviour and perceptions impact an individual's ability to manage their diabetes. The research also reveals knowledge about social transition and its relationship to urban diabetes.

## GLOBAL REFLECTIONS

In close collaboration with the local academic partners, more than 500 qualitative interviews across five cities have been analysed, and an in-depth analysis of the role that social factors and cultural determinants play in the development and management of urban diabetes has been carried out. While it may not be possible to address the multitude of factors and determinants simultaneously and at all levels, it is most certainly possible to take action now: we can all begin by meeting people with diabetes with a better understanding of the drivers behind their personal challenges; we can begin to see urban environments in the light of these vulnerability factors; and we can begin to limit the negative factors that create vulnerability while promoting those that create resilience.



Launch of the Cities Changing Diabetes programme in Mexico City, 2014



Launch of the Cities Changing Diabetes programme in Copenhagen, 2014



Launch of the Cities Changing Diabetes programme in Houston, 2014

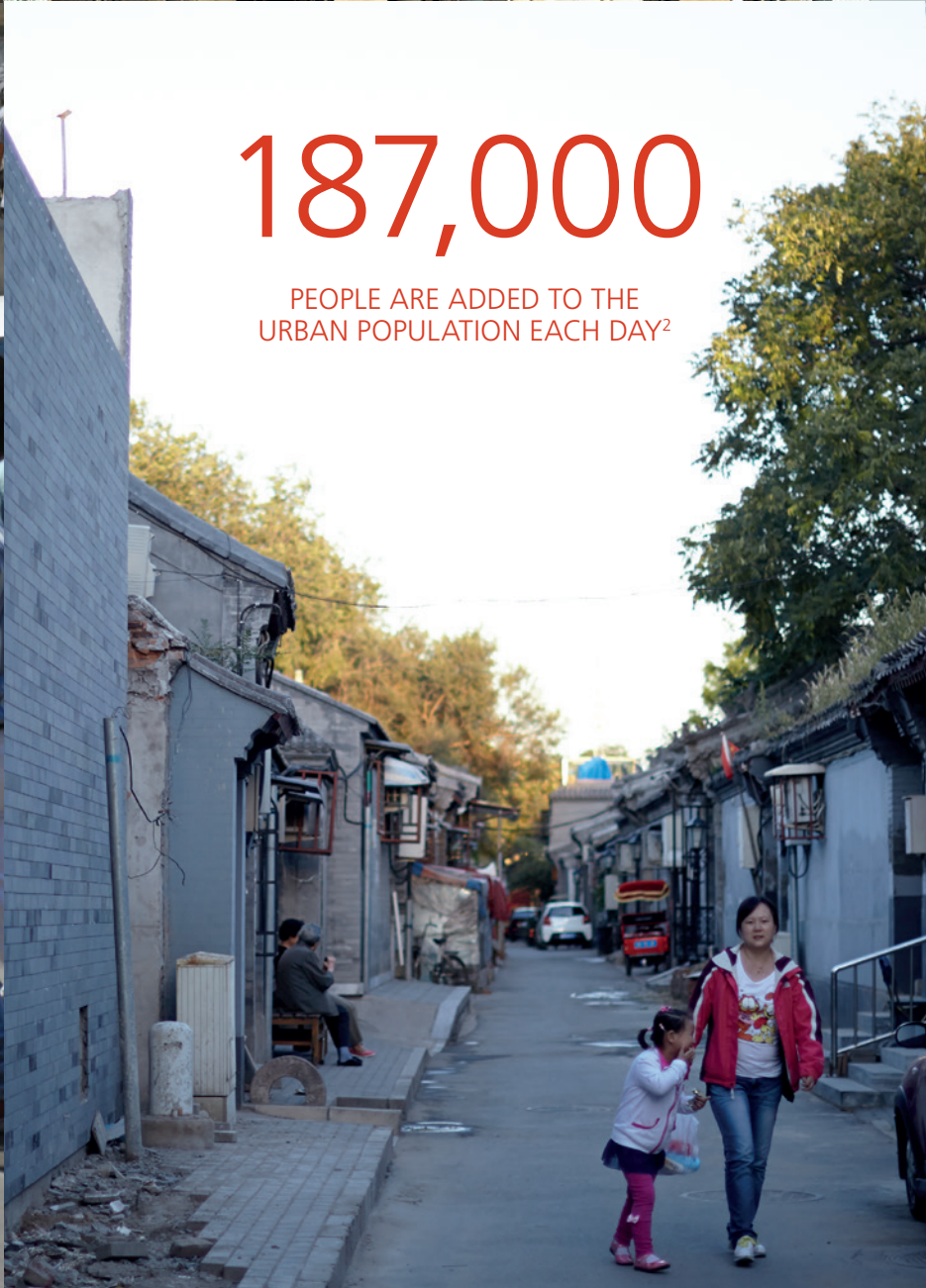


Launch of the Cities Changing Diabetes programme in Tianjin, 2014



Launch of the Cities Changing Diabetes programme in Shanghai, 2014

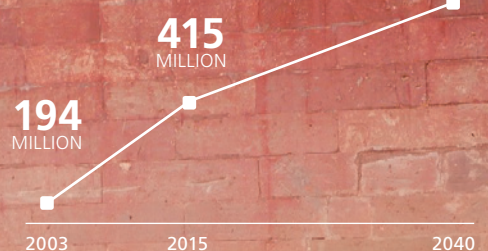




# 187,000

PEOPLE ARE ADDED TO THE  
URBAN POPULATION EACH DAY<sup>2</sup>



IDF GLOBAL ESTIMATES  
OF PEOPLE WITH DIABETES<sup>1,3</sup>

2/3

OF PEOPLE WITH DIABETES  
LIVE IN CITIES<sup>1</sup>

# THE CHALLENGE OF URBAN DIABETES

URBANISATION INCREASINGLY INFLUENCES HEALTH AND IS THUS GAINING GROUND AS A CRITICAL FOCUS AREA WHEN ADDRESSING THE GROWING TYPE 2 DIABETES PANDEMIC.

The increase in diabetes is one of today's major health challenges, a global emergency in slow motion. Worldwide, 415 million people are living with diabetes.<sup>1</sup> Without concerted action, it is estimated that this will climb to 642 million by 2040.<sup>1</sup> Today, more than half of the world's population lives in urban areas<sup>2</sup> and so do two-thirds of all people with diabetes.<sup>1</sup> That makes cities an important focal point for tackling diabetes. However, there is a need to better understand what drives urban diabetes.

*"I'm not the type who loves to go out and eat unhealthy stuff, but on days when I feel very ill, I have to order food from outside. That's when my weight goes up – because of all that deep-fried stuff."*

Female with type 2 diabetes, 60, Copenhagen

# RISE OF THE CITY

# 66%

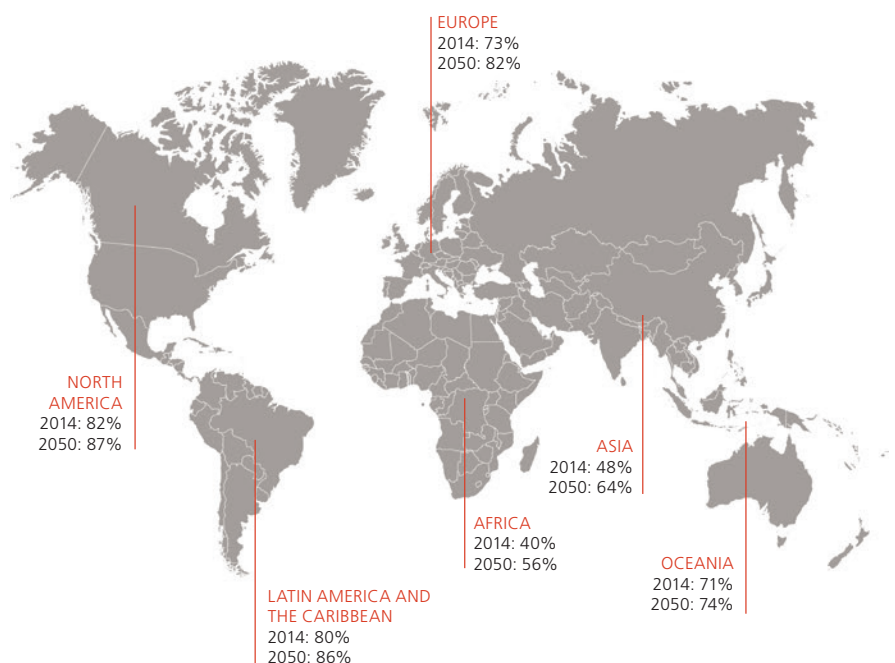
OF THE WORLD'S  
POPULATION WILL LIVE IN  
URBAN AREAS BY 2050<sup>2</sup>

URBANISATION HAS BEEN ONE OF THE MOST SIGNIFICANT DEMOGRAPHIC SHIFTS IN THE PAST CENTURY AND REPRESENTS A SUBSTANTIAL CHANGE FROM HOW THE WORLD'S POPULATION HAS LIVED FOR SEVERAL THOUSAND YEARS.

Widespread urbanisation is a recent phenomenon. In 1900, just 15% of the world's population lived in cities. The 20th century transformed this picture, with the world's urban population growing to 54% of all people today, and it is expected to reach two-thirds of the total population by the middle of this century.<sup>2</sup>

The level and growth of urbanisation vary considerably from region to region. Today, the most urbanised regions include North America (82% living in urban areas), Latin America and the Caribbean (80%), and Europe (73%). The process of urbanisation in these regions was largely the result of industrialisation in the first half of the century.<sup>4</sup> In contrast, Africa and Asia remain mostly rural, with 40% and 48% respectively of the population living in urban areas. All regions are expected to urbanise further over the coming decades, with the least urbanised regions, Africa and Asia, urbanising faster than the other regions and reaching levels of 56% and 64%, respectively, by 2050.<sup>2</sup> Urbanisation in Africa and Asia is related to a variety of factors. In China, growth in annual gross domestic product (GDP) per capita drives approximately half of the urban land expansion, while in India and Africa it is primarily driven by urban population growth.<sup>5,6</sup>

FIGURE 1 PROPORTION OF URBAN POPULATION BY REGION, 2014–2050<sup>2</sup>





## CITIES ATTRACT PEOPLE

The drivers of urbanisation are multiple, interlinked and complex. The process itself has historically been associated with significant economic and social transformations that have brought greater geographic mobility, lower fertility, longer life expectancy and population ageing.<sup>2</sup> Put simply, cities attract people because of the proximity, and thus enhanced accessibility, of opportunities.

The most striking example of urbanisation is the rise of the megacity, a metropolitan area with a total population in excess of 10 million people. While there were just 10 megacities in 1990, that figure has almost tripled to 28 today.<sup>2</sup>

Predictions put the world's population at 8.5 billion in 2030.<sup>7</sup> That is an extra 1.1 billion people on the planet in just 15 years, or 83 million annually. Almost all of this dramatic growth will be in cities,<sup>2</sup> with many 'push' and 'pull' factors working to draw people to these urban centres.

Push factors include population increase,<sup>8–10</sup> modernisation of the agricultural sector, famine and natural disasters – all leading to migration from rural areas to cities.

Of the pull factors, the strongest one is the prospect of making a better living than what is possible in a rural setting.<sup>11</sup> Cities have large economies and, as such, many opportunities to earn a living and even prosper. Secondly, facilities such as electricity, clean water, access to education, health services, communication and recreational facilities are more likely to be available in urban environments. A third factor is the cultural attraction of a city and the glamour of the 'modern' way of life.<sup>11</sup>

## URBAN ENVIRONMENTS IMPACT HEALTH

Urban areas are extremely complex environments in which a large number of environmental, social, cultural and economic factors have an impact on individual and population health.<sup>12</sup> Studies on the health impacts of urbanisation reveal that urbanisation can have both positive and adverse effects.<sup>13</sup> Urban living generally provides improved education and raised per capita incomes that can – but do not always – translate into improved health.<sup>14</sup> Also, the economies of proximity associated with dense populations can reduce the costs of delivering infrastructure and services, which can complement health. However, living in urban areas can also often entail greater exposure to a wealth of risk factors that can be detrimental to health.

One of the most prominent features of urbanisation is how it impacts on lifestyle. Changes in food habits, physical activity, work patterns, smoking, alcohol consumption, leisure-time activities and travelling patterns all impact on health. Many of these factors are associated with an increased risk of diseases such as type 2 diabetes.<sup>15</sup>

Today's urban areas are also characterised by increasing health differentials within cities.<sup>16</sup> Although health, on average, is improved in urban areas, the urban poor that live in slums or in marginalised situations may experience such inadequate living conditions that their health is even worse than that observed in rural areas.<sup>17</sup> The stressors, such as higher rates of crime and

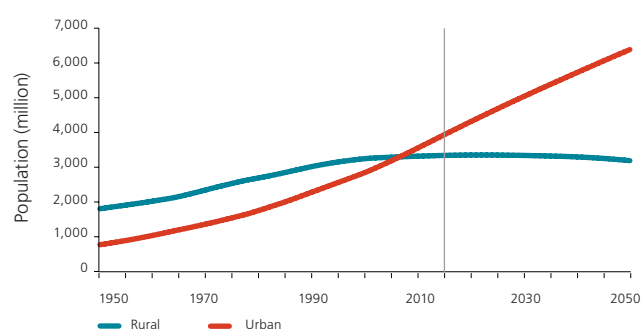
violence and psychosocial aspects that often go hand-in-hand with the increased density and diversity of cities, also play a role in shaping the health of a city's citizens.<sup>16</sup>

Some urban environments face particular challenges associated with migration and informal settlements, frequently driven by food insecurity, job insecurity and long-term and emerging conflicts.<sup>16</sup> These individuals often do not have access to health insurance,<sup>18</sup> which can lead to vast disparities in healthcare outcomes as well as two-tiered healthcare systems where insured individuals have access to preventive and routine healthcare while marginalised populations use 'safety-net' emergency room care.<sup>18</sup>

As urban populations grow, the quality of the urban environment will play an increasingly important role in public health.<sup>19</sup>

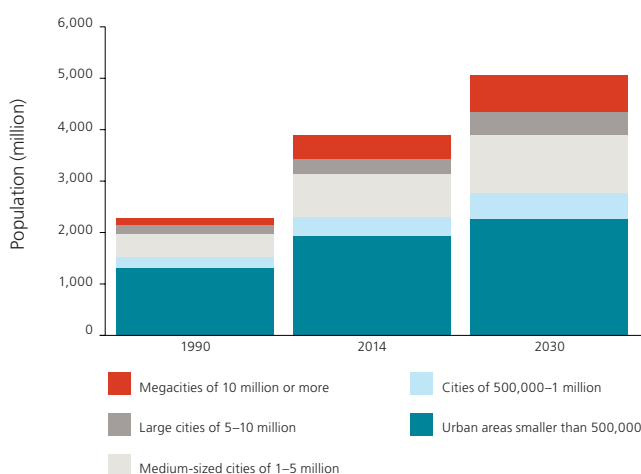
**FIGURE 2 URBAN AND RURAL POPULATION OF THE WORLD 1950–2050**

Globally, more people live in urban areas than in rural areas, with 54% of the world's population residing in urban areas.<sup>2</sup>



**FIGURE 3 GROWTH OF CITIES 1990–2030**

Close to half of the world's urban citizens reside in relatively small settlements of less than 500,000 people. Large cities with 5–10 million inhabitants account for a small but growing proportion of the global urban population.<sup>2</sup>





# RISE OF DIABETES

THERE IS A HISTORIC CORRELATION BETWEEN URBANISATION AND PEOPLE'S HEALTH. FACTORS THAT IMPACT OUR HEALTH ARE PART OF THE FOUNDATIONS OF CITIES AND THE WAY WE LIVE IN THEM.

In the 18th and 19th centuries, industrialisation and the growth of cities led rapidly to the spread of a number of communicable diseases, such as cholera, typhoid, yellow fever, typhus, scarlet fever, diphtheria, influenza and tuberculosis, leading to increased mortality and shortened life expectancy.<sup>20,21</sup> To combat these health issues, cities began to develop new citywide sewer systems. In fact, sanitary reformers are considered by many to have been the first urban planners.<sup>22</sup>

However, today our cities are faced with new health challenges. With relative stealth, chronic diseases have replaced the killers of earlier centuries. This is particularly evident in the case of type 2 diabetes. In most countries, the prevalence of type 2 diabetes has increased in tandem with rapid cultural and social changes – all of which can, to some extent, be linked to increasing urbanisation.<sup>23</sup>

Today, there are 415 million people with diabetes worldwide, corresponding to 8.8% of the global adult population.<sup>1</sup> Approximately 95% of people with diabetes have type 2 diabetes<sup>24</sup> and almost two-thirds of all people with diabetes live in urban areas.<sup>1,25</sup> By 2040, the number of people with diabetes is expected to rise to 642 million,<sup>1</sup> with 74% of them living in urban areas.<sup>1</sup>

## THE LINK BETWEEN URBANISATION AND DIABETES

It is not fully understood why some people develop type 2 diabetes and others do not. However, it is clear that certain biomedical factors increase the risk of developing type 2 diabetes. Some of these factors are nonmodifiable, such as family history, ethnic background and age, while others, including body weight and levels of physical activity, can be modified.<sup>24</sup> These factors can also impact health outcomes of people who already have diabetes.

There is a strong social patterning in the incidence of type 2 diabetes, with two risk factors becoming overarching themes.<sup>12</sup> The first is an ageing population while the second is rising levels of obesity. Both themes are relevant in the context of understanding the link between urbanisation and diabetes.<sup>12</sup>

### AGEING POPULATION

The world's population is growing older and the proportion of the elderly is expected to continue rising.<sup>26</sup> In 2010, an estimated 524 million people were aged 65 years or older – 8% of the world's population. By 2050, this number is expected to nearly triple to about 1.5 billion, representing approximately 16% of the world's population.<sup>26</sup> The risk of developing type 2 diabetes increases with age.<sup>24</sup> As populations age, so the prevalence of type 2 diabetes will increase. While population ageing is not unique to urban areas, the fact that 66% of the global population will live in cities by 2050 and that people with diabetes are living longer<sup>25</sup> means that cities need to plan the urban physical, economic and social environment to limit the impact of diabetes.

### RISING LEVELS OF OBESITY

Together, being overweight or having obesity probably accounts for about 80–90% of type 2 diabetes cases and are important obstacles to its successful long-term management.<sup>27,28</sup> Research shows that each kilogram of body weight gained increases the risk of developing type 2 diabetes by 4.5%.<sup>29</sup> Furthermore, losing 5–10% of body weight can reduce the risk of developing type 2 diabetes by up to 50%.<sup>30–35</sup>





**475** BY 2040  
**MILLION**  
PEOPLE WITH DIABETES WILL LIVE IN  
URBAN AREAS<sup>1</sup>

Exposure to ‘obesogenic environments’ is often cited as a contributing factor to the increasing rates of obesity. These environments – which are often urban – can encourage lower levels of physical activity and the consumption of excess calories.<sup>37</sup>

Cities offer a greater range of food choices, generally at lower prices. Urban work often demands less physical exertion than rural work, and as more and more women work outside the home, families may be too busy to shop for, prepare and cook healthy meals at home. In addition, densely populated urban areas often lack facilities and outdoor areas for exercise and recreation.<sup>38</sup> Cities often have more roads, cars and car travel, and less walking or cycling for transportation or leisure.<sup>39</sup> Lower levels of physical activity are being caused by the increasing use of automated transport, technology in the home, sedentary work and more passive leisure pursuits.<sup>40</sup> All these factors contribute to the rising levels of obesity and, in turn, a rising number of people with type 2 diabetes.<sup>37,41</sup>

## LOOKING BEHIND THE RISK FACTORS

Although each person starts out with their own genetic health profile, a number of social factors and cultural determinants (Box 1) come into play in an individual’s overall health throughout their life. Together, these factors impact the way people live their lives and their risk for developing type 2 diabetes as well as influence the outcome of treatment and care of people who already have diabetes.

Increasingly, social factors and cultural determinants are being recognised for their relationship with the soaring incidence of type 2 diabetes, as well as the opportunities they present to counter it. This is why it is important to address the social factors and cultural determinants of urban diabetes.

In general, the understanding of the role of culture as a determinant of health is not as well-developed as our understanding of many social factors. However, culture should be considered separately from social factors. For many groups, culture is central to their health and wellbeing, quite apart from social factors.<sup>42</sup>

*“We know that diabetes is significantly shaped by sociocultural factors; however, the sciences that traditionally study these factors are vastly underrepresented.”*

Prof David Napier,  
University College London

### BOX 1

#### SOCIAL RISK FACTORS

Social factors of health are the conditions in which individuals are born, grow, live, work and age, and the wider set of forces and systems shaping the conditions of daily life. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels. The social factors of health are mostly responsible for health inequities – the unfair and avoidable differences in health status seen within and between countries.<sup>43</sup> Examples of social factors include financial, geographic, time and resource factors.

#### CULTURAL DETERMINANTS

Cultural determinants are external determinants much like other key determinants of an environmental, geographic, political or economic nature.<sup>44</sup> The cultural determinants of health are those factors that determine how shared conventions, understandings and practices impact health and wellbeing. Cultural determinants form the foundation out of which social factors emerge.<sup>45</sup> Cultural determinants include traditional and conventional factors, common shared perception of health, illness and body size.<sup>45</sup>

\* Obesogenic environments – The obesogenicity of an environment has been defined as “The sum of influences that the surroundings, opportunities or conditions of life have on promoting obesity in individuals or populations”.<sup>36</sup>

# THE DEVELOPMENT OF TYPE 2 DIABETES IS THE RESULT OF A COMPLEX INTERACTION OF NONMODIFIABLE AND MODIFIABLE RISK FACTORS.

## ABOUT DIABETES<sup>25</sup>

Diabetes is a chronic condition that occurs when the body cannot produce enough insulin or cannot use insulin effectively. Insulin is a hormone produced in the pancreas that allows glucose from food to enter the body's cells where it is converted into the energy needed by muscles and tissues to function.

When glucose cannot enter the body's cells, it remains circulating in the blood (a condition known as hyperglycaemia), damaging the body's tissues over time. This damage can, over years, lead to disabling and life-threatening health complications. The main types of diabetes are type 1 and type 2.

TYPE 1 DIABETES is an autoimmune disease where the body's immune system attacks and destroys the insulin-producing cells of the pancreas. This form of diabetes accounts for 3–5% of diabetes globally.<sup>24</sup> It is most common in children and young people, but can also develop later in life. Why type 1 diabetes occurs is not entirely understood, nor can it be prevented or cured. People with type 1 diabetes are dependent on insulin injections for survival.

TYPE 2 DIABETES results from a failure of the body's cells to use insulin effectively (insulin resistance) and/or the ability to produce enough insulin. It is the most common form of diabetes, accounting for about 95% of all cases.<sup>24</sup> It generally occurs in middle-aged and older people, but the age of diagnosis is decreasing and it is becoming increasingly common in overweight children, adolescents and young adults.<sup>24</sup> Type 2 diabetes can be partly prevented or significantly delayed.

IT IS POSSIBLE TO PREVENT TYPE 2 DIABETES OR AT LEAST DELAY ITS ONSET. A COMBINATION OF MODERATE WEIGHT LOSS, INCREASED PHYSICAL ACTIVITY AND A HEALTHY DIET CAN LEAD TO A 60% REDUCTION IN INCIDENCE IN INDIVIDUALS AT HIGH RISK.<sup>34,35</sup>

NONMODIFIABLE BIOMEDICAL RISK FACTORS that impact a person's risk of developing type 2 diabetes and diabetes-related complications include:

- Family history – Type 2 diabetes has a strong link to family history and lineage, and studies of twins have shown that genetics play an important role in its development.<sup>46</sup>
- Ethnic background – People of African-American, Asian-American, Latino/Hispanic-American, Native American or Pacific Islander descent have a greater likelihood of developing type 2 diabetes.<sup>47</sup>
- Age – The risk of developing type 2 diabetes increases with age.<sup>24</sup>
- History of gestational diabetes – A history of diabetes during pregnancy is a risk factor for developing type 2 diabetes later in life.<sup>24</sup>

MODIFIABLE BIOMEDICAL RISK FACTORS that can be influenced to impact the risk of developing type 2 diabetes and diabetes-related complications include:

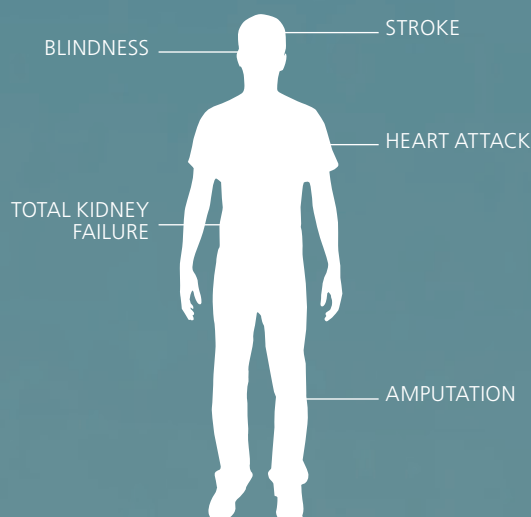
- Body weight – Overweight and obesity are major risk factors for developing type 2 diabetes.<sup>24</sup> Losing 5–10% of body weight can reduce the risk of developing type 2 diabetes by up to 50%.<sup>30–35</sup>
- Physical activity – Along with overweight/obesity, physical inactivity ranks among the top modifiable risk factors for type 2 diabetes.<sup>24</sup> By achieving 150 minutes per week of moderate-intensity aerobic exercise or 90 minutes per week of vigorous-intensity aerobic physical activity or a combination of the two, the risk of developing type 2 diabetes can be minimised.<sup>48</sup>
- Blood pressure – In addition to causing damage to the cardiovascular system, untreated high blood pressure has been linked to the development of type 2 diabetes.<sup>24</sup>
- Cholesterol levels – Low HDL ('good' cholesterol) and/or high triglycerides can increase the risk of type 2 diabetes.<sup>24</sup>





DIABETES AND ITS DISABLING COMPLICATIONS HAVE A HIGH IMPACT ON THE AFFECTED INDIVIDUALS AND THEIR FAMILIES AND IT IS AN INCREASING ECONOMIC BURDEN FOR SOCIETY.

#### POTENTIAL COMPLICATIONS OF DIABETES



##### BLINDNESS

Diabetes is the leading cause of blindness in people under the age of 60 in industrialised countries.<sup>53</sup>

##### TOTAL KIDNEY FAILURE

Diabetes-induced kidney disease is the leading single cause of end-stage kidney disease requiring dialysis.<sup>54</sup>

##### STROKE

People with diabetes are up to four times more likely to have a stroke.<sup>55</sup>

##### HEART ATTACK

At least 50% of people with diabetes die from cardiovascular disease.<sup>56</sup>

##### AMPUTATION

Diabetes is the leading cause of lower limb amputation.<sup>57</sup>

#### DIABETES AFFECTS EVERYONE

Because of the chronic nature of diabetes, the severity of its complications and the means required to control them, diabetes is a costly disease. The majority of costs are driven by the treatment of diabetes-related complications.<sup>50</sup> Not only does it place considerable economic and psychosocial burdens<sup>49</sup> on affected individuals and their families but it also has tremendous associated costs for society.<sup>50</sup>

#### IMPACT ON INDIVIDUALS AND THEIR FAMILIES

Diabetes is a challenging disease that significantly affects individuals and places a significant burden of care on their families. It impacts not only on physical wellbeing but also on psychosocial and emotional wellbeing and quality of life.<sup>49,51</sup> Today, diabetes is the seventh-leading cause of years lived with disability (YLD)<sup>52</sup> and is the fourth-leading cause of death in most high-income countries.<sup>9</sup> Diabetes often puts an additional financial strain on families. With or without insurance, the extra costs of medication and visits to the doctor can be overwhelming, trapping a family in poverty or pushing those with limited resources into poverty.<sup>50</sup>

#### SOCIETY PAYS A HIGH PRICE FOR DIABETES

Diabetes-related costs are a significant burden on a country's economy and are already estimated to account for 12% of global healthcare expenditure or 673 billion US dollars annually.<sup>1</sup> If projections hold true, this number will increase to over 802 billion dollars by 2040.<sup>1</sup> In addition to healthcare spending, diabetes is also associated with significant indirect costs from work-related absenteeism, reduced productivity both at work and at home, reduced labour force participation from chronic disability and premature mortality.<sup>50</sup>

**673** **DIABETES COST**  
**BILLION**  
US DOLLARS IN GLOBAL HEALTHCARE  
EXPENDITURE IN 2015<sup>1</sup>

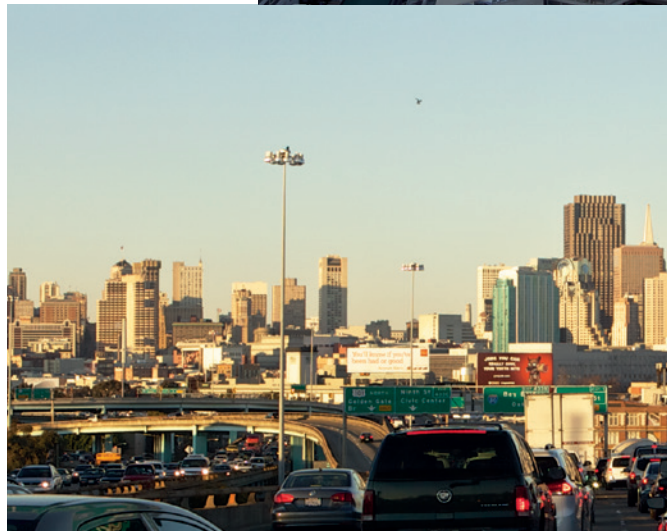






*“Urban diabetes is one of the major challenges in terms of health in cities today. People are inactive, they’re sitting in their cars and don’t bicycle or walk. To tackle urban diabetes today, in my view, that cure is called urban planning.”*

Helle Sørholt, Architect, Copenhagen





# RETHINKING DIABETES

TODAY, NOT ENOUGH IS KNOWN ABOUT THE DYNAMICS OF HOW URBAN ENVIRONMENTS CAN INFLUENCE DIABETES AND HOW TO DELIVER THE POTENTIAL HEALTH BENEFITS THAT CITY LIVING CAN BRING.

The Cities Changing Diabetes programme is mapping the extent of the urban diabetes challenge and working to generate an understanding of the drivers behind this pandemic.

*"I typically run two miles a day. I can't say my diet is the healthiest. I do have a passion for co-Southern comfort foods and I probably drink a little too much alcohol. But other than that, yeah, I'm healthy."*

Female at risk of type 2 diabetes, 50, Houston

# BUILDING NEW KNOWLEDGE



TODAY, ROUGHLY HALF OF ALL PEOPLE WITH TYPE 2 DIABETES ARE NOT DIAGNOSED; HALF OF THOSE DIAGNOSED DO NOT RECEIVE CARE; HALF OF THOSE WHO RECEIVE CARE DO NOT ACHIEVE THEIR TREATMENT TARGETS; AND HALF OF THOSE WHO REACH THEIR TARGETS DO NOT ACHIEVE THE DESIRED OUTCOMES.

Both quantitative and qualitative research were conducted in each of the cities. The Rule of Halves was used as a framework for the quantitative research.

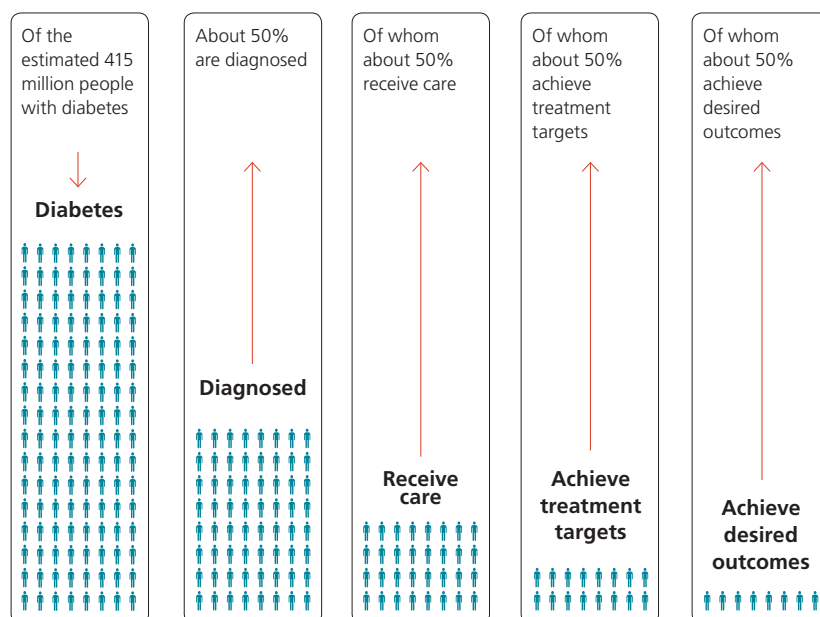
Applying the Rule of Halves (Figure 4),<sup>58</sup> it is possible to hypothesise that, on average, just 6% of people with diabetes will live their lives free from diabetes-related complications. While actual rates vary from city to city and from country to country, this framework can be used to raise critical questions and so understand some of the challenges related to tackling diabetes.

## MAPPING THE URBAN DIABETES CHALLENGE

The aim of the quantitative research for estimating the Rule of Halves is to assess the prevalence of diabetes, the rate of diagnosis among people with diabetes and the number of people with diabetes receiving care, achieving treatment targets and achieving desired outcomes. This makes it possible to understand significant gaps in diabetes diagnosis and care, and indicates where efforts should be focused to have the highest impact.

Each of the cities has estimated the Rule of Halves and, in some cases, the number of people at increased risk of developing type 2 diabetes has also been estimated. The research demonstrates the local diabetes burden and highlights where the largest gaps are.

FIGURE 4 THE RULE OF HALVES<sup>58</sup>



\* The Rule of Halves is a general framework that estimates the global diabetes situation. Actual rates of diagnosis, treatment, targets and outcomes vary in different countries.



## UNVEILING THE SOCIAL FACTORS AND CULTURAL DETERMINANTS

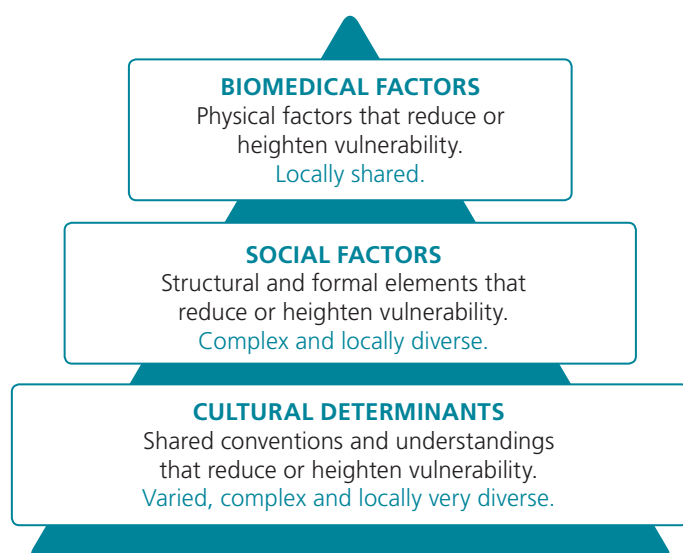
The aim of the qualitative research is to understand what makes certain people vulnerable to diabetes and its complications. This makes it possible to go beyond the quantitative Rule of Halves results by exploring the social risk factors and cultural determinants of urban diabetes.

The social factors and cultural determinants are known to impact diabetes vulnerability. Vulnerability is created along a spectrum of biomedical, social and cultural factors. While the biomedical factors are well-known, too little is known about the social factors and cultural determinants that contribute significantly to vulnerability to diabetes.

Understanding the social factors and cultural determinants – in combination with the biomedical factors – provides a holistic understanding of diabetes vulnerability. The levels of vulnerability are related to the presence and combination of social, cultural and biomedical factors. Those most vulnerable will be those who experience all social factors and cultural determinants as well as biomedical factors. Those least vulnerable will be those who do not experience any of the social factors and cultural determinants, even in the face of biomedical factors (Figure 5).

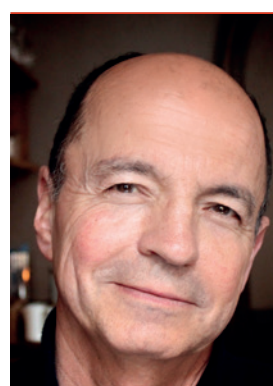
The outset is a Diabetes Vulnerability Assessment (D-VA) tool, which is the first fully integrated rapid assessment instrument to identify the social factors and cultural determinants for developing diabetes and living with diabetes and its complications.<sup>59</sup>

FIGURE 5 UNDERSTANDING VULNERABILITY



The D-VA is guided by three fundamental research questions:

- What are the **social factors** for urban diabetes? Which ones are modifiable?
- What are the **cultural determinants** of urban diabetes? Which ones are modifiable?
- Who is **most vulnerable** because of these social factors and cultural determinants of diabetes? How can they become less vulnerable?



PROFESSOR DAVID NAPIER  
UNIVERSITY COLLEGE LONDON

### PLACING THE SPOTLIGHT ON SOCIAL FACTORS AND CULTURAL DETERMINANTS OF THE DIABETES PANDEMIC.

Many of today's most pressing global health problems can be understood and solved only by getting to grips with the cultural determinants, social factors and environmental settings that shape health and that also cause disease. Fortunately, healthcare communities around the globe are doing so increasingly.

Biomedical approaches to health and illness have contributed to vast reductions in mortality and morbidity worldwide. But in general, these approaches have yet to account for the strong effects of culture, society and environment on individual health. We cannot afford to ignore the impact of these factors when attempting to tackle an issue as overwhelming as the current diabetes pandemic.

While today's cities have made it possible for millions to access services and care, urban areas have also become hotspots for inequality, increasing human suffering and the burden of diabetes. This confluence of ever-growing cities and the rise in diabetes must be taken seriously as a force determining the health outcomes of increasing numbers of people across the globe. The problem is undeniably complex and will require both local and global cooperation.







# TALE OF FIVE CITIES

PARTNERS IN FIVE CITIES ARE COLLABORATING TO GENERATE NEW KNOWLEDGE AND INSIGHTS INTO URBAN DIABETES.

The Cities Changing Diabetes programme is currently active in five cities of varying sizes and densities, and at different stages of development. Each city is contributing through its partnerships to establish a new knowledge base of the social factors and cultural determinants that make some people vulnerable to the development of type 2 diabetes and its complications in their city.

The work in the study cities will act as a platform for the programme to grow globally. It will provide a basis for connecting and understanding the challenge of urban diabetes, and for enabling and inspiring many more cities to join in the global fight.

*"Once you get diagnosed with diabetes, you don't have the same illusion of growing old. Your wishes fade away and life shortens."*

Male with diabetes, 50, Mexico City





**MEXICO CITY** MEXICO  
MINISTER OF HEALTH  
DR JOSÉ ARMANDO AHUED ORTEGA

*"Diabetes is a very serious threat to the health of the Mexican population and is the most important healthcare challenge in Mexico City. But we cannot let this disease defeat us. Therefore I'm delighted about the Cities Changing Diabetes partnership with Novo Nordisk, academic researchers and other participating cities across the world. We want to see a decrease in diabetes prevalence and also to treat better the patients who have diabetes. That's why the Government of Mexico City will collaborate closely with Novo Nordisk and other partners to get more knowledgeable about diabetes in our city and to take concrete actions to improve the quality of care and health outcomes for people living with diabetes."*



**COPENHAGEN** DENMARK  
MAYOR OF HEALTH  
AND CARE  
NINNA THOMSEN

*"In 2014, Copenhagen was named the world's most liveable city by Monocle magazine. This is a tribute to our great political ambitions for creating an active, healthy and green city."*

*"Yet the challenge of urban diabetes in Copenhagen is real and still on the rise. In particular, it's a consequence of social inequality."*

*"Cities Changing Diabetes will challenge us to do more – providing new data and new routes to collaboration across our own city as well as a window on important work in other cities across the world."*

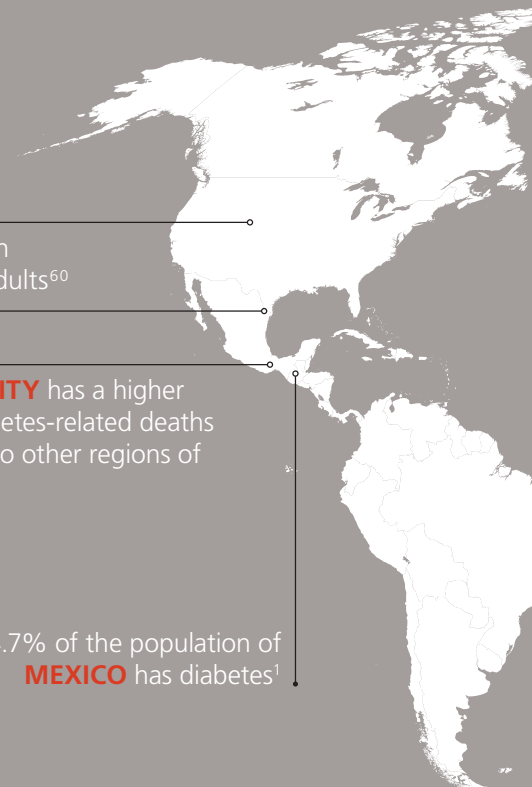
ACROSS THE WORLD, STUDIES ARE BEGINNING TO EXPOSE THE LINKS BETWEEN URBAN LIFESTYLES AND THE PREVALENCE OF DIABETES. IT IS VITAL THAT WE CREATE CITIES WHICH HELP US LIVE MORE HEALTHILY.

81% of people with diabetes in the **US** live in urban areas<sup>25</sup>

Obesity is **HOUSTON'S** most common chronic condition, affecting 32% of adults<sup>60</sup>

**MEXICO CITY** has a higher rate of diabetes-related deaths compared to other regions of Mexico<sup>61</sup>

14.7% of the population of **MEXICO** has diabetes<sup>1</sup>







**HOUSTON** USA  
DIRECTOR, HOUSTON  
HEALTH DEPARTMENT  
STEPHEN L WILLIAMS

*"Twelve months ago, Houston embarked on a journey to get to the root of the diabetes epidemic that we, like so many urban areas around the world, are facing. Through focused studies and the unyielding support of key stakeholders throughout our city, the emerging research that the Cities Changing Diabetes initiative in Houston is producing may not only stem the tide of urban diabetes in our neighbourhoods, but in neighbourhoods throughout the world. We're proud to be able to impact the diabetes landscape through Cities Changing Diabetes."*



**TIANJIN** CHINA  
DIRECTOR, TIANJIN  
HEALTH & FAMILY  
PLANNING COMMISSION  
WANG HESHENG

*"With our economic development has come improved quality of life. But as we grow we also face challenges – and one of those is urban diabetes. The Tianjin Health & Family Planning Commission takes diabetes prevention and control very seriously, investing a lot in scientific research, clinical treatment and community health centres. This work is paying off, yet the population with diabetes is still growing."*

*"It's a long journey requiring the collaboration of multiple partners, including city leaders and planners, the social sector and academic partners: that's why we're pleased to be a part of Cities Changing Diabetes."*



**SHANGHAI** CHINA  
DIRECTOR, SHANGHAI  
INSTITUTE OF DIABETES  
JIA WEIPING

*"For over a decade now, Shanghai has had a plan in place for chronic disease prevention and control. A huge amount is being done, backed by significant healthcare resources, yet the number of patients and complications are increasing. That shows the force of the urban diabetes challenge for us."*

*"The dynamics driving urban diabetes in Shanghai are complex: growing wealth, changing lifestyles and an ageing population, alongside a rising number of younger people getting the disease. Also, fast-paced working lives can stand in the way of the management and treatment of diabetes. We all have more to learn, and more we can do."*

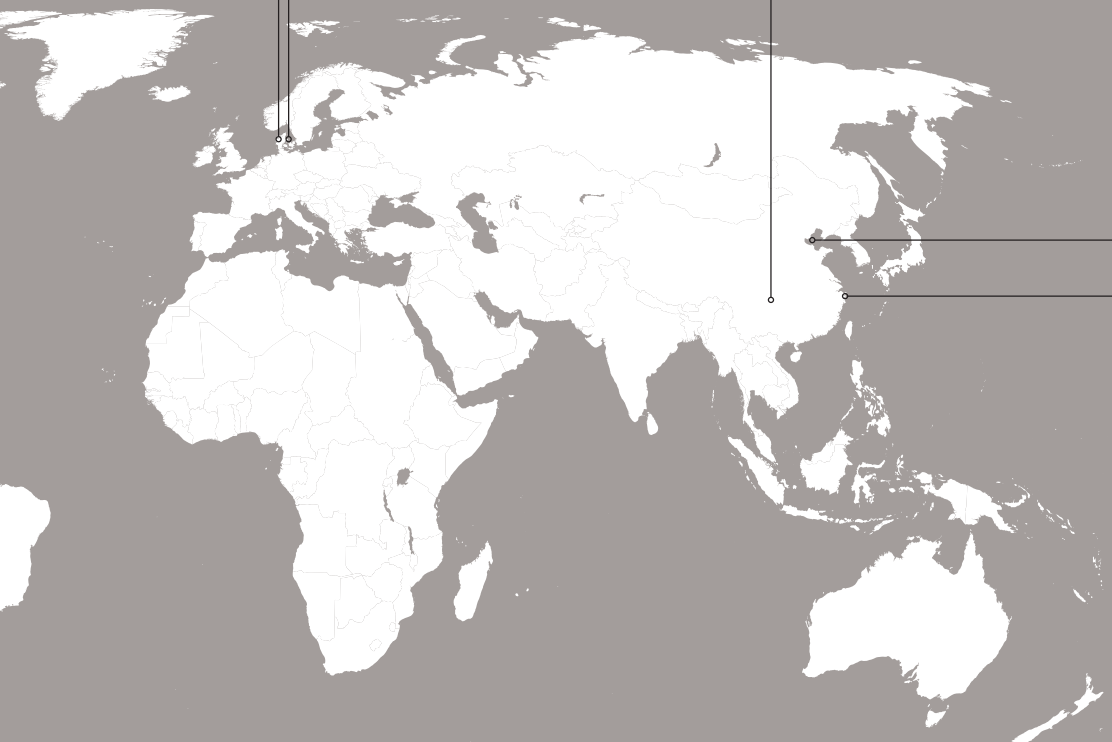
88% of the population of **DENMARK** live in urban areas<sup>2</sup>

In **COPENHAGEN**, the prevalence of diabetes ranges from 2.5% to 7.4% across districts of the city<sup>62</sup>

The population of **CHINA** living in urban areas is projected to increase from 54% today to 76% by 2050<sup>2</sup>

11.7% of people in **TIANJIN** have obesity<sup>63</sup>

10.4% of people in **SHANGHAI** have obesity<sup>64</sup>







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## DID YOU KNOW?

MEXICO'S  
URBAN POPULATION  
**GREW 36%**  
BETWEEN 1965 AND 2000<sup>2</sup>

MORE THAN  
**200,000**  
CARS ARE ADDED  
TO MEXICO CITY'S  
STREETS EACH YEAR<sup>65</sup>

COLLECTIVELY, MEXICANS  
DRINK THE EQUIVALENT OF  
**3.6 MILLION**  
CANS OF **SOFT DRINK**  
EACH DAY<sup>66</sup>

MEXICO CITY'S METRO IS ONE  
OF THE WORLD'S BUSIEST WITH  
**>4 MILLION**  
USERS EACH DAY<sup>67</sup>

MEXICO CITY HAS A  
HIGH POPULATION  
**DENSITY**  
AT 9,700 PEOPLE PER KM<sup>2</sup>,  
THIS IS 3.5 TIMES MORE THAN  
COPENHAGEN<sup>68</sup>

MEXICO CITY IS ONE OF THE  
BEST CITIES IN THE WORLD FOR  
**STREET  
FOOD**<sup>69</sup>

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# MEXICO CITY

## ONE OF THE WORLD'S LARGEST MEGACITIES

URBAN TRANSITION IN MEXICO IS OCCURRING AT A RAPID PACE, BUILDING ONE OF THE WORLD'S LARGEST MEGACITIES AND BRINGING WITH IT MANY MOBILITY, ENVIRONMENTAL AND PUBLIC HEALTH CHALLENGES.

In 1975, when it reached a population of more than 10 million, Mexico City\* was the third city in the world to achieve megacity status.<sup>70</sup> Today, Mexico City is the largest metropolitan area in the western hemisphere, and the fourth largest city in the world. With a population today of more than 20 million, the city accounts for over 20% of the country's total population.<sup>71</sup>

In the 1960s, Mexico City experienced the highest growth rate in its history, with an average annual increase of more than 6%.<sup>72</sup> This significant growth was primarily driven by industrialisation and the need for labourers in the city.<sup>73</sup> This pace eventually slowed to below 1% in 1980, and has continued at this rate ever since.<sup>73</sup>

The geography of the metropolitan area of Mexico City has a significant impact on its citizens and their health. The city lies 2,230 metres above sea level in a bowl-shaped valley formed by high mountains.<sup>74</sup> These mountains trap the air pollution in the area, rather than allowing it to dissipate. This, together with the sheer number of people living in the city, over 40,000 factories, limited fresh water supply and high levels of traffic, is associated with many challenges that impact how people live.<sup>74</sup>

### DIABETES CHALLENGE IN MEXICO CITY

Recent research on the burden of type 2 diabetes, conducted in Mexico City's Federal District, indicates that 13.9% of adults in the city have type 2 diabetes.<sup>75</sup> This is close to the national prevalence of 14.7% for both type 1 and type 2 diabetes.<sup>2</sup> Based on the Rule of Halves (Figure 6), the research reveals that 29% of people with type 2 diabetes are unaware of their condition. Of those who are diagnosed, 86% receive care. However, only one in four of those achieves treatment targets.<sup>75</sup>

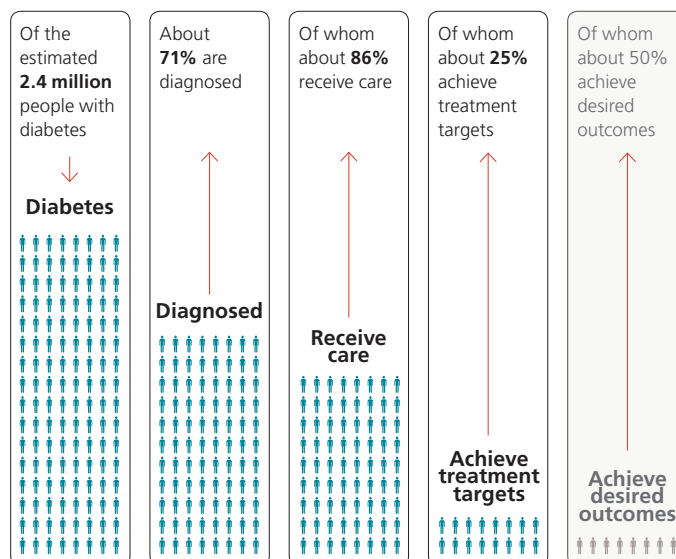
Furthermore, the new research reveals that 19.8% of the adult population in Mexico City is estimated to have impaired glucose tolerance, commonly referred to as prediabetes, putting them at increased risk of developing type 2 diabetes in the near future.<sup>75</sup>

There are significant differences in the prevalence of type 2 diabetes for different age groups (Figure 7). A significant percentage of the population is impacted in the prime of their working life (age 30–59). The highest prevalence is among those between the ages of 60 and 69 at 38.8%.<sup>75</sup>

Among those with previously diagnosed type 2 diabetes, there are also high rates of complications. Almost 63% of people with diagnosed diabetes report complications related to eyesight, while over 39% report neuropathy-related complications (Figure 8).<sup>75</sup>

**FIGURE 6 RULE OF HALVES FOR MEXICO CITY**

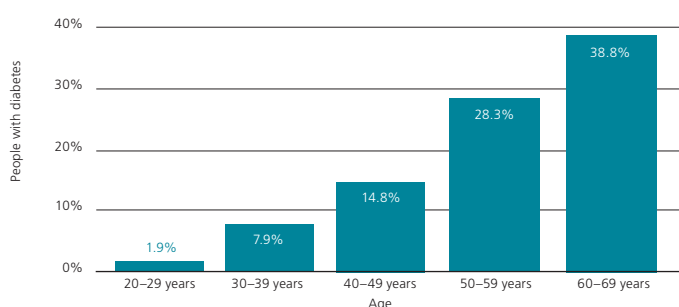
The Rule of Halves for Mexico City is based on new research performed among people with type 2 diabetes between the ages of 20 and 69, living in Mexico City.<sup>75</sup>



NOTE: Estimates for the Rule of Halves are based on research conducted in the Federal District. The last pillar is estimated based on the general Rule of Halves due to lack of data.

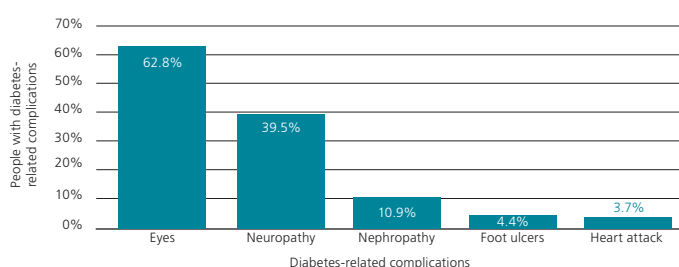
**FIGURE 7 DIABETES IMPACTS PEOPLE OF WORKING AGE**

The majority of people with type 2 diabetes are in the prime of their working life.<sup>75</sup>



**FIGURE 8 HIGH LEVELS OF DIABETES-RELATED COMPLICATIONS**

Almost 63% of people with type 2 diabetes experience eyesight problems.<sup>75</sup>



NOTE: Diabetes-related complications refers to people with previously diagnosed diabetes.

\* Unless otherwise specified, Mexico City refers to the Federal District.



## A CITY CHALLENGED BY RISING OBESITY

Underlying the high prevalence of type 2 diabetes in Mexico City are many demographic, epidemiologic and nutritional transitions which, in turn, have led to one of the highest obesity rates in the world.<sup>77</sup> The recent research shows that 74% of adults in Mexico City are overweight or have obesity (39% and 35% respectively). Among women, the prevalence of obesity is almost 40% (Figure 9).<sup>75</sup> In addition, Mexico ranks the highest in the world for childhood obesity.<sup>78</sup>

While the causes of overweight and obesity are complex, significant changes in diet are considered to be major driving factors.<sup>79</sup> A general increase in fast-food consumption, increased access and exposure to low-cost processed foods with high quantities of sugar combined with fat and sodium<sup>80</sup> and simultaneous decreases in the time available for food preparation<sup>81</sup> and physical exercise have come together to drive the rapid increase in levels of obesity and related diseases.<sup>77</sup> This is illustrated by the fact that sugary drinks account for more than 10% of the average Mexican's total calorie intake.<sup>82</sup>

A recent analysis by the Mexican Institute for Competitiveness (IMCO) puts the societal cost of overweight and obesity at 82–98 billion Mexican pesos (about 5.25–6.25 billion US dollars).<sup>83</sup> The prevalence of overweight and obesity is set to continue rising. It is predicted that, by 2050, only 10% of the adult population will be of 'normal' weight.<sup>84</sup> Unless action is taken to address this situation, the economic costs will be staggering.

## INCREASING COST OF DIABETES

Diabetes is already the leading cause of death in the country, and the number of people with diabetes is expected to rise to more than 20 million people by 2040.<sup>1</sup>

Between 2015 and 2040, the prevalence of diabetes in Mexico City is projected to grow to 22.2% – or over 6.3 million people.<sup>85</sup> Diabetes-related costs are expected to almost triple from 1.8 billion dollars in 2015 to 4.6 billion dollars in 2040 (Figure 11).<sup>85</sup>

There is a clear need for action in Mexico City to address the obesity epidemic as, together with the increasing age of the general population, it is the main factor driving the rising prevalence of type 2 diabetes (Figure 10).

If effective obesity prevention were to halve the growth of obesity from the current 1.6%<sup>86</sup> to 0.8%, annual diabetes-related savings would amount to 416 million dollars by 2040 and the total savings between 2015 and 2040 would amount to 5.3 billion dollars.<sup>85</sup>

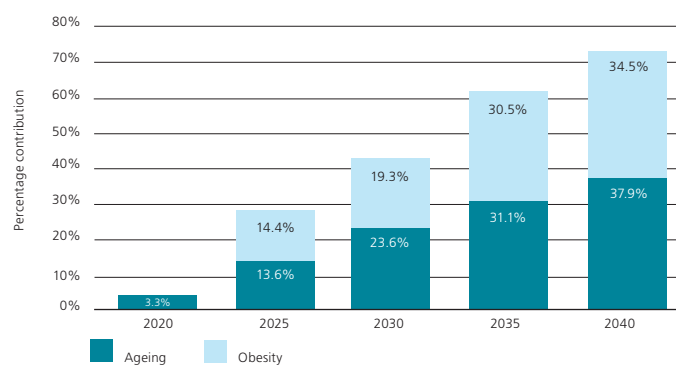
**FIGURE 9 PREVALENCE OF OBESITY IN MEXICO CITY**

Almost 35% of adults in Mexico City have obesity.<sup>75</sup>



**FIGURE 10 DOMINATING EFFECT OF AGEING AND OBESITY**

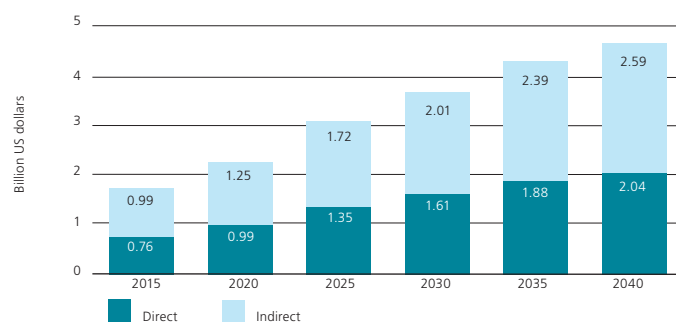
The prevalence of type 2 diabetes could increase to over 22% by 2040, with ageing and obesity accounting for a significant percentage.<sup>85</sup>



NOTE: The forecast of obesity rates for Mexico is available for the years, 2020, 2030 and 2040. Therefore effects of the growth of obesity rates on the prevalence of diabetes are only modelled from 2025.

**FIGURE 11 HIGH COST OF INACTION**

Diabetes-related costs are projected to almost triple between 2015 and 2040.<sup>85</sup>



NOTE: Direct costs are those that result from outpatient and inpatient health services (including surgery), laboratory and radiological tests and drug therapy. Indirect costs are identified as "resources foregone as a result of a health condition".

For further explanations about the projections, see page 63.



# UNDERSTANDING THE COMPLEXITY OF VULNERABILITY

SOCIOECONOMIC VULNERABILITIES ARE EXACERBATED WHEN PEOPLE CANNOT ENGAGE WITH HEALTHCARE SERVICES. BARRIERS TO CARE PROVISION INCLUDE LACK OF RESOURCES, LACK OF UNDERSTANDING OF WHAT SERVICES ENTAIL AND LACK OF TRUST IN INSTITUTIONS AND CARE PROVISION.

The vulnerability assessment reveals new knowledge about how access to healthcare and perceptions about the causes and consequences of disease influence health behaviour.

## KEY INSIGHTS INTO VULNERABILITY IN MEXICO CITY

Various insights into vulnerability for type 2 diabetes and diabetes-related complications have emerged from the research, the most important of which are highlighted below.

### THE RIGHT TO HEALTH AND HEALTHCARE

How individuals and communities engage with healthcare resources is influenced by their trust or mistrust in the quality of care, their perceived right of access to those services, and barriers to accessing them. Insufficient insurance or the absence of insurance altogether can either be a motivator to manage one's own health to avoid a precarious situation, or a disheartening experience for those who feel theirs is a 'helpless' condition.

With an abundance of needs but limited resources, it is logical to prioritise certain needs over others. In the face of socioeconomic disadvantage, people find themselves having to make a choice between food and medication; paying the bills or paying for transport to their hospital appointment. Similarly, when confronted with more than one health concern at a given moment, people choose to focus their attention and energy on illness at the expense of other health concerns.

*"When I first got sick with this illness, I went to the health centre but I didn't like the way they treated me... and as to medication – well, there isn't any."*

Male with type 2 diabetes, 60

### GENDER AND DIABETES CARE AND MANAGEMENT

Gender is very relevant to the experience of illness. In a society that places the emphasis on traditional gender roles, women struggle to manage their health alongside their domestic obligations. Not wanting to be perceived as selfish, burdensome or vulnerable, women in Mexico City are prone to neglect the dietary and physical requirements necessary to care for their personal health.

Women's perception of themselves as vulnerable to the violence of others impacts their willingness to leave the safety of their homes and thus represents a major barrier to health-seeking behaviours, such as attending informative classes or doctor's appointments on their own, or engaging in physical exercise. On the other hand, many men still depend on the care provided by the women in their lives. If there is no one there to assist them, men in Mexico City often struggle to manage their own care.

*"I feel stable because fortunately I have enough to eat... I'm a little afraid to go out and walk." Interrupted by her father during the interview: "Are you going to take long? Because you have things to do."*

Female with type 2 diabetes, 31

### AVAILABLE TREATMENTS AND CARE

The type of care and treatment utilised and sought after is dependent on availability of particular options and attitudes towards those options. For example, in the presence of widespread distrust in the quality of services offered at hospitals, people tend to seek out alternative forms of care, including homoeopathic treatments, or ask their local pharmacist for health advice.

*"One should not suffer from having to buy the medications. Whatever they give you, at least it's something."*

Male with type 2 diabetes, 59

### CONCEPTS OF DIABETES IN MEXICO CITY

Perception of diabetes, and of its causes and consequences, determines how people live with the disease. A poor understanding of what the disease is, why they have it and how it will affect the body limits the ability of individuals to adequately care for their diabetes. The data collected from Mexico City reveals that the negative consequences and symptoms of diabetes (such as loss of sight, amputation and kidney failure) are often based on a lack of understanding of the disease. In turn, a poor understanding of the disease and its dangers is the direct result of barriers to access to resources and information.

Conceptualised as a place of stress, exploitation, social insecurity and delinquency, the urban environment in Mexico City is often referred to as causative of disease. In addition, there is a popularly held belief that diabetes is caused by fear and other strong negative emotions, such as anxiety or stress ('susto'). This belief that diabetes is an emotional or psychological issue poses a direct barrier to meeting the physical demands necessary for preventing and managing the disease. Though many recognise the impact of stress (particularly stressors in the urban setting) and high-sugar diets on the development and management of diabetes, very few acknowledge the role of exercise in this equation. However, recognition of the importance of exercise is only one of several major barriers, such as the absence of safe and appropriate places to exercise and the availability of time to devote to exercise.

*"Diabetes is an illness of the big cities."*

Male with type 2 diabetes, 63

### BOX ABOUT THE RESEARCH

The research was performed by the National Institute of Public Health of Mexico.

#### Quantitative research

Surveys were conducted among a representative sample of 2,500 people aged 20–69 living in the 16 delegations that constitute the Federal District of Mexico City. Information about the characteristics of housing, demography, health information, food consumption and levels of physical activity was collected along with information about anthropometry, biomarkers for diabetes and lipidaemia. In addition, blood samples were collected from 1,300 participants.

#### Qualitative research

The vulnerability assessment was based on 220 individual interviews with people with type 2 diabetes performed by trained fieldworkers in people's homes.



## A FIELDWORKER'S TAKE ON THE VULNERABILITY ASSESSMENT



**IZCHEL COSÍO BARROSO**  
ANTHROPOLOGIST, NATIONAL  
INSTITUTE OF PUBLIC  
HEALTH OF MEXICO

*"This study has allowed me to understand the complexity of the condition of diabetes. I'm more aware of the many dimensions of prevention and care, and how these relate to the type and degree of vulnerability of the people in Mexico City."*

## THREE CASES FROM MEXICO CITY

Three abbreviated cases that exemplify some of the key insights into vulnerability to diabetes and its complications are presented below. The name given to each case is fictitious in the interest of anonymity.



### MEET IZTAC

#### WHY IS THIS CASE INTERESTING?

This case is interesting because her story is shared by many people living in similar conditions in Mexico City, where a woman receiving less than the monthly minimum wage is a provider for her children and her grandchildren. Despite the undeniable hardship, lack of support networks and being almost blind, this woman is as strong and self-sufficient as she can be in the circumstances. However, were she to lose her job, this would change immediately for the worse.

#### ABOUT IZTAC

Iztac is a 44-year-old woman from the borough of Iztacalco in Mexico City. She has two sons and two grandsons, and they all live in a simple building near a main street with heavy car and foot traffic. On one corner of her street is a primary school, and there is a metro station nearby. Along the street are the customary roadside food stalls selling quesadillas and tacos.

Since she was seven years old, Izta has been blind in her left eye, and her right eye only has 15% visibility. This makes it hard for her to read and write. Her type 2 diabetes, which was diagnosed 10 years ago, has led to and exacerbated her vision loss. Izta sees diabetes as just *"another disease that you get"*, because since childhood she has been *"living with disease"*, referring to both her vision and mobility problems due to a leg injury as a result of being run over.

Even though diabetes tires her and causes pain in her feet, both of which affect her work performance, Izta sells bottled gas door to door each day. She has had episodes where her glucose level has dropped during her workday and she has had to be given medical attention, meaning that she was unable to continue

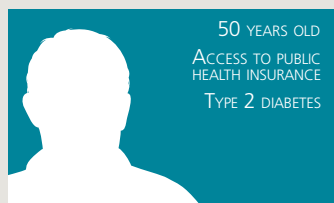
working. When she has only a little money available, she buys a chocolate bar and a soft drink to raise her glucose level and enable her to carry on working.

#### IZTAC AND DIABETES

Her current situation means she cannot maintain a healthy diet due to lack of time and money, even though she knows it is important for those with diabetes. In general, Izta feels that her diabetes is a consequence of living with stress due to family and working problems, a fact that she believes is inherent in the city and its dynamics. Her view is that labour exploitation, noise, hurry and widespread insecurity lead to stress and later cause health issues. The Mexico City is a setting *"that makes you ill"*, according to Izta.

*"You can give me a nice talk about nutrition, but no, [...] I won't be able to stick to it... Partly for economic reasons, partly because sometimes you just pick something up from the street vendors... In my case, because I'm diabetic, it's bad for me not to eat, and so sometimes I just have tripe tacos and coke [...]. With that, I can go all day."*





## MEET CAMILO

### WHY IS THIS CASE INTERESTING?

This case is interesting because Camilo has adopted an active self-care role towards his diabetes, resulting in fairly good blood glucose control. He has created a strategy to feel and live happily with the support of his nuclear family, which contrasts with their socioeconomic level. Even with a sedentary job as a taxi driver, he sticks to his eating habits and his treatment.

### ABOUT CAMILO

Camilo is a 50-year-old man living in the southern part of Mexico City. The neighbourhood is characterised by people from diverse socioeconomic conditions. Numerous tortilla stands, grocery shops, tiny clothing shops, pharmacies, etc can be found on the streets. Occasionally there is also a market offering a great variety of fresh fruits, meat, tacos, pizza and quesadillas.

Camilo was diagnosed with diabetes after an episode of exhaustion. The diagnosis did not come as a surprise to him as he had had experience with diabetes before. His mother passed away due to diabetes-related complications, and three of his brothers live with the condition. At first, his diagnosis caused him depression, feeling that diabetes implied many limitations.

*"Once you get diagnosed with diabetes, you don't have the same illusion of growing old. Your wishes fade away and life shortens."*

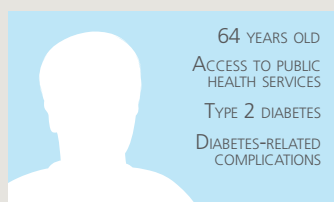
As a result, he delayed seeking medical support until he started experiencing a deterioration in his health. Also, realising that his seven-year-old son is dependent on him influenced his decision to seek care.

### CAMILLO AND DIABETES

Camilo acknowledges that without the support of the public healthcare system, he could not afford the medical consultations and medicines associated with his diabetes. He also holds his endocrinologist in high regard as she provided him with detailed information about diabetes-related complications. Avoiding these complications has served as motivation to foster a self-care routine.

For some years, Camilo has been trying to eat salt-free and avoid soft drinks and high-fat food, and instead eat more vegetables. He has realised that Mexican society *"eats to get full, not to get nutrients"*, and that the mission of diabetes is to *"announce that we're eating badly"*. He thinks that maybe diabetes should be understood as a painful way to rectify bad eating habits, so the next generations can adopt healthier lifestyles.

In Camilo's opinion, the public health sector does not adequately communicate the services provided at healthcare centres, nor does it have sufficient clinics to take care of the total population who have diabetes.



## MEET OTTO

### WHY IS THIS CASE INTERESTING?

The case is representative of male participants in the study because Otto is part of the group of interviewees with the greatest numerical presence (age 64–69). Receiving only a small pension, he must fulfil his traditional male role as provider for four people. His health and economic situation cause him considerable anxiety, and have led to persistent suicidal thoughts. Hypertension and complications from diabetes can worsen quickly given the precarious financial circumstances.

### ABOUT OTTO

Otto is a 64-year-old man who lives with his wife and children in the Álvaro Obregón area of Mexico City. His home is a single room in a building off an avenue with very heavy car traffic. There are grocery stores and food businesses on the street outside. Otto lives in a critical financial situation: all family support comes from just his monthly pension, which must cover his medical expenses, the basic needs of a family of four as well as provide for the education of his two sons.

Otto was diagnosed with diabetes 22 years ago, but at the time he did not care about the disease and *"kept a life of excess"*. When he noticed he was losing weight without trying, he made a medical appointment. For the past 15 years, he has been receiving regular medical treatment. His medical expenses, including medications, appointments, surgeries and hospitalisation expenditure, are covered through the Instituto Mexicano del Seguro Social (IMSS). However, the town where Otto lives is highly politicised, and he needs to belong to a political party to have access to various public services.

*"I feel like I'm not going to last much longer... I feel alone, even though I'm with my wife and children."*

### OTTO AND DIABETES

In common with many in Mexico, diabetes is seen here as a result of 'susto' – experiencing

emotions that can be described as shocking, such as fright, fear, joy and anger. Otto has been robbed several times, most of them at gunpoint, and he suffered an accident where he was in a bus that rolled over. According to him, one of these 'scares' caused his diabetes. He has requested help from several institutions, in the hope of receiving some kind of support, but with no success.

The main problems Otto faces regarding his health are foot complications due to diabetes, which prevent him from walking with ease and mean that he needs to use a walking frame or wheelchair to move. He has recently undergone an operation on his feet. His current medical condition means that he is confined to constant rest, as he is weak and exhausted. Poor surgery recovery could cause further health complications.

At his last medical check-up at the IMSS, staff members stole his walking frame, a situation that dealt a hard blow to his morale and finances. Otto's greatest worry is that he may be unable to help his family due to this physical and emotional state: *"I feel that I won't last long, I feel death. I already want God to take me, but then I think of my children and don't want them to be left alone; what will they do when I die?"*



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## DID YOU KNOW?

**96%** OF RESIDENTS  
LIVE WITHIN  
15 MINUTES' WALKING  
DISTANCE OF A RECREATIONAL  
GREEN AREA<sup>87</sup>

DISPARITIES IN AVERAGE  
LIFESPAN OF ALMOST  
**7** YEARS EXIST  
BETWEEN AREAS  
OF THE CITY<sup>87</sup>

COPENHAGEN WAS NAMED  
**GREEN** CAPITAL  
OF EUROPE  
IN 2014<sup>88</sup>

THE POPULATION OF  
COPENHAGEN INCREASES BY  
**1,000** PEOPLE EACH  
MONTH<sup>89</sup>

CYCLISTS IN COPENHAGEN  
COLLECTIVELY CYCLE  
**31x** AROUND  
THE WORLD  
EACH DAY<sup>90</sup>

COPENHAGEN HAS A  
POPULATION DENSITY OF  
**2,800** PEOPLE  
PER KM<sup>2</sup>,<sup>68</sup>

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# COPENHAGEN

## THE GREEN AND HEALTHY CAPITAL

COPENHAGEN IS RENOWNED AS AN ENVIRONMENTALLY FRIENDLY AND HEALTHY CITY. DESPITE UNIVERSAL ACCESS TO HEALTHCARE, THE CITY STILL FACES CHALLENGES, WITH A HIGH RISK OF TYPE 2 DIABETES AMONG CERTAIN VULNERABLE GROUPS.

Copenhagen is the capital of Denmark and the largest city in Scandinavia, with a population of over 580,000 people<sup>91</sup> living in the municipality of Copenhagen and 1.2 million residents in the greater Copenhagen area. Despite its relatively small size, Copenhagen is a growing region that serves as the cultural, economic and social centre of Denmark. Over the past 20 years, the city has experienced population growth just like many other cities in the world. In the municipality of Copenhagen, the total population increased by 23% between 1995 and 2015, and is expected to rise by a further 15% by 2025.<sup>91</sup>

Copenhagen is recognised as one of the most liveable and healthy cities of the world. Part of this is due to its city planning, where public spaces, public swimming pools, green areas and cycle paths are an integrated part of urban city planning.<sup>89</sup>

Copenhagen is renowned for its cycling culture. Since 2006, total car traffic in Copenhagen has decreased, whereas bike traffic has increased. Creating a city for bikes has been part of the public planning strategy for decades, and today there are more bikes than residents – 678,000 bikes to 580,000 people. Cycling is an integrated component of everyday life in Copenhagen, with four out of five households having access to a bike. In contrast, only one in three households owns a car. Each day, 63% of people living in the city cycle to work or school.<sup>90</sup>

### DIABETES CHALLENGE IN COPENHAGEN

In Copenhagen, the prevalence of diabetes is 5.1%.<sup>92\*</sup> With respect to the Rule of Halves, about one in four people with diabetes is unaware of their condition. Despite the fact that almost everybody diagnosed with diabetes receives care, about half do not achieve treatment targets (Figure 12).<sup>92</sup>

#### The economic upside of prevention

If action is not taken, the prevalence of diabetes in Copenhagen is projected to increase from 5.1% in 2015 to 6.7% by 2040.<sup>85</sup> This will result in the number of people with diabetes in Copenhagen increasing by almost 27,000 people to about 51,500 in 2040.<sup>85</sup> A significant driver behind the increase in prevalence will be the ageing population. However, almost 10% of this increase can be attributed to obesity (Figure 13).<sup>85</sup>

In Copenhagen, the prevalence of self-reported obesity among people over the age of 15 is 10%, and the prevalence of overweight is 26%.<sup>93</sup>

Diabetes-related costs are set to more than double by 2040.<sup>85</sup> The total cost related to diabetes is expected to reach almost 900 million US dollars in 2040 compared to 418 million dollars today (Figure 14).<sup>85</sup>

\* In Copenhagen, the 5.1% prevalence of diabetes includes both type 1 and type 2 diabetes.

FIGURE 12 RULE OF HALVES FOR COPENHAGEN

The Rule of Halves for Copenhagen is based on existing published research and covers type 1 and type 2 diabetes among adults over the age of 16.<sup>92</sup>

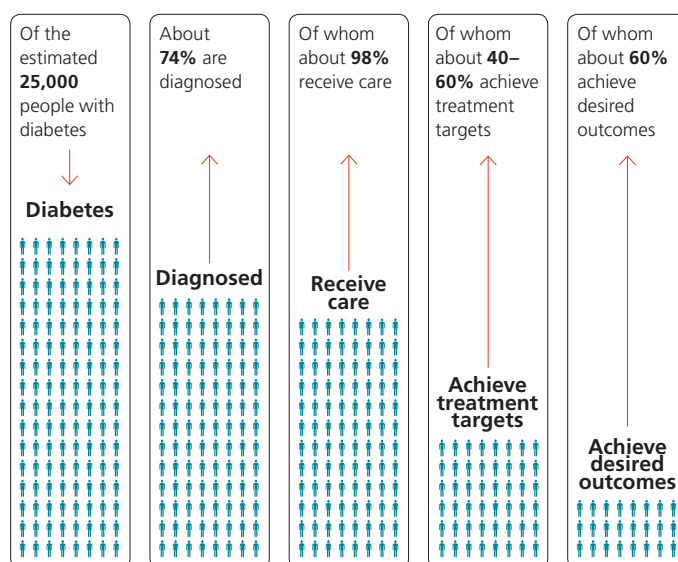


FIGURE 13 DOMINATING EFFECT OF AGEING AND OBESITY

Type 2 diabetes prevalence could reach 6.7% by 2040, with ageing and obesity accounting for a significant percentage.<sup>85</sup>

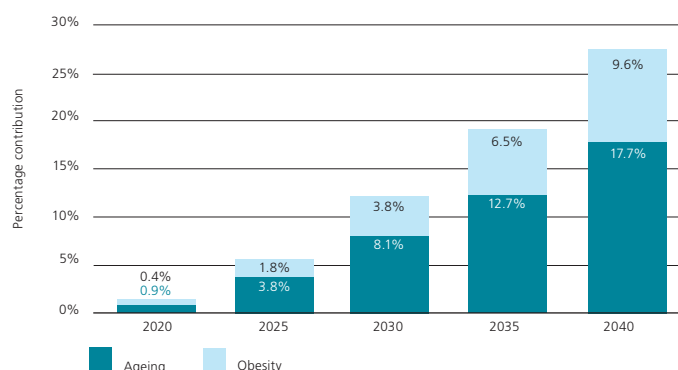
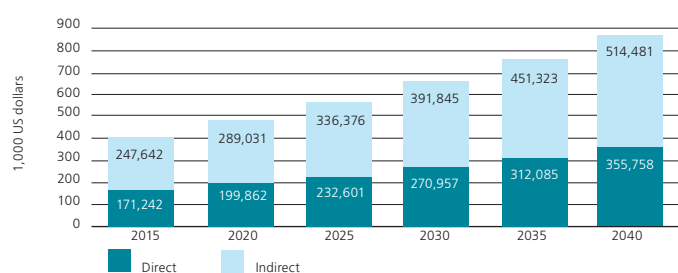


FIGURE 14 HIGH COST OF INACTION

Diabetes-related costs are projected to double between 2015 and 2040.<sup>85</sup>



NOTE: Direct costs are those that result from outpatient and inpatient health services (including surgery), laboratory and radiological tests, and drug therapy. Indirect costs are identified as "resources foregone as a result of a health condition".

For further explanations about the projections, see page 63.

# UNDERSTANDING INEQUALITY IN HEALTH

THERE ARE MAJOR SOCIOECONOMIC DIFFERENCES IN THE PREVALENCE OF RISK FACTORS AND IN THE PREVALENCE OF DIABETES IN COPENHAGEN.

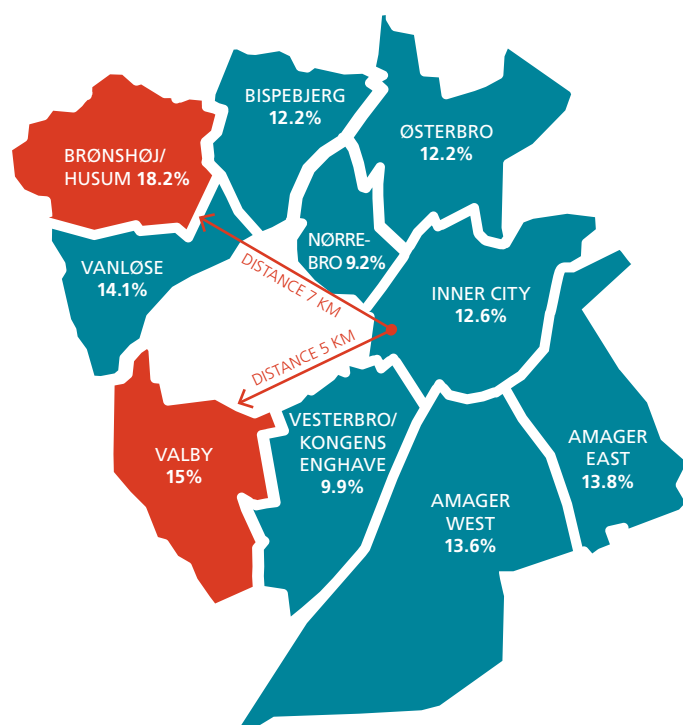
In Copenhagen, the research has focused on addressing inequality in health. Denmark is based on a welfare state model, and the underlying principle is that all citizens have equal rights to social security. Within the Danish healthcare system, health coverage is universal and compulsory, as all residents of Denmark are entitled to healthcare that is largely free at the point of use. The Danish welfare model is subsidised by the State and, as a result, Denmark has one of the highest taxation levels in the world. With relatively small economic inequalities, one would expect small inequalities in wealth to translate into small inequalities in health, including the occurrence of diabetes.

However, despite the relatively low prevalence of diabetes of 5.1% in Copenhagen, the research reveals that 10–20% of the population is at high risk of developing type 2 diabetes.<sup>92</sup>

The risk of developing type 2 diabetes is especially elevated in two districts of Copenhagen compared to the more affluent inner city area, despite the close proximity of only 7 km (Figure 15).<sup>92</sup>

**FIGURE 15 ELEVATED TYPE 2 DIABETES RISK IN TWO CITY DISTRICTS DESPITE RELATIVE PROXIMITY<sup>92</sup>**

Percentage of individuals at high risk of developing type 2 diabetes across districts in Copenhagen.

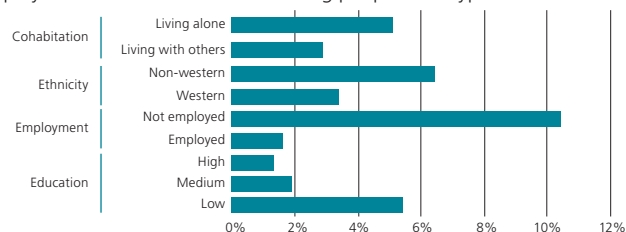


## VULNERABLE SOCIOECONOMIC GROUPS

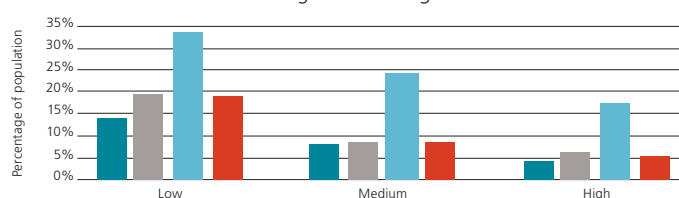
Existing research reveals that there are major socioeconomic differences in the prevalence of type 2 diabetes and the risk of developing it. Citizens with low levels of education have twice the prevalence of high-risk scores and diabetes compared to citizens with higher levels of education, the rate of high-risk scores and diabetes among citizens not employed is significantly higher than that among employed citizens of the same age, and populations with a non-western background have twice the prevalence of diabetes compared to populations with a western background (Figures 16–18).<sup>92</sup>

**FIGURE 16 PREVALENCE OF SELF-REPORTED TYPE 2 DIABETES ACROSS SOCIOECONOMIC FACTORS<sup>92</sup>**

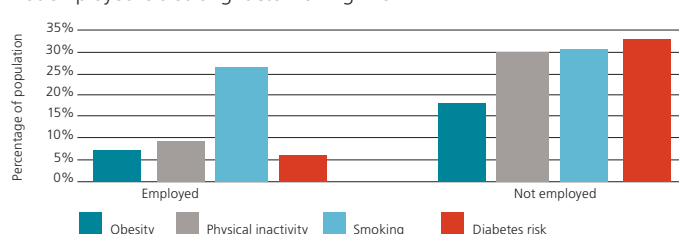
Unemployment is a common factor among people with type 2 diabetes.



**FIGURE 17 RISK PROFILES – LEVEL OF EDUCATION<sup>92</sup>**  
Low-level of education is a strong factor for high risk.



**FIGURE 18 RISK PROFILE – EMPLOYMENT STATUS<sup>92</sup>**  
Not employed is a strong factor for high risk.





# UNDERSTANDING THE COMPLEXITY OF INEQUALITY AND VULNERABILITY

DIABETES IS NOT THE BIGGEST CONCERN IN AN EVERYDAY LIFE WHERE OTHER SOCIAL AND HEALTH ISSUES ARE MORE PREDOMINANT.

The vulnerability assessment reveals new knowledge about why some people are vulnerable to developing type 2 diabetes and its complications, despite equal access to healthcare, preventive services and healthy initiatives in the community.

## KEY INSIGHTS INTO VULNERABILITY IN COPENHAGEN

Various insights into vulnerability among people at risk of developing type 2 diabetes and people with a diagnosis emerged from the research, the most important of which are highlighted below.

### HIERARCHY OF EVERYDAY ISSUES

Vulnerability in Copenhagen is closely associated with the Danish term 'manglende overskud', which translates as lack of energy. Several issues in everyday life impact on people's ability to focus on their health, influencing their vulnerability to developing diabetes and diabetes-related complications. Other social and health issues, such as comorbidities, unemployment, financial difficulties, major life events and loneliness, often influence people's daily decisions, leaving no energy to care for their health or even their diabetes. Social and health issues are interlinked, and diabetes is not the highest in the hierarchy of everyday issues.

*"I tell myself every day that I should go to the gym, but I haven't accomplished that yet. When I've solved some of my issues, I hope I'll have the energy ('overskud') to go there."*

Female at risk of type 2 diabetes, 61

The research indicates that people at risk of developing type 2 diabetes do not perceive diabetes as a severe health risk compared to other diseases. Some perceive diabetes as a 'healthy disease' due to the likelihood of being independent of medication if the condition is managed well.

*"But of course you're at risk, and I'd say that diabetes isn't the worst disease you can get, it might even be the least; but no, it isn't something I think about."*

Male at risk of type 2 diabetes, 57

### SUFFICIENT KNOWLEDGE

Lack of information and knowledge are often cited as key barriers to people taking action in relation to diabetes. However, findings from participants in Copenhagen challenge the notion that lack of knowledge is a barrier to preventing diabetes and its complications. Insights from the research indicate that people are aware of diabetes risk factors and diabetes-related complications, and that they have sufficient knowledge.

*"I'm perfectly aware of what is healthy and what isn't and I know what I'm supposed to do, but from my perspective there are cliffs between knowledge and action."*

Female with type 2 diabetes, 50

In addition, the majority of participants are unaware of the prevention services available through the healthcare system. Based on the research, people face different challenges in relation to leveraging the healthcare system.

Often, to access healthcare services in Denmark, people require a referral from a general practitioner (GP). The fact that GPs serve as gatekeepers to information and services can act as a barrier to people accessing preventive services such as community health centres (CHC). The inconvenience of the procedure of requesting a referral means that many people miss out on the benefits of available services.

*"It's not a question about the referral. I just have to call my doctor and let him know that I need one. They're starting up a new course now which I could take part in. I need it. But then there are things in your everyday and you just don't get it done. I want to."*

Female with type 2 diabetes, 60

### LIVING ALONE AND SOCIAL SUPPORT

Having a family is of great importance. People value regular interaction with their family members as well as the feeling of being loved and of importance. In the face of difficulties, relatives and friends provide a support structure that people see as being essential to their wellbeing. In the absence of social support, people can experience difficulties with basic everyday tasks such as getting out of bed in the morning or preparing a home-cooked meal.

Living alone was also an indicator of vulnerability in the research, with a number of participants experiencing difficulties with being on their own. Living alone can influence the participants' ability to take care of their own health. In general, many of the participants find it unsatisfying to eat alone and, consequently, they do not bother preparing a proper meal. Instead they end up choosing easy solutions such as bread, frozen products or takeaways.

*"I like cooking and things like that, but when you're sitting looking at the dinner that you're about to eat, you somehow lose your appetite when you're alone."*

Male at risk of type 2 diabetes, 37

Participants also seem to be more motivated to participate in social activities, physical exercise classes or attending the gym when they have someone to join them.

### BOX ABOUT THE RESEARCH

The research was performed by the University of Copenhagen, Department of Public Health, and Steno Diabetes Center.

#### Quantitative research

The Rule of Halves research was conducted based on existing quantitative data from registries and surveys. Findings were used to identify locations and define profiles as a basis for the qualitative research. Two 'high-risk' locations were defined through the quantitative research.

#### Qualitative research

The two 'high-risk' locations Brønshøj/Husum and Valby served as a basis for recruiting participants for the qualitative vulnerability assessment. People at increased risk of developing type 2 diabetes or with existing diabetes were identified. All participants matched at least two of the following factors: male gender, over 45 years of age, short education, unemployed, BMI >30, non-western background and cohabitation status (living alone). In total, 24 citizens at risk and 26 people with type 2 diabetes were interviewed by trained fieldworkers in their homes.



Picture: Compliments of [www.copenhagenmediacenter.com](http://www.copenhagenmediacenter.com)

## A FIELDWORKER'S TAKE ON THE VULNERABILITY ASSESSMENT



**ASSOCIATE PROF ULLA CHRISTENSEN**  
DEPARTMENT OF PUBLIC HEALTH,  
UNIVERSITY OF COPENHAGEN,  
LOCAL ACADEMIC PARTNER  
FOR THE COPENHAGEN CITIES  
CHANGING DIABETES RESEARCH

*"We experienced significant difficulties in establishing contact with the most vulnerable diabetes patients and citizens at risk of developing diabetes. As a result, we established a new network of contacts consisting of employees from local social initiatives and organisations in the vulnerable areas of Valby and Brønshøj/Husum. They invited us to attend local social activities and thereby we were able to recruit several relevant informants. However, we still believe that some citizens and patients are even more vulnerable than the ones we've been able to establish contact with."*

*"Despite the results of the quantitative research, we didn't find that the participants with a non-western background were 'worse off' compared to the informants of Danish origin. In fact, many of our informants with a non-western background seemed focused on leading a healthy lifestyle and were good at utilising the social initiatives set up for them in the local communities."*

## THREE CASES FROM COPENHAGEN

Three abbreviated cases that exemplify some of the key insights into vulnerability to developing type 2 diabetes and vulnerabilities associated with living with type 2 diabetes in Copenhagen are presented below. The name given to each case is fictitious in the interest of anonymity.



### MEET SANNE

#### WHY IS THIS CASE INTERESTING?

This case demonstrates how multiple diseases can have enormous implications for self-management of diabetes. It also highlights how comorbidities can isolate a person in their home.

#### ABOUT SANNE

Sanne is 60 years old and lives on her own in an apartment in the district of Valby.

She was diagnosed with type 2 diabetes in 2005 and, as a result of her diabetes, she has developed inflammation of the nerves in her feet. Despite this, she says that: *"Diabetes doesn't take up much thought in my everyday life. What matters the most is the pain caused by my other conditions."* Besides type 2 diabetes, Sanne suffers from bone marrow cancer (multiple myeloma), which causes her intense pain every day. Consequently, she stays alone at home most of the day due to her conditions.

When Sanne was first diagnosed with type 2 diabetes, she did not take proper care of herself and her diabetes. Now she feels that she must live with the consequences. As she puts it: *"I'm well aware that if my leg needs to be chopped off one day, then it's probably my own fault, right? It isn't something that worries me – just a part of my life."*

Her other diseases prevent her from exercising, and she does not have any energy to cook proper meals for herself. She often tends

to go for easily prepared and less nutritious meals, such as bread with cold cuts or ready-made meals from the supermarket. On days when she is feeling particularly ill, she orders takeaways, although she says: *"I'm not the type who loves to go out and eat unhealthy stuff, but on days when I feel very ill, I have to order food from outside. That's when my weight goes up – because of all that deep-fried stuff."*

Apart from health professionals, Sanne does not see many people during the day. Her friends and her sister visit her a couple of times a year. When her friends are visiting, they do the cooking and they take into account that she has diabetes.

#### SANNE AND RISK OF DIABETES COMPLICATIONS

Sanne is aware of her risk of developing serious diabetes complications. Because of her cancer, which causes her pain, she does not have the energy to focus on her diabetes. This makes her extremely vulnerable to getting serious fluctuations in blood sugar and complications.





## MEET MICHAEL

### WHY IS THIS CASE INTERESTING?

This case shows that being aware of one's risk does not necessarily translate into leading a healthy lifestyle. Issues in everyday life, such as unemployment, may have a greater influence on one's mental and physical ability to make healthy choices.

### ABOUT MICHAEL

Michael is a 51-year-old unemployed man who lives together with his 39-year-old girlfriend, Anna, in a small house in Tingbjerg in the district of Brønshøj/Husum.

They are both overweight, and Michael is aware of his risk of developing diabetes, especially after Anne was diagnosed with type 2 diabetes a few months ago. He believes that the diagnosis will have a positive and healthy effect on them, as they now have a reason to make healthier choices.

However, on a daily basis he does not give it a lot of thought. Being unemployed and a job-seeker takes up a lot of his time and energy in his everyday life. Sometimes being unemployed gets too much for him. When this happens, Michael's motivation with regard to eating healthier weakens, and he ends up using food as a comfort: *"If you're having an emotional downturn because you have difficulties finding a job, then somehow you eat more compulsively and maybe you eat more than what's good for you."*

He also believes that diabetes is 'the healthiest disease' because you can become independent of insulin if you manage your diabetes well:

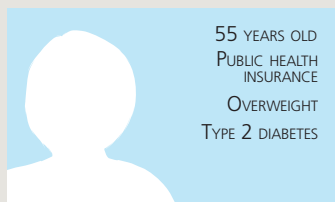
*"It's the healthiest disease because if you lose weight, the disease will disappear."*

Both Michael and Anna would like to lose weight by participating in physical exercise activities, but membership fees for the gym are expensive. Some local exercise facilities are free of charge, including an exercise class for women only. Both Anna and Michael prefer activities where they are able to participate together or with someone they know well to help keep them motivated.

*"If we were to participate in an organised activity, then we would have to participate together [...]. The motivation is lacking when you have to go alone."*

### MICHAEL AND DIABETES RISK

Being overweight makes Michael feel at risk of developing diabetes. However, he does not give it any thought during his everyday life, as thinking about it makes it unbearable on top of all his other issues.



## MEET KAREN

### WHY IS THIS CASE INTERESTING?

This case shows the importance of support from family and friends, and how living alone can influence self-management of type 2 diabetes.

### ABOUT KAREN

Karen is a 55-year-old woman who lives alone in the Tingbjerg and has two grown-up children.

Karen was diagnosed with type 2 diabetes one year ago, but it has not made a great impact on her everyday life as she does not experience any physical signs of her condition. For this reason, Karen has difficulty accepting her diagnosis.

In the past five years, she has lost several close family members, and when the feeling of loss takes over, it becomes a challenge for Karen to manage her diabetes. *"I think about what I'm supposed to eat and what I should avoid, and then sometimes it just doesn't matter when I'm sitting alone and thinking about life,"* she says.

Karen's GP wants her to lose weight, and Karen knows which lifestyle changes she has to make, but she has difficulty transforming her knowledge into action. As she puts it: *"I hear the same story every time: 'Mind your diet, mind your diet', and then I say: ... of course I know what I'm supposed to eat and what I'm not allowed to eat, right?"*

She does not enjoy cooking and eating alone. Consequently, she does not cook hot meals for herself at home. Instead, she eats bread with butter and cheese every day because it is easy to prepare. She associates this kind of meal with quality of life. She is therefore not willing to sacrifice this by eating something healthier. *"You have to feel alive,"* she says. Her two

grown-up sons are very aware of their mother's monotonous diet and invite her over for supper at least once a week to make sure that she eats a cooked meal. They also call her daily to ensure that she is alright and not engrossed in depressive thoughts.

A few years ago, she was injured in a traffic accident and still struggles to walk as a result. Currently, Karen is participating in a free 12-week diabetes-exercise course offered by the local community health centre. She enjoys this because she has the opportunity to exercise with other people similar to herself, either with physical limitations or large body size. She previously tried to attend a local gym, but she never felt comfortable there among the slim young fitness users and their condescending stares. *"I wanted to do some exercise, but I didn't like going to the gym because I was overweight. I have tried – but people stare as if there's something wrong with you."*

Karen is worried about becoming inactive again when the 12-week course ends, as she knows that she will most likely not continue the exercises at home on her own.

### KAREN AND DIABETES

Karen knows that her unhealthy lifestyle has consequences and that it is one of the reasons why she has diabetes, but making drastic lifestyle changes is just too difficult for her right now. Transforming knowledge into action is difficult for her.



An aerial photograph of the Houston skyline, showing a dense cluster of skyscrapers in the center, surrounded by a vast urban area with lower-rise buildings and parking lots. A large, white, billowing cloud formation drifts across the middle of the image, partially obscuring the city below.

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## DID YOU KNOW?

ONLY  
**1%** OF HOUSTON'S  
WORKFORCE  
WALKS TO WORK<sup>94</sup>

MORE THAN  
**90** DIFFERENT  
LANGUAGES  
ARE SPOKEN IN THE  
HOUSTON AREA<sup>95</sup>

HOUSTON HAS MORE  
**PARKLAND**  
THAN ANY OTHER CITY IN THE  
US<sup>95</sup>

HOUSTONIANS  
**EAT OUT**  
MORE OFTEN THAN RESIDENTS  
OF ANY OTHER CITY IN THE US<sup>96</sup>

HOUSTON HAS A  
**VERY LOW**  
POPULATION DENSITY  
AT 1,200 PEOPLE PER KM<sup>2</sup>,  
THIS IS FIVE TIMES LESS THAN  
SHANGHAI<sup>68</sup>

NEW YORK CITY, SAN  
FRANCISCO AND BOSTON  
**COULD FIT**  
INTO THE TOTAL AREA OF  
HOUSTON<sup>95</sup>

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# HOUSTON

## THE FASTEST-GROWING CITY IN THE US

AS HOUSTON'S POPULATION GROWS, SO TOO WILL THE BURDEN ON THE HEALTHCARE SYSTEM AND WITH IT THE NEED TO PREVENT DISEASES SUCH AS TYPE 2 DIABETES.

Houston is the fifth-largest metropolitan area in the United States with a population of more than 5.5 million people,<sup>97</sup> and is accredited with being the fastest-growing city in the US.<sup>98</sup>

Over the past four years, the Houston metropolitan area has undergone a boom, growing by half a million people – half from moves and the other half from births.<sup>98</sup> Today, more than 100 ethnic groups shape the population, which makes it one of the most ethnically diverse populations in the US. Since 2010, population growth has been mirrored by developers, adding an additional 30,000 apartment units and some 70 new office buildings with a combined area equivalent to more than 1,000 American football fields.<sup>99</sup> Houston is considered to be the most sprawling city in the US, spreading outwards as opposed to upwards as no physical impediments like rivers, lakes and mountains limit its expansion.

The spectacular growth that Houston has experienced, especially over the last four decades, is a result of construction of transportation systems and the fortuitous nearby location of useful natural resources.

Houston is a car-centric city. Every day, over half a million people, one-fifth of the workers living in the Houston metropolitan area, commute to a county other than the one they live in. Of these commuters, 85% drive alone, 11% carpool and 3% utilise public transportation.<sup>99</sup> On a city level, Houston experiences a substantial influx of daily workers. The city's daytime population grows by a third due to workers commuting into the city.<sup>99</sup>

### DIABETES CHALLENGE IN HOUSTON

The prevalence of type 2 diabetes is 9.1% in Houston. According to the Rule of Halves for Houston (Figure 19), about one in four people with diabetes is undiagnosed. Of those who are diagnosed, 78% receive treatment, of whom one in 10 does not achieve treatment targets.<sup>85</sup>

#### The economic upside of prevention

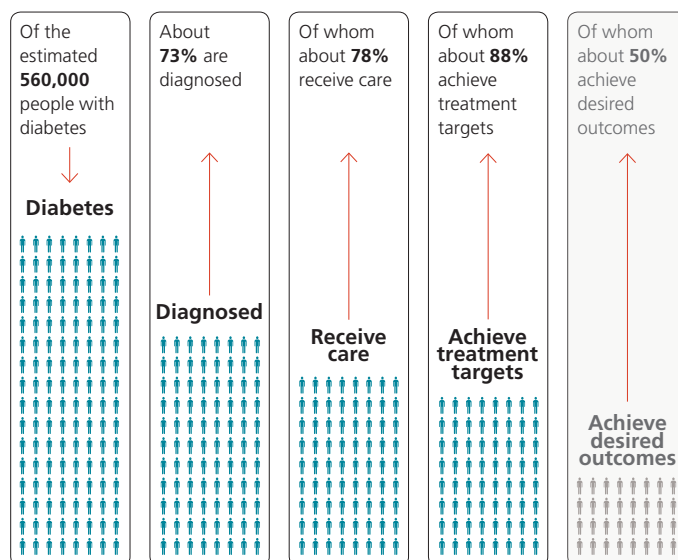
If action is not taken, the prevalence of type 2 diabetes in Houston is projected to grow to more than 1.1 million people by 2040.<sup>85</sup> This is almost a threefold increase in the number of people with diabetes and an increase in prevalence to 19%.<sup>85</sup>

Obesity and age are the primary drivers of growth in the prevalence of type 2 diabetes (Figure 20). Obesity is a significant public health issue in Houston, with 32% of adults self-reported as obese,<sup>60</sup> and is expected to add an estimated 118,000 cases of type 2 diabetes by 2040 above the baseline.<sup>85</sup>

Based on the projections of diabetes prevalence, diabetes-related costs are expected to double by 2040 (Figure 21). Total costs related to diabetes are expected to grow from 4.1 billion US dollars in 2015 to 11.4 billion dollars by 2040.<sup>85</sup> Reducing the growth rate of obesity from 1.6%<sup>60</sup> to 0.8% would result in annual diabetes-related savings of 600 million dollars by 2040, and the total savings between 2015 and 2040 would amount to 5.3 billion dollars.<sup>85</sup>

**FIGURE 19 RULE OF HALVES FOR HOUSTON**

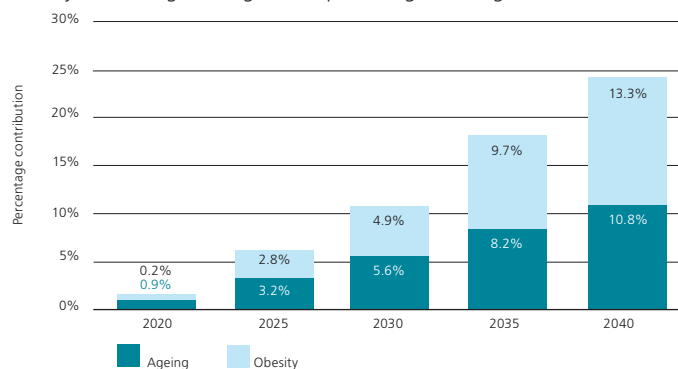
The Rule of Halves for Houston is based on existing published research and covers type 2 diabetes among adults over the age of 20.<sup>85</sup>



NOTE: The last pillar is estimated based on the general Rule of Halves due to lack of data.

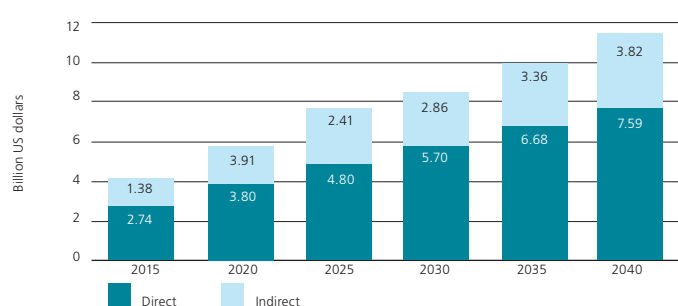
**FIGURE 20 DOMINATING EFFECT OF AGEING AND OBESITY**

Type 2 diabetes prevalence could reach almost 20% by 2040, with obesity accounting for a significant percentage of this growth.<sup>85</sup>



**FIGURE 21 HIGH COST OF INACTION**

Diabetes-related costs are projected to almost triple between 2015 and 2040.<sup>85</sup>



NOTE: Direct costs are those that result from outpatient and inpatient health services (including surgery), laboratory and radiological tests, and drug therapy. Indirect costs are identified as "resources foregone as a result of a health condition".

For further explanations about the projections, see page 63.

# PIECING TOGETHER THE PREVENTION PUZZLE

THERE IS A DIFFERENCE BETWEEN BEING DISADVANTAGED AND BEING VULNERABLE.

In Houston, the research has focused on exploring vulnerability among people at increased risk of developing type 2 diabetes. The findings challenge the notion of disadvantage being equal to vulnerability and enable rethinking of who is vulnerable to developing type 2 diabetes. New knowledge about vulnerable profiles and locations has also been identified.

## NEW KNOWLEDGE ABOUT VULNERABLE GROUPS

The quantitative analysis (Box) reveals **three distinct profiles** (Table 1) that appear to be predictive of those who are most vulnerable to developing type 2 diabetes. These profiles reveal vulnerabilities ranging from access to health insurance and public programmes to difficulty buying food. Of particular interest is that the profiles make it clear that being disadvantaged does not necessarily equate to being vulnerable.

*“This [Profile 1] is not a common profile that we associate with disadvantages or a target for public health community-based interventions – normally.”*

Prof Stephen Linder, School of Public Health, University of Texas.  
Local academic lead for the Houston Cities Changing Diabetes research.

## NEW KNOWLEDGE ABOUT VULNERABLE LOCATIONS

**Three neighbourhoods** with the highest concentration of residents fitting each of the vulnerability profiles were identified (Figure 22).<sup>60,85</sup> Two of these locations, Greater Heights and Atascocita/Lake Houston, have not previously been targets for health interventions.

The data from the research could eventually enable the development of an urban health map that assigns diabetes risk to specific zip codes and neighbourhoods. This will enable city health officials and local community organisations to better coordinate and target scarce community-based resources more efficiently to lower diabetes incidence and improve treatment.

### BOX ABOUT THE RESEARCH

The research was performed by the University of Texas, School of Public Health.

#### Quantitative research

Cluster research of existing characteristics of people with diagnosed type 2 diabetes made it possible to identify and geographically locate people who are vulnerable to developing type 2 diabetes.

#### Qualitative research

The three locations served as a basis for recruiting participants for the qualitative vulnerability assessment, which was based on 125 individual interviews performed by trained fieldworkers in people's homes. Results qualify the findings from the quantitative research and provide insights into the characteristics of people who are vulnerable to developing type 2 diabetes and the associated social risk factors and cultural determinants.



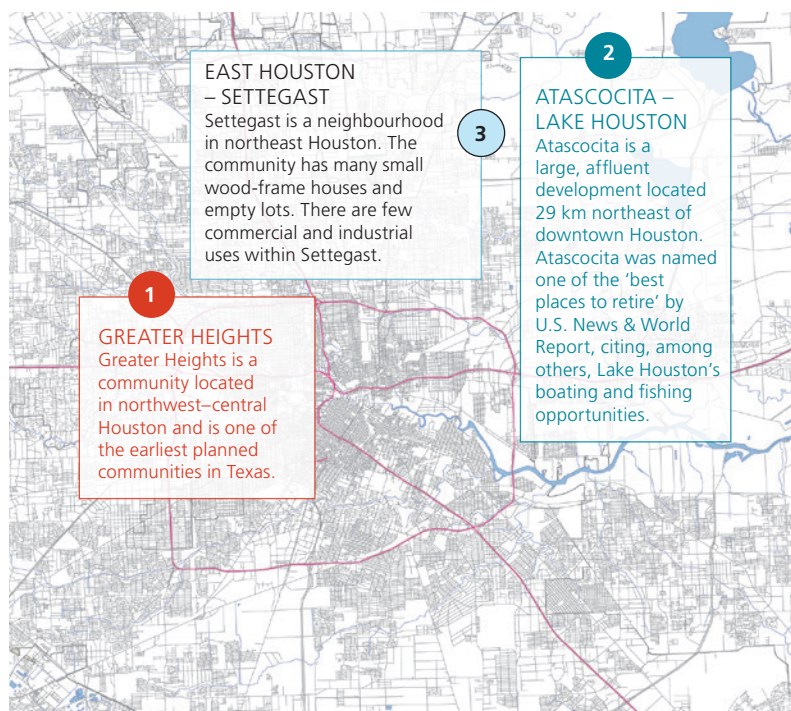
TABLE 1 THREE DISTINCT VULNERABILITY PROFILES<sup>60,85</sup>

| # | INDICATOR                       | PROFILE 1 | PROFILE 2 | PROFILE 3 |
|---|---------------------------------|-----------|-----------|-----------|
| 1 | Health insurance                | Private   | Public    | Private   |
| 2 | Age (years)                     | 55–64     | 65+       | 55–64     |
| 3 | Public programmes               | None      | None      | 1+        |
| 4 | Employment                      | Yes       | No        | No        |
| 5 | Fed. Poverty Level <sup>A</sup> | 400%+     | 200–399%  | <100%     |
| 6 | Difficulty buying food          | Never     | Never     | Some      |
| 7 | Days poor health                | 0 days    | 0 days    | 8+ days   |
| 8 | Race/ethnicity <sup>B</sup>     | White NH  | White NH  | Black NH  |

A. The Federal Poverty Level is a measure of income issued annually by the US Department of Health and Human Services and used to determine eligibility for certain programmes and benefits.

B. Race/ethnicity: White NH = White non-Hispanic, Black NH = Black non-Hispanic

FIGURE 22 THREE DISTINCT VULNERABLE LOCATIONS<sup>60,85</sup>





# UNDERSTANDING THE COMPLEXITY OF VULNERABILITY

SOME PEOPLE ARE DISADVANTAGED BUT NOT VULNERABLE, OTHERS ARE NOT PARTICULARLY DISADVANTAGED BUT STILL VULNERABLE.

The vulnerability assessment reveals new knowledge about why some people – disadvantaged or non-disadvantaged – are vulnerable to developing type 2 diabetes by exploring some of the social and cultural factors behind vulnerability in Houston.

## KEY INSIGHTS INTO VULNERABILITY IN HOUSTON

Various insights into vulnerability to developing type 2 diabetes have emerged from the research, the most important of which are highlighted below.

### CHANGE AND TRANSITION

Perceived changes and transitions at societal and/or community level as well as individual level lead to uncertainties and a sense of instability. Expanding cities such as Houston are, by definition, in flux and often unstable, which can easily exaggerate existing social stressors: for example, existing services change, move or are shut down, with concrete consequences for those relying on them.

Change and transition in Houston are experienced both practically (eg where a new influx of people crowds a neighbourhood), and psychologically (eg where that influx causes distress in residing individuals). Furthermore, the changing faces of neighbourhoods and society concern many, though some felt that “things were improving”.

*“The more the community has grown, the more it has gotten disconnected. When I was a kid, you knew everybody.”*

Female at risk of type 2 diabetes, 60, Atascocita

### NOURISHING TRADITIONS

In Houston, the notion of food as a ‘nourishing tradition’ has a profound impact on the way food is perceived and what certain meals and dishes mean for community coherence. Heritage is strongly interwoven with food in Houston, and traditional foods carry meaning beyond nutrition and diet. For many participants, food and food-related rituals constitute an essential social connector that relates people to a common identity. These foods and related rituals are also perceived as ‘comfort’ food.

Therefore, cooking and offering these foods creates a sense of community and connectivity, and providing this kind of food becomes a way of caring for oneself, others and a common culture or heritage.

However, because these foods and beverages are seen as part of a cultural identity that cannot and should not be changed, there is also a common justification among participants that following certain habits, whether healthy or not, is warranted.

*“You’re asking a Southern girl [what kind of tea she drinks]? There is no other kind. Sweet tea!”*

Female at risk of type 2 diabetes, 50, Atascocita



### PEER APPEARANCE

The comparison of ‘self’ and ‘other’ is a fundamental way in which people make sense of their immediate social environment. As a result, normative body images shift in settings where body size increases or decreases in a significant proportion of a group of people.

But in scenarios where body weight across a group changes noticeably, the classification of self as ‘not as bad’, ‘healthier than’, ‘fitter than’, etc can have a detrimental effect on weight perception and management. When the normative body images change, so do the perceptions of what a ‘healthy body’ might look like. Many Houston participants make references to the bodies of others as ‘big’ (just like their own), or ‘even bigger’ (where they feel noticeably slimmer than peers). As is the case with ‘nourishing traditions’, the relative notion of self in relation to peer appearance serves as justification for and validation of the status quo in Houston.

*“I see some of these people come in the store and I just cringe and think, oh, you’re skinny compared to these people.”*

Female at risk of type 2 diabetes, 63, Greater Heights

### TIME-POOR

The concept of ‘time poverty’ is highly relevant in a city such as Houston, where long working hours combine with long commutes and living in neighbourhoods where basic amenities are not readily accessible.

Time poverty fundamentally impacts the way people live their lives. It impacts social relations, neighbourliness, healthy living strategies, etc and it is embedded into everyday life and practices: the way people work, live and eat. It is a kind of cultural time poverty. Among some of the participants, a longing for more social activities and social interactions in the community is interlinked with the notion of cultural time poverty.

Being time-poor means having to carefully manage free time, and often requires ‘trade-offs’ in order to complete everyday tasks. Thus, a hierarchy of demand (or need) is created, into which work, daily chores, management and, ultimately, leisure activities are organised. In order to create a situation in which diabetes and other chronic conditions can be successfully prevented, sufficient time and energy must be allocated to healthier living, and this should be reinforced beyond the individual at organisational and institutional levels.

*“The day can be so hectic [...], then you have children [...]. And we just cook these nachos so we can go to bed because it’s getting late.”*

Male at risk of type 2 diabetes, 48, Greater Heights



## A FIELDWORKER'S TAKE ON THE VULNERABILITY ASSESSMENT



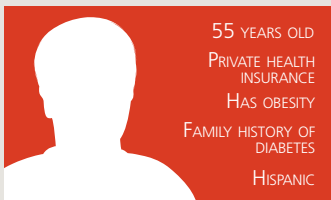
ETHAN MCGAFFEY, ANTHROPOLOGIST  
FIELDWORKER, HOUSTON

*"The unique stories from individuals who are obviously vulnerable and living in poverty can be so painful and impactful that they gloss the quieter vulnerability of being at increased risk of developing diabetes – even though these individuals are financially secure. I found the high rates of comorbidity among many respondents, regardless of income level, especially striking."*

*"My hopes for this programme are really – from an individual perspective – to get that broad understanding of the cultural components of diabetes: what influences diabetes, and how is diabetes perceived, how is health perceived, and how are unhealthy and illness perceived."*

## THREE CASES FROM HOUSTON

Three abbreviated cases that exemplify some of the key insights into vulnerability to developing type 2 diabetes in Houston are presented below. The name given to each case is fictitious in the interest of anonymity.



### MEET CARLOS

#### WHY IS THIS CASE INTERESTING?

This case gives an example of a participant who, though apparently healthy, has a high risk of developing a range of chronic conditions such as type 2 diabetes. In the absence of diagnosed diabetes risk factors (other than obesity), he might easily slip through the net of standard diabetes screening protocols.

#### ABOUT CARLOS

Carlos is a 55-year-old IT network engineer who lives in Houston together with his wife. He has worked for the same company for the past 16 years and regularly works over 40 hours a week. Each day, Carlos commutes to work and travels mostly by car.

He feels that his health is very much linked to his being severely overweight and thinks there is a problem with his metabolism because he cannot otherwise explain his weight problem.

In general, Carlos feels that he eats healthily. Typical meals in Carlos's household will consist of pasta with rice and *"a meat which would be either chicken or beef, and bread, and some kind of vegetable, either you know, something green. It'll either be a salad or green peas, green beans, something like that"*. At home, they mainly drink soda as he finds the tap water is 'yellow at times' and he believes the water is potentially unsafe to drink.

Currently, Carlos has no ongoing diagnosed health concerns. To him, being healthy means being the right body weight, eating correctly, getting exercise and going to the doctor for regular check-ups. The latter two pose a problem for him.

After work he is usually too tired to exercise:

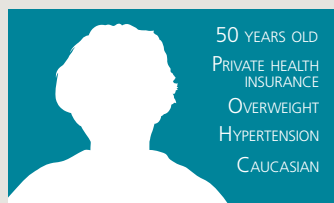
*"I think a lot of the issue is, I think, that by the time I get done with work, I really don't want to exercise. I'm really at – I'm just tired."* Carlos also tends to put the wellbeing of other members of his family first. He says that he is not focusing on his own health needs, which, as he puts it, *"may be a macho thing [...] I don't get sick, you know"*.

#### CARLOS AND DIABETES RISK

Diabetes is an important topic in Carlos's household since his cousin passed away three years ago from diabetes complications. Importantly, Carlos might very well go on to develop diabetes because of a combination of biological risk factors (BMI, family history) and social and cultural factors (such as nourishing traditions).

Also, he does not realise how much at risk he actually is: he thinks diabetes affects mostly *"poor people"* whereas his family is doing well financially. Added to this, various social and cultural factors impact his ability to live a healthier life. All these combine to make him very vulnerable to developing diabetes.





## MEET EVE

### WHY IS THIS CASE INTERESTING?

This case is interesting as it gives an example of a participant clearly at high risk of developing type 2 diabetes who does not fall into the typical target population for intervention and who shows that fundamental knowledge and access to resources alone do not translate into diabetes risk awareness, behavioural change and good health outcomes.

### ABOUT EVE

Eve is a 50-year-old married teacher from a quiet, middle-class residential neighbourhood in Atascotica, Houston, where she and her family have lived for the past 20 years. It is a 'tight-knit' community, where residents know each other very well and a lot of the social activities are centred around the community of the local Baptist church, where she is an active member.

There are no grocery stores nearby, only a couple of fast-food restaurants, a couple of nicer restaurants and some gas stations.

Eve loves to entertain, and especially in the summer months she and her husband will have friends over for a meal *"at least once or twice a week"*. Eve enjoys cooking and would like to have people over more regularly, but *"everybody out here is really, really busy"*.

When she cooks for her family during a typical busy week, she focuses on convenience and ease. Typically, a meal will consist of *"some sort of meat, some kind of starch, and one or two vegetables"* and the main drink is homemade tea. Eve is aware that what she eats can affect her health. Her father had high blood pressure and she has been diagnosed with prehypertension. However, she also feels very strongly about being able to make her own

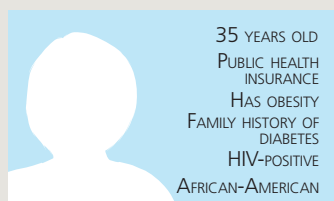
decisions regarding diet, which has, in part, spurred her to run two miles a day.

It is clear that Eve is quite knowledgeable about health yet, in principle, not risk-aware. She is, for example, not aware of the fact that her BMI approaches the category of obesity: *"I don't know where they come up with those numbers, but according to the charts, I'm overweight."*

To her, the fact that she can regularly run signifies that she is healthy: *"I typically run 2 miles a day. I can't say my diet is the healthiest. I do have a passion for co-Southern comfort foods and I probably drink a little too much alcohol. But other than that, yeah, I'm healthy."*

### EVE AND DIABETES RISK

Eve feels that she could be at risk of diabetes if she led a sedentary lifestyle, but diabetes does not pose a significant threat to her: *"When you think of someone dying early, you think of them dying from cancer, heart disease, you know, strokes. You're, you're not really thinking about diabetes."* This makes her, in combination with several significant biological risk factors, surprisingly vulnerable to developing diabetes.



## MEET JACLYN

### WHY IS THIS CASE INTERESTING?

This case represents a participant who is vulnerable to developing type 2 diabetes due to social and economic disadvantage and multiple pre-existing health conditions.

### ABOUT JACLYN

Jaclyn lives in the Settegast area of Houston together with her three children and her grandfather, in a house owned by both of them. She is currently unemployed but makes a little income from baking, though it is not sufficient. The family also receives food stamps, and sometimes Jaclyn finds it difficult to buy food, though she *"makes it work"*.

At 35 years old, Jaclyn's overall health is very poor. She was recently diagnosed with HIV, has asthma and has obesity. She feels that her days are shaped by her being unwell. When she has a good day, she can go and play with her children and be active. However, because of her medical conditions and her weight problems, this is a rare experience for her.

Besides taking care of herself, she also has to take care of her elderly grandfather and her three children, two of whom have been diagnosed with mental health disorders.

While her diet is in part constrained by financial considerations, she does try to cook healthy food and provide vegetables, especially because her sons are also overweight. She feels that her diet, in combination with what she describes as relatively high activity levels, have prevented her from developing diabetes – unlike the rest of her family. Although she is quite aware of

what she should be eating, due to her current financial situation she says they *"can't go and get those good fruits and vegetables, you know like we gotta settle for canned food"*. Jaclyn is planning to grow her own fruit and vegetables because *"it's healthier. I [...] can control what pesticides to and not put on 'em"*. However, this is pending due to her health, financial constraints and possible move to another location.

Her understanding of diabetes is quite good, as *"literally everyone"* in her family has diabetes except for herself and her children. She, therefore, checks her children's blood sugar levels regularly. Her mother and grandmother both died from diabetes-related complications while many of her relatives control their blood glucose levels with medication.

### JACLYN AND DIABETES RISK

Though Jaclyn knows what she should or could do in principle to improve her condition, the stressors of being unemployed and caring for an elderly grandfather and three children, two of whom have diagnosed mental health disorders, negatively impact her ability to take concrete action. The combination of biomedical factors and various stressors in her everyday life makes her very vulnerable to developing diabetes.



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## DID YOU KNOW?

TIANJIN IS ONE OF THE  
BIGGEST INDUSTRIAL  
**PORTS**  
IN CHINA<sup>100</sup>

MORE THAN  
**51** OF THE 55 CHINESE  
ETHNIC MINORITIES  
ARE REPRESENTED IN TIANJIN<sup>101</sup>

THE AIR IN TIANJIN IS  
**FRESH** ONLY 9  
DAYS  
OF THE YEAR<sup>102</sup>

**450** MILLION TONNES  
OF CARGO  
WERE HANDLED BY THE  
PORT OF TIANJIN IN 2011<sup>100</sup>

TIANJIN IS THE BIRTHPLACE OF THE  
**VERY FIRST**  
UNIVERSITY IN CHINA<sup>101</sup>

TIANJIN HAS AN  
**AVERAGE**  
POPULATION DENSITY  
AT 5,400 PEOPLE PER KM<sup>2</sup>,  
THIS IS SLIGHTLY LESS THAN  
SHANGHAI<sup>68</sup>

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# TIANJIN

## A RAPIDLY EXPANDING INDUSTRIAL MEGACITY

TIANJIN IS A MEGACITY AND THE FIFTH LARGEST CITY IN CHINA, WITH A POPULATION OF 11 MILLION PEOPLE.<sup>2</sup>

Over the past few years, Tianjin has experienced extraordinary economic development, making it one of the world's fastest-growing large cities. The city grew by an additional 1.7 million citizens between 2010 and 2013,<sup>103</sup> and its population is expected to increase to 15 million people by 2030.<sup>2</sup> Tianjin is by far the fastest-growing provincial-level jurisdiction in China, outpacing both Beijing and Shanghai.<sup>103</sup>

Tianjin's history dates back to the 12th century, and the city became one of China's key trading ports in the latter half of the 19th century. Since then, Tianjin has developed into a centre of industry and foreign trade.<sup>104</sup> Today, the port of Tianjin serves as the main maritime gateway to Beijing, the nation's capital, and trades with more than 600 ports in 180 countries around the world. This has led to the city becoming a leading manufacturing hub for China.<sup>100</sup> In 2014, the city of Tianjin recorded China's highest per capita gross domestic product (GDP) of 17,126 US dollars, followed by Beijing with 16,278 dollars and Shanghai with 15,847.<sup>100</sup> The city's GDP per capita surpasses that of many countries, including Russia and Brazil.<sup>100</sup>

Tianjin, with its major petrochemical, textile, car manufacturing, mechanical and metalworking industries, has emerged as an economic powerhouse in both Asia and the world. However, concurrent with this growth, the city has also experienced high emissions of primary air pollutants and a degradation in air quality. Abundant coal and oil resources expose the city to high emissions from burning fossil fuels.<sup>100</sup>

Today, Tianjin is shifting from a strategy of 'growth and quantity' to one of 'development and quality', and a key element of its plans is to improve the city's living environment.<sup>100</sup> With the urban area expanding geographically, Tianjin reflects the international trend of cities in experiencing strong growth, yet declining overall urban density.<sup>100</sup>

### DIABETES CHALLENGE IN TIANJIN

Not unlike the rest of China, Tianjin is experiencing a diabetes epidemic. Already 9.5% of adults have type 2 diabetes. According to the Rule of Halves for Tianjin (Figure 23), only about half are diagnosed. It has not been possible to calculate the remaining three pillars.<sup>85</sup>

#### The economic upside of prevention

If action is not taken, the prevalence of type 2 diabetes in Tianjin is projected to increase from 9.5% to 18.1% by 2040.<sup>85</sup> This is almost a twofold increase and translates to more than an additional 1.6 million people with diabetes. Obesity is expected to be the predominant modifiable driver behind this increase, accounting for almost 600,000 cases of type 2 diabetes by 2040 (Figure 24).<sup>85</sup>

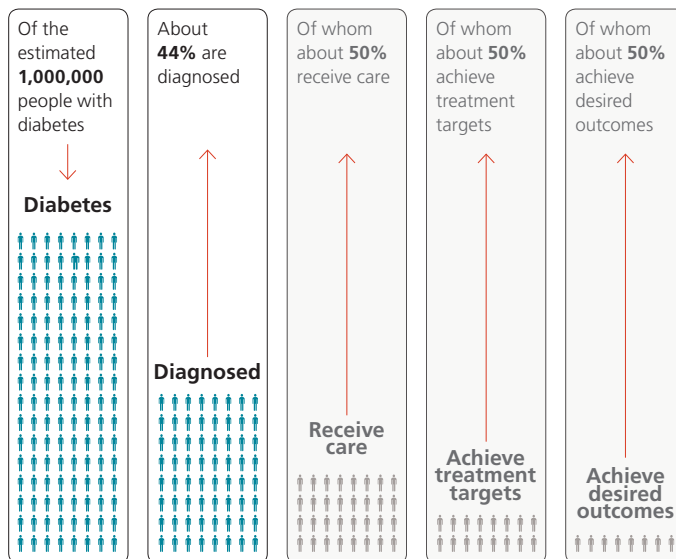
Over this same period, diabetes-related costs are set to increase by more than 250% from 2.4 billion dollars in 2015 to 6.1 billion dollars in 2040 (Figure 25).<sup>85</sup>

If effective prevention of obesity were to halve the growth of obesity from the current 2.1%<sup>105</sup> to 1.05%, annual diabetes-related savings would amount to 6.7 billion dollars between 2015 and 2040.<sup>85</sup>

NOTE: People of Asian descent have an increased risk of developing health problems at a lower body mass index (BMI) than other ethnic groups. Therefore, lower adult BMI cut-offs to determine overweight and obesity are used to assess BMI.

FIGURE 23 RULE OF HALVES FOR TIANJIN

The Rule of Halves for Tianjin is based on existing published research and covers type 2 diabetes among adults in Tianjin.<sup>58,85</sup>



NOTE: The last three pillars are estimated based on the general Rule of Halves due to lack of data.

FIGURE 24 DOMINATING EFFECT OF AGEING AND OBESITY

Type 2 diabetes prevalence could reach 18.1% by 2040, with obesity accounting for a significant percentage of this growth.<sup>85</sup>

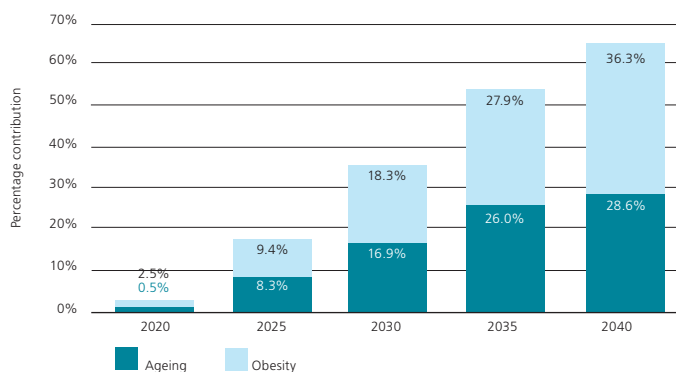
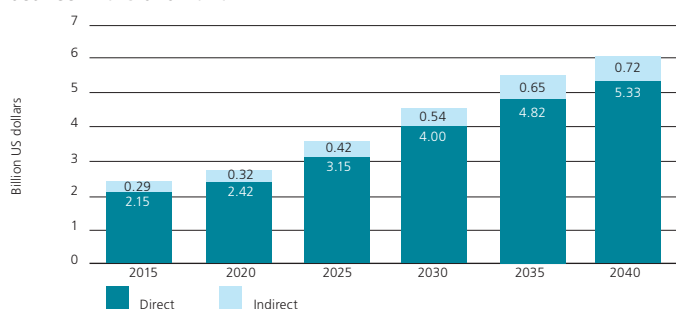


FIGURE 25 HIGH COST OF INACTION

Diabetes-related costs are projected to increase by more than 250% between 2015 and 2040.<sup>85</sup>



NOTE: Direct costs are those that result from outpatient and inpatient health services (including surgery), laboratory and radiological tests, and drug therapy. Indirect costs are identified as "resources foregone as a result of a health condition".

For further explanations about the projections, see page 63.

# UNDERSTANDING THE COMPLEXITY OF VULNERABILITY

SOME PEOPLE ARE VULNERABLE BECAUSE OF SOCIOECONOMIC FACTORS, SOME BECAUSE OF CULTURAL BELIEFS, OTHERS BECAUSE OF LITERACY AND EDUCATION, AND OTHERS BECAUSE OF MENTAL HEALTH.

In Tianjin, the vulnerability assessment reveals new insights into how vulnerability impacts people's ability to manage their diabetes. It also reveals misconceptions about the causes of diabetes.

## KEY INSIGHTS INTO VULNERABILITY IN TIANJIN

Various insights into vulnerability for type 2 diabetes and its complications have emerged from the research, the most important of which are highlighted below.

### FINANCIAL BURDEN OF DIABETES

As a chronic disease, diabetes is a burden not just physically and emotionally, but also financially. Even among participants who have health insurance plans, the treatment of diabetes can be challenging in the face of financial constraints.

In Tianjin, the cost of healthcare and pharmaceutical medicines often drives people with diabetes to seek alternative, less expensive treatment options. Some participants find themselves having to 'budget' their medication or to make a choice about which resources they will have to do without. These conditions in Tianjin seem to allow for a viable market of counterfeit medicines that are informally advertised as 'miracle cures'. Though participants acknowledge that these are not real alternatives and that compromising the extent or quality of their treatment will lead to even greater expenses in the long run (perhaps due to diabetes complications), many participants do not know how else to manage a situation of financial limitations.

*"I was afraid of diabetes for I had taken medicine for my whole life. Recently, I began to take insulin injections again and had complications, which made me scared. I was tortured all these years for I suffered headache which couldn't be described and hearing loss due to the counterfeit drug."*

Female with type 2 diabetes, 60

### BELIEFS AND ATTITUDES ABOUT DIABETES

How people think about diabetes can sometimes be detrimental to how they engage with the illness. Many participants in Tianjin feel that diabetes is not a 'serious' disease, and therefore do not pay much attention to everyday diabetes care. However, once diabetes-related complications occur, they dramatically impact beliefs and attitude towards the illness: suddenly, it is taken much more seriously. Participants experience great anxiety about the complications associated with the disease, and therefore make sure they do everything they can to prevent them.

Overall, there are many negative associations with diabetes. Diagnosis can be experienced as a traumatic event. Some report feeling that diabetes was an early death sentence, either literally or in that it takes away the pleasures and spontaneity of life.



Beliefs about what causes diabetes are equally important, as they determine the behaviours people will engage to avoid developing the disease. The following causes were independently mentioned by a number of participants:

- Poor food choices
- Lack of exercise
- Lack of education on diabetes
- Overworking
- Poor mental health or excessive stress/anxiety
- Environmental factors (water and air quality)
- Food quality and safety
- Hormones and chemical additives in food
- 'Gutter oil' (refers to all types of low-grade oils such as recycled cooking oil, repeated use of frying oil, etc)
- Greasy foods, pesticides, genetically modified foods, etc.

*"After I settled down in Tianjin, I got diabetes due to the food which was polluted by pesticides."*

Female with type 2 diabetes, 60

*"Once I met a patient who suffered from diabetes. When he was dead, I was invited to dress him. When I lifted his quilt, a flow of disgusting smell came up to me. Suddenly I realised that it was a curse from the dead man's ghost. At the moment I thought that I might have diabetes as well. The result was that I got diabetes within a month!"*

Female with type 2 diabetes, 66

### BOX 1 ABOUT THE RESEARCH

In Tianjin, the research was performed by Tianjin Medical University.

#### Quantitative research

The Rule of Halves research was based on previously published quantitative data for Tianjin.

#### Qualitative research

The vulnerability assessment is ongoing. The insights presented here are based on 67 individual interviews with people with type 2 diabetes performed by medical doctors from local hospitals. Further interviews and analysis are ongoing.





### DIABETES LITERACY AND EDUCATION

Whether having diabetes or not, the consensus among our participants is that there cannot be enough information on diabetes treatment and prevention. Poor diabetes literacy was identified as a cause of its increasing prevalence in China.

*"Many doctors cannot provide clear explanations for patients' symptoms, and no final conclusion has yet been reached on the cause of diabetes."*

Male with type 2 diabetes

Some participants mentioned how insufficient education ultimately also endangers the health of people with diabetes, who are vulnerable to misleading advice, advertisements or compromised treatment avenues. Misconceptions about what causes diabetes need to be tackled in order to reduce its occurrence. It was expressed by some that had they known about diabetes beforehand, they would have taken the necessary measures to avoid developing it in the first place.

Doctors' comprehensive understanding of the disease was also seen as being of significant importance. This gave the people with diabetes/participants the confidence to manage their condition and to ask questions when their confidence was lacking. Without this, diabetes becomes a losing battle for people with diabetes.

*"Both doctors and nurses are kind. They enlighten me and take good care of me. I became cheerful and confident. My doctor asked me to be optimistic, eat carefully and pay more attention to taking exercise. In my opinion, as long as I take doctor's advice and keep a good mood, diabetes is nothing to me."*

Female with type 2 diabetes, 53

### DIABETES AND MENTAL HEALTH

Diabetes can be a weighty emotional burden. Feelings of guilt and regret over the state of their health were common among participants in Tianjin. Many also experience anxiety about the genetic risk factors of diabetes, and express great worries that their children will inherit the disease. Depression is a frequent comorbidity in Tianjin.

While some people take a nonchalant attitude towards the care of their diabetes, for others this responsibility is very serious. When their health outcomes do not meet their expectations or match their efforts, they are extremely disappointed. In addition, seeing or feeling the effects of diabetes on their physical state causes many people a significant amount of grief over their deteriorating health.

Diagnosis was, in many cases, experienced as an end to life as they had known it before, and was thus accompanied by much sadness and anxiety.

*"I used to be strong-minded, but I reached rock bottom since my right eye went blind. I can't go to sleep without the help of medicine."*

Female with type 2 diabetes, 54

*"I was depressed when I knew I got diabetes. Diabetes is chronic cancer. I feared I would be blind and amputated and could eat nothing. Hopeless. Hopeless. I cried every time I was hospitalised. Then I took antidepressant medicine and I told myself that I should adjust. Then I got better. It has been 25 or 30 years. I told them to be strong. Live every happy day. Don't take it as a burden. It's OK."*

Female with type 2 diabetes, 50



## A FIELDWORKER'S TAKE ON THE VULNERABILITY ASSESSMENT



**PROF CHEN LIMING**  
PRESIDENT OF TIANJIN  
METABOLIC HOSPITAL

*"When people with diabetes share their experience about diabetes with us, we can more easily understand why they are more susceptible to developing diabetes, why their conditions are more difficult to control, and why they have developed complications much earlier... we feel sorry for them, and at the same time we are also aware that, in fact, there are still a lot of things that can be done for people with diabetes by our country, society, hospitals and the families of the patients."*

*"In this age, with diabetes increasing sharply in China, we hope that the data and results of the project in Tianjin and other cities in the world can help all people with diabetes worldwide and many people living with prediabetes."*

## THREE CASES FROM TIANJIN

Three abbreviated cases that exemplify some of the key insights into vulnerability for type 2 diabetes and its complications in Tianjin are presented below. The name given to each case is fictitious in the interest of anonymity.



55 YEARS OLD  
WORKS AS A FULL-TIME LABOURER  
SLIGHTLY OVERWEIGHT  
TYPE 2 DIABETES

### MEET XIA

#### WHY IS THIS CASE INTERESTING?

This case is interesting because Xia is representative of a group of people engaging in small-scale agriculture in the suburbs of Tianjin. They typically have a low level of income and education, and have worked as physical labourers all their lives. The practice of growing your own food is not common in Tianjin anymore.

#### ABOUT XIA

Xia is a 55-year-old woman from Tianjin, where she lives with her husband in an apartment. Her children live in the same building on another floor. The area surrounding the apartment building is open and spacious, and there is a playground nearby with exercise equipment, where people dance and play ball games.

Xia is fond of exercise, but rarely has the time for it. She is kept very busy by her farm work and housework, such as preparing meals. She also has health issues that make it difficult for her to participate.

Each day, Xia spends many hours doing farm work. However, she believes she is in good physical condition as she spends many hours each day doing this. Each day, she also cycles the half-hour distance to cultivate her furthest away vegetable field.

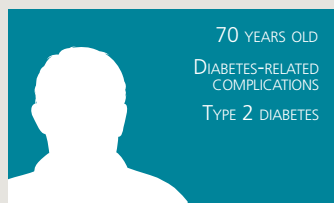
Often during the day, Xia does not eat regularly and, at times, even skips meals. She believes that a poor and irregular diet most probably causes diabetes, but knows nothing more: *"I think I get the diabetes because I eat too much this time and too little next [time]."*

Xia is very concerned about the complications of diabetes, which could hinder her ability to farm and take care of her family. Though she, in principle, trusts doctors, she is very unsure as to what help doctors can give her, which means that she avoids seeking medical attention, even when necessary. She also mistrusts any advice or information from her family, neighbours and friends because she feels it is unreliable: *"I just believe the hospital and I don't believe the information from other place. I pay all my attention on the doctors and I don't believe other people."* Recently, however, her children did successfully manage to persuade her to pay a visit to the hospital because her hands were so numb and swollen that she could not hold a broom.

#### XIA AND DIABETES

Xia has a very limited knowledge of diabetes, though she knows that she can get information at the local hospital. To her, diabetes seems troublesome, since people with diabetes need to be quite careful in every way – they need to avoid overexhaustion and always watch their diet, but she is unsure as to what is specifically suitable to eat. She also feels that those with diabetes have a quick temper.





## MEET LIU

### WHY IS THIS CASE INTERESTING?

Liu's case is of interest as it illustrates how financial disadvantage can compromise a person's ability to self-manage their diabetes despite their personal determination to manage the condition. Liu is representative of many people who suffer from diabetes-related complications but, due to economic hardship, have to compromise their treatment.

### ABOUT LIU

Liu is a well-groomed 70-year-old man. He is retired and lives together with his wife and son, who has returned from studying abroad.

Diabetes has cost Liu his left foot. His foot was amputated 30 years ago after a small wound on his toe developed into a large ulcer – this is a common complication of diabetes. He is now confined to a wheelchair as a result of his disability. This experience has left him disappointed with the medical system available to people like himself. He has suffered a lot as a consequence of diabetes, but this does not stop him from engaging in medical care and looking after his health.

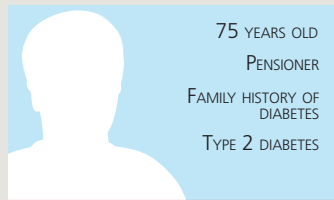
Consequently, Liu is keen to prevent and control any diabetes-related complications, and keeps himself informed about what challenges can arise as well as how he can treat or avoid them. He believes that diabetes is caused by lack of exercise or by dietary habits such as eating fried foods or consuming excessive sugar. Furthermore, he holds the view that a big risk factor for developing diabetes is genetic predisposition.

Although he and his wife each receive 2,500 Chinese yuan (about 393 dollars) a month from their pensions, this is not enough to meet their needs. So to support his family's needs, Liu sells newspapers, cigarettes and soft drinks on the streets in his neighbourhood. Fortunately for Liu, he has the support of many of his neighbours, who keep in regular contact with him and help Liu carry things up and down the stairs at his home. *"My son has returned from studying abroad and doesn't have a job as yet, so I have to earn money."*

### LIU AND DIABETES

Liu pays careful attention to his diet, regulating his blood sugar levels by eating balanced meals at regular intervals, and he is diligent about going to the hospital regularly for examinations and seeking appropriate therapies.

However, due to his financial situation, he has to compromise on his medication. The high costs of treatment represent a significant burden for Liu. He feels his treatment is compromised because he cannot afford better healthcare. Financial limitations are a great source of stress for Liu and represent a significant burden to his overall wellbeing.



## MEET SHI

### WHY IS THIS CASE INTERESTING?

This case is interesting as it gives an example of a participant who, despite his diabetes and multiple diabetes-related complications, still has the ability to act as a diabetes advocate among friends and in the community.

### ABOUT SHI

Shi is a 75-year-old retired man who lives with his wife in the Hexi district of Tianjin, a densely populated residential area. The area has good public transport links, schools, grocery shops and some restaurants, making it convenient and pleasant, and a small park, where Shi goes every day to chat with his many neighbours and to do some exercise.

Shi has an optimistic attitude and a strong sense of self-discipline. *"No matter what happens, I can do things by myself. First of all, I rarely eat out. Second, I take my medicine on time."* Shi has lived with type 2 diabetes since 1988 and keeps copies of all his case histories, hospital records and receipts, carefully keeping track of his healthcare expenses.

He trusts doctors and has spent quite a bit of time in hospitals: *"The number of doctors whom I know is large enough to set up a hospital by themselves."* As advised by his doctor, he always takes his medicine on time: *"I punctually take medicine and injection and rarely miss this practice."*

Shi likes to share his doctor's advice with his friends and former colleagues. They often seek advice from him about how to take medicine, and he always likes to help because he feels that *"they lack the knowledge about diabetes"*.

Shi used to love being physically active from an early age, and he was a well-known football player in his youth. However, considering his physical condition, he now works out much less frequently, regarding the practice of doing housework as his primary form of exercise. In his opinion, physical exercise is good for the health and should be promoted.

Shi also feels that misleading information is often released to those who have diabetes via the media, including newspapers and commercials. *"I wish the government would crack down on some false advertising, even stop them."* He also feels that those with less knowledge about diabetes than he has might be particularly vulnerable to the disease. He knows of worrying incidents where particular individuals sell counterfeit diabetes drugs to the public.

### SHI AND DIABETES

As someone who is health-conscious, Shi is very concerned about diabetes in his community. He knows a lot of people and has voluntarily taken on the task of being a diabetes advocate among friends, former colleagues and classmates.

He feels strongly that it is necessary to intensify efforts to create public awareness of diabetes. He feels that misleading information has often been released to those who are less knowledgeable about diabetes, and this makes them vulnerable.

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## DID YOU KNOW?

SHANGHAI IS  
SINKING AT A RATE OF  
**1.5 CM** PER  
YEAR<sup>106</sup>

MORE THAN  
**174,000**  
EXPATS LIVE IN SHANGHAI<sup>107</sup>

SHANGHAI HAS THE  
**24<sup>TH</sup>** HIGHEST COST  
OF LIVING  
IN THE WORLD AND THE SECOND  
HIGHEST IN CHINA<sup>108</sup>

**548 KM** OF TRACK  
MAKES SHANGHAI'S  
METRO SYSTEM THE  
LONGEST IN THE WORLD<sup>109</sup>

SHANGHAI'S  
CONTAINER SHIPPING PORT IS  
**THE BUSIEST**  
IN THE WORLD<sup>108</sup>

IN 2013, SHANGHAI  
WAS HOME TO  
**1,407** CENTENARIANS<sup>110</sup>

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# SHANGHAI

## A FAST-RISING GLOBAL METROPOLIS

SINCE CHINA'S ECONOMIC REFORM IN THE LATE 1970s, SHANGHAI, THE COUNTRY'S LARGEST AND MOST MODERN CITY, HAS EXPERIENCED RAPID EXPANSION AND URBANISATION.<sup>111</sup> TODAY, THE CITY IS THE SIXTH LARGEST IN THE WORLD.<sup>68</sup>

More than 23 million people live in Shanghai, and this is projected to grow to 31 million by 2030.<sup>2</sup> Population density has significantly increased from 1,734 people per square kilometre in 1970<sup>112</sup> to 6,100 in 2013.<sup>68</sup> The increase in population density in Shanghai has been driven by the influx of a large 'floating population'<sup>112</sup> of people from rural areas, who lack legal city residence. These people, who 'float' between the countryside and the city, currently account for as much as 40% of the city's total population. Without an urban permit, rural residents are often denied access to the subsidised healthcare services, housing and education for their children that people with urban residence enjoy.

The rapid urbanisation has also created serious environmental problems in Shanghai, including its climatic and ecological effects and environmental pollution.<sup>112</sup> As urbanisation, the population and economic development have increased, so pollution has increasingly become a health issue in Shanghai. While air pollution in Shanghai is low in comparison with some other Chinese cities, it is still significant by world standards, and is becoming a serious public health concern.<sup>113,114</sup>

Despite these challenges, people in Shanghai live to a good age. In 2014, the average life expectancy of Shanghai residents was 82 years. The population of people aged 60 and over had reached 3.87 million by the end of 2013, and the number of senior citizens living in Shanghai is set to pass 6 million by 2025.<sup>110</sup>

Today, Shanghai is not only a large commercial centre, but it is also a popular tourist destination with a number of historical landmarks. In addition, the city has an extensive public park system, offering its citizens some reprieve from the urban jungle. By 2012, the city had 157 parks, with 138 of them free of charge.<sup>115</sup>

### DIABETES CHALLENGE IN SHANGHAI

In Shanghai, the prevalence of type 2 diabetes among people over the age of 35 is 17.6%, totalling almost 2 million adults. According to the Rule of Halves, about one in three people with type 2 diabetes is unaware of their condition.<sup>85</sup> Of the people who are diagnosed with type 2 diabetes, almost all receive care.<sup>85</sup> However, three in five people receiving care do not manage to achieve their treatment targets (Figure 26).<sup>85,116</sup> The prevalence of type 2 diabetes for all people in Shanghai has been calculated to be 8.3%, and this figure has been used for the projections.<sup>85</sup>

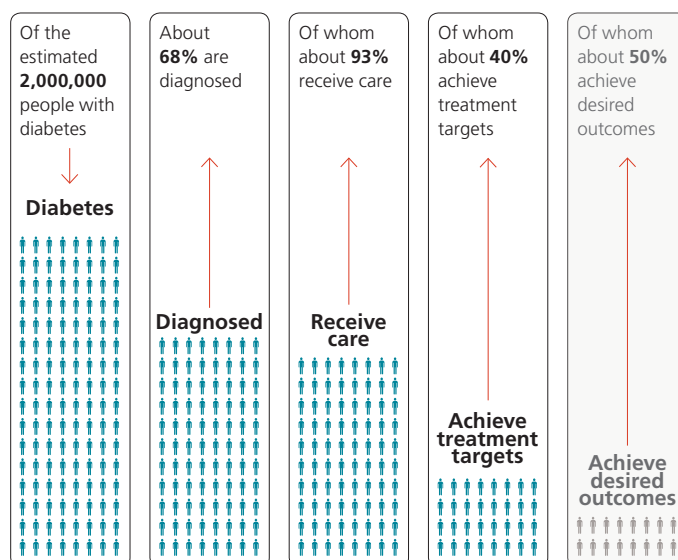
#### The economic upside of prevention

If action is not taken, the total prevalence of type 2 diabetes in Shanghai is projected to almost double from 8.3% in 2015 to 15.5% by 2040.<sup>85</sup> This will result in an additional 2.8 million people with type 2 diabetes by 2040.<sup>85</sup> A significant driver behind the increase in prevalence will be the ageing population, contributing over 770,000 cases, while obesity will account for over 370,000 cases (Figure 27).<sup>85</sup>

Diabetes-related costs are set to more than double by 2040, rising from 4.5 billion US dollars in 2015 to an estimated 10.9 billion dollars in 2040 (Figure 28).<sup>85</sup> However, if we could halve the growth rate of obesity from 1.6%<sup>117</sup> to 0.8%, annual savings could amount to 450 million dollars by 2040, and the total savings between 2015 and 2040 would amount to 4.5 billion dollars.<sup>85</sup>

FIGURE 26 RULE OF HALVES FOR SHANGHAI

The Rule of Halves for Shanghai is based on existing published research and covers type 2 diabetes among adults over the age of 35 in Shanghai.<sup>58,85</sup>



NOTE: The last pillar is estimated based on the general Rule of Halves due to lack of data.

FIGURE 27 DOMINATING EFFECT OF AGEING AND OBESITY

Type 2 diabetes prevalence in the total population could reach almost 15.5% by 2040, with obesity accounting for a significant percentage of this growth.<sup>85</sup>

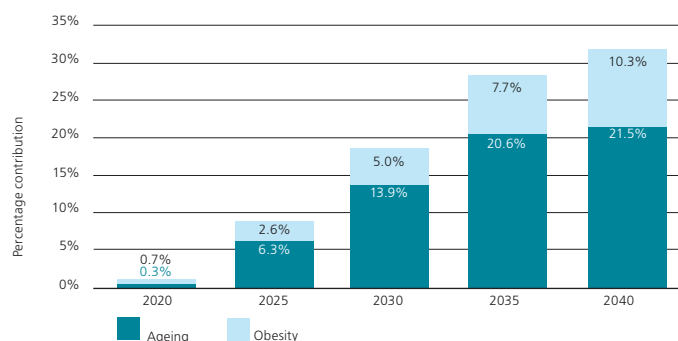
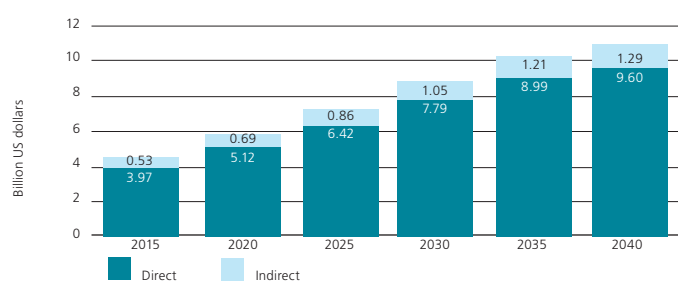


FIGURE 28 HIGH COST OF INACTION

Diabetes-related costs are projected to double between 2015 and 2040.<sup>85</sup>



NOTES: Direct costs are those that result from outpatient and inpatient health services (including surgery), laboratory and radiological tests, and drug therapy. Indirect costs are identified as "resources foregone as a result of a health condition".

For further explanations about the projections, see page 63.

People of Asian descent have an increased risk of developing health problems at a lower body mass index (BMI) than other ethnic groups. Therefore, lower adult BMI cut-offs to determine overweight and obesity are used to assess BMI.

# UNDERSTANDING THE COMPLEXITY OF VULNERABILITY

DIABETES VULNERABILITY EXTENDS BEYOND THE INDIVIDUAL AND IS INFLUENCED BY THE SOCIAL AND CULTURAL ENVIRONMENT THAT PEOPLE LIVE IN.

In Shanghai, the vulnerability assessment reveals insights into how diabetes impacts families and how family behaviour and perceptions impact an individual's ability to manage their diabetes. The research also reveals knowledge about social transition and its relationship to urban diabetes.

## KEY INSIGHTS INTO VULNERABILITY IN SHANGHAI

Various insights into vulnerability for type 2 diabetes and its complications have emerged from the research, the most important of which are highlighted below.

### FAMILIAL RESPONSIBILITY AND DIABETES

A disease not only affects the individual who receives the diagnosis but also all those who have a significant role in the life of that individual. Thus, family relationships play an important role in the management of diabetes for participants in Shanghai. People with diabetes rely on their family for support and care in matters concerning their treatment. Among participants, familial support is shown to be a highly positive element in diabetes management and control. On the other hand, diabetes can become a justified exemption from household duties because of 'sick' status. In extreme cases this is perhaps also dangerous, as individuals can lose independence and control of their disease. When these expectations are not met, it often results in poorer management of their health.

*"My husband and my son did the washing and cleaned the house. They wouldn't let me do it because of my poor health. I was too dependent to feel a threatened loss."*

Female with type 2 diabetes, 64

When diabetes becomes a burden, it is a burden inflicted upon the whole family or household. This in turn creates feelings of guilt or shame for the individual with diabetes who has brought 'trouble' upon the family. Participants describe much anxiety over inconveniencing their family with their health needs and care, especially in the presence of complications. As diabetes is accepted as being hereditary, many participants worry excessively about the genetic inheritance they are leaving to their children.

*"To some extent diabetes changes my life track, making me feel there always is a timing bomb around me, which will bring troubles to my family and bring some fears to me that my children will have the same disease."*

Male with type 2 diabetes, 43



### RAPID SOCIAL AND ECONOMIC TRANSITION IN CHINA (A DISEASE OF WEALTH?)

*"The living conditions become well now, you can eat chicken, duck, fish and meat every day as long as you dare to eat and are not afraid to suffer from diabetes."*

Male with type 2 diabetes, 71

For many participants, the memory of an age of material poverty is still fresh in their minds. They recollect times of hunger and scarce food resources, but also recollect how everything has changed since the reform and China 'opening up'. People's material lives have improved greatly during this period and they have taken full advantage of the abundance of food resources. In this sense, diabetes can be understood as a disease of wealth, or excessively lavish tastes for sugar and fatty foods.

*"There was nothing good to eat in the past. I can remember that when I gave birth to my son, even the eggs were in ration. There was nothing to eat at that time, not like now, when we can get everything. There is no difference between normal days and spring festival, as everyday is like a festival."*

Female with type 2 diabetes, 68

Many participants believe they developed diabetes due to the extreme dietary changes that they have experienced throughout their lives. It was frequently expressed that the knowledge of diabetes and how to prevent it would have altered their past behaviour drastically. It is a sad irony for many that today, with such vast availability of food, they have to adhere to such strict and bland diets because of their disease.

#### BOX 1 ABOUT THE RESEARCH

The research was performed by Shanghai Diabetes Institute.

##### Quantitative research

The Rule of Halves research is based on previously published quantitative data for Shanghai.

##### Qualitative research

The insights presented here are based on 103 individual interviews with people with type 2 diabetes performed by healthcare professionals from local community health centres. In total, 120 interviews were conducted.





### DIABETES AND STIGMA

In Shanghai, many participants experience negative beliefs around diabetes as well as significant societal disapproval. This has very real impacts on the diagnosis, care provision, and physical and mental wellbeing of those affected. In a setting where communal help and support are an essential component of being integrated into society (and being well both physically and mentally), at times the diagnosis severely prevents people with diabetes from accessing help and support.

*"I got diabetes when I was about 30 years old and my parents didn't want anybody to know I had diabetes, so we didn't receive help from others."*

Male with type 2 diabetes, 46

In part, this seems to be due to the stigma felt (linked to the perception that diabetes is a condition of the elderly and 'weak'), especially when a diagnosis of diabetes is made at a young age. Furthermore, a sense of stigma becomes enacted where individuals develop strategies or tactics to avoid drawing attention to themselves and their condition. Peer support is very difficult to access for some participants in Shanghai, simply because they do not know who else has the condition, and they do not want to draw attention to themselves. The psychological implications of the experience of shame, which prevents individuals from engaging in certain social activities (such as sharing communal or family meals) due to the anticipation of being stigmatised, have profound consequences for health and overall sense of wellbeing.

Stigma is also closely linked here to the understanding of diabetes as a genetic condition that is passed on to one's children. For example, in one case, the daughter of a participant did not tell her fiancé's family about her mother's diabetes for fear her in-laws would discriminate against them (due to the potential of passing on the condition) and call off the prospective marriage.

*"My neighbours don't know I have diabetes, because others have this kind of disease at 60 or 70 years old, but I'm just over 40 years old. This makes me embarrassed."*

Male with type 2 diabetes, 42

### UNDERSTANDING OF DIABETES

How people understand diabetes is crucial to their behaviour and reactions to the disease. In general, participants had the perception that all chronic diseases, including diabetes, are inherited. In addition, they believed that diabetes can be caused or aggravated by bad dietary habits. Moreover, there was a sense that it is easier to manage diabetes by regulating diet and diabetes medication once it has been diagnosed rather than to be pre-emptive. There also seemed to be a greater sense of fear of the risks of diabetes complications than of diabetes itself, and this fear frequently acts as an incentive to modify unhealthy habits or behaviours. Many of these perceptions also seem to be grounded in retrospective knowledge and, consequently, retrospective action, for example with regard to modifying diet and/or following medical advice/taking medication.

*"The disease will have no influence on developing a relationship [for marriage], but I do worry about genetic problems. I intend to adopt a healthy child, which will save a lot of troubles."*

Female with type 2 diabetes, 22

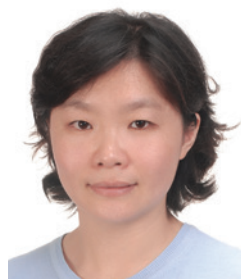
There seems to be an inversely proportional relationship between scientific and nonscientific explanations of diabetes and medicines with regard to cost-effectiveness. On the one hand, participants perceived conventional medicine as being effective, but concluded that it is difficult to understand how it works and that it is often financially prohibitive. In addition, biomedical pharmaceuticals are looked upon with a degree of scepticism because of potential side effects. On the other hand, alternative or complementary medicine is easier to understand and more accessible in spite of any perceived inferiority with regard to contemporary medicine.

*"Recently, when communicating with my old colleagues, I found that the water in our previous living place in Chongqing wasn't good, and a lot of people developed cancer. Some people died before retirement and some people have diabetes. I don't know whether my diabetes was induced by that water or not. None of my parents or siblings has diabetes, and I'm not fat and like exercise. Thus, why did I develop this disease? I still can't figure out."*

Male with type 2 diabetes, 69



## A FIELDWORKER'S TAKE ON THE VULNERABILITY ASSESSMENT

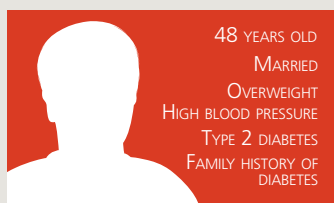


**XUHONG HOU**  
LOCAL ACADEMIC PARTNER  
FOR THE SHANGHAI CITIES  
CHANGING DIABETES RESEARCH

*"I would like to express my sincerest thanks to our wonderful research team. They presented us with fruitful results with Chinese characteristics the past two months. I've been very impressed by their hard work and dedication to the Shanghai Diabetes Vulnerability Assessment study."*

## THREE CASES FROM SHANGHAI

Three abbreviated cases that exemplify some of the key insights into vulnerability for type 2 diabetes and its complications in Shanghai are presented below. The name given to each case is fictitious in the interest of anonymity.



### MEET CAOYANG

#### WHY IS THIS CASE INTERESTING?

This case is interesting because it is representative of a middle-aged man with type 2 diabetes who has steady employment, a family and lives in Shanghai. However, with the stressors of work and the demands of everyday life, these men may not focus enough on their own health and do not prioritise monitoring their blood glucose.

#### ABOUT CAOYANG

Caoyang is a 48-year-old man who lives together with his family in Shanghai. He has full-time employment and is generally very busy at work. Caoyang was diagnosed with type 2 diabetes at a general physical check-up last year. During the examination, it was also discovered that his cholesterol and blood pressure were too high. At first, he was not too troubled by this.

He enjoys eating sweet foods. He was accustomed to adding sugar to nearly every dish when cooking. He also ate many salty foods, which he believes contributed to his developing diabetes. Upon diagnosis, his doctor advised a more controlled diet and recommended that he engage in more physical activity.

For Caoyang, the lifestyle changes that his diabetes demanded were tough to accommodate. To the disappointment of his family, he did not adhere to the dietary restrictions on sweet, fatty and salty foods, often justifying that *"it makes no difference to eat occasionally"*. This changed for Caoyang when he was hospitalised. At that time, his blood glucose was very high and he was put on medication.

For six months, under the supervision of his doctor and his own family, his blood sugar levels have significantly improved. This change has allowed Caoyang to gradually stop taking medicine. Today, he relies solely on dietary control and exercise to manage his diabetes.

Due to his work, Caoyang feels that he does not have much spare time to test his blood glucose and, therefore, he usually goes to the hospital to have his blood glucose tested

once every six months. Generally speaking, he is not very trusting of doctors and suspects that they often exaggerate the seriousness of a condition to get people to comply. He believes he is still a young man and, therefore, healthy. Illness is not a significant threat to him. He believes that *"diabetes isn't a serious illness and I don't care... diabetes isn't a serious disease to me and I'm certainly not concerned"*.

His wife has made great adjustments in the preparation of meals to accommodate her husband's condition. She no longer adds sugar to dishes, and only very little oil and salt. At first, Caoyang had difficulty adjusting to this but, fortunately, with the efforts of his family, he has gradually become accustomed to it. His family also supports him by helping him measure his blood pressure at home every few weeks.

Caoyang enjoys exercise. Every day after supper, he goes to the sports centre behind his house for a walk. This helps him to maintain his blood glucose at normal levels.

#### CAOYANG AND DIABETES

Caoyang does not care much about his diabetes in his everyday life, and he finds it difficult to adhere to the related dietary restrictions. In his daily life, he focuses on his work so he can provide for his family. Also, he perceives himself as young and healthy, and is currently not concerned about his diabetes or its potential complications. At home, his family actively engage in his diabetes management, but at work he downplays this due to his work schedule.





## MEET LINGLING

### WHY IS THIS CASE INTERESTING?

This case is interesting because of the participant's attitude towards diabetes. For her, diabetes has influenced her 'self-perception'. She is not willing to be made a victim of the disease and does not allow it to control her life. It is diabetes that must live with her, not she with it.

### ABOUT LINGLING

Lingling is a 77-year-old retired woman living on her own in Shanghai who was diagnosed with type 2 diabetes at the age of 52. When Lingling's husband passed away, as a way to combat her grief, she went to work in Shenzhen for a year. When she returned home to Shanghai, she had lost a lot of weight, and a neighbour expressed his concern that she might have diabetes. At the time, she did not know what diabetes was but, taking advantage of her insurance, she went to the doctor for a check-up.

She is not optimistic or pessimistic about her condition, but merely wants to *"let the nature take its course"*. She does not put much effort into her diet or into monitoring her blood glucose levels. She believes this is the best way to accept her condition.

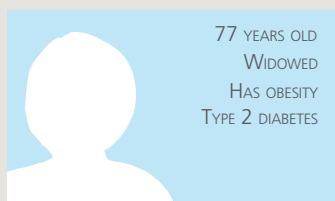
For Lingling, diabetes is a hereditary disease. Both her children have 'inherited' it from her. She tries to help them by sharing information on a healthy diet so that they can keep their blood sugar controlled. She also advises them to get sufficient sleep and says that worrying is of no use. *"Don't be worried, and your blood sugar will decline."* To her, diabetes is not such

a horrible illness, but it is important to know the disease and learn how to manage it in order to live well. She does not live her life as a diabetes 'patient', she feels healthy and enjoys her life.

Since her diagnosis, she has been very grateful for all the help she has received from her family and the community. They help her with her household chores and often give her some vegetables and noodles. Though she is very touched by these gestures, she feels somewhat guilty about receiving help, particularly from her children, who face the same struggles with diabetes as she does.

### LINGLING AND DIABETES

Lingling does not take too much enjoyment in exercise since her legs cause her great pain although, in her youth, she was very active. She says she likes sports, but she does not feel she can move as easily as she used to. Her lack of mobility often keeps her from participating in various community events and local traditions. Financial limitations also represent a barrier to her good health. Due to this, she feels very fortunate to have insurance to help her pay for her health-related expenses.



## MEET ZHENRU

### WHY IS THIS CASE INTERESTING?

This case is interesting because it exemplifies how important emotional wellbeing is for diabetes management and care, as well as support from the community, including family members, friends and medical workers.

### ABOUT ZHENRU

Zhenru is a retired 64-year-old woman living in Shanghai with her son, his wife and their young daughter. Five years ago, Zhenru's husband – who also, like Zhenru, had type 2 diabetes – passed away. It is apparent that she suffers from loneliness as a result.

While he was alive, her husband did a great deal to help Zhenru manage her diabetes. For example, he did the cooking and made sure she followed a healthy diet with plenty of vegetables. *"I was very spoiled and dependent on him and never had to exert myself."*

At home, Zhenru shares the cooking responsibilities with her son and his wife. A typical meal for them consists of rice and vegetables from the local market. However, Zhenru does, on occasion, buy ready-made food like dumplings, because of the convenience.

Both Zhenru's parents had diabetes and she was well-informed about the disease from an early age. For her, diabetes is primarily a genetic condition, but she says it is likely that it was her love of sweet foods that also contributed to her developing diabetes. She no longer eats sweet foods and takes less enjoyment in her meals. Due to her belief that diabetes is hereditary, her primary concern is that her son may develop the condition.

According to Zhenru, she takes a lot of pills to manage her health, including metformin and sleeping tablets. Despite all the medication, she is surprised at her ill health. However, she does recognise how much treatment has helped her since she was first diagnosed at the age of 29, and is very grateful for all the medical services she has received. She has a good relationship with her doctor, whom she sees often and holds in high esteem.

### ZHENRU AND DIABETES

Zhenru's husband used to take excellent care of her and played a crucial role in her diabetes management. Since he passed away, she has tried to take more control over her health matters. She is a member of a diabetes club that meets regularly to talk about the condition. The group offers information and support to all its members. This resource is invaluable to her, as it has given her a lot of knowledge about how to live with her illness, and she has found this hugely empowering. The birth of her granddaughter has also rejuvenated her motivation to take care of her personal health. However, her melancholia impacts on her ability to do so.

She is very thankful to have her community, consisting of her family, friends, neighbours and doctors, who have all provided her with a lot of care and support since her husband passed away. However, the fact that he can no longer provide support, together with her melancholia, puts her in a vulnerable position.





550 FACE-TO-FACE  
INTERVIEWS

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75 FIELDWORKERS  
IN FIVE CITIES, ACROSS  
FOUR CONTINENTS

2 HOURS  
PER INTERVIEW

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1,100 HOURS  
COLLECTIVELY SPENT  
ON CONDUCTING  
INTERVIEWS





# GLOBAL REFLECTIONS

WHEN WE LOOK AT PEOPLE THROUGH SOCIAL AND CULTURAL LENSES, WE SEE THAT DIABETES IS MORE THAN JUST A SET OF CLINICAL SIGNS AND SYMPTOMS.

We see an illness that is about such things as transportation – the labourer who commutes long distances to work and spends a third of his income on bus fares. It is about loneliness – the single man living alone who wants to change but must do so with little or no social support. It is about time – the mother who is working two jobs and relies on fast-food to feed her children. It is about one's perception of self – the overweight office worker who sees his colleagues with obesity and feels slim and healthy in comparison.

Diabetes is about more than these factors in isolation. Diabetes is about how they combine in complex ways, moving a person towards a 'tipping point' of chronic disease. However, on the path to this tipping point there are elements that accelerate the pace, and some that slow it down – or even change its course. These are the social factors and cultural determinants that contribute to vulnerability or resilience to diabetes, and they are the focus of our research collaboration for the Cities Changing Diabetes programme.

Global reflections were compiled and written by  
David Napier, UCL and Anna-Maria Volkmann, UCL

*"It was said that if mother suffers from diabetes, so will her children. If father suffers from diabetes, things will be better."*

Female with type 2 diabetes, 50, Shanghai

# SOCIAL FACTORS, CULTURAL DETERMINANTS AND DIABETES VULNERABILITY

BIOLOGY AND MEDICINE ARE WITHOUT QUESTION IMPORTANT IN DIABETES PREVENTION AND CARE; BUT WE IGNORE AT OUR PERIL THE COMPLEX SOCIAL AND CULTURAL DRIVERS OF DISEASE.

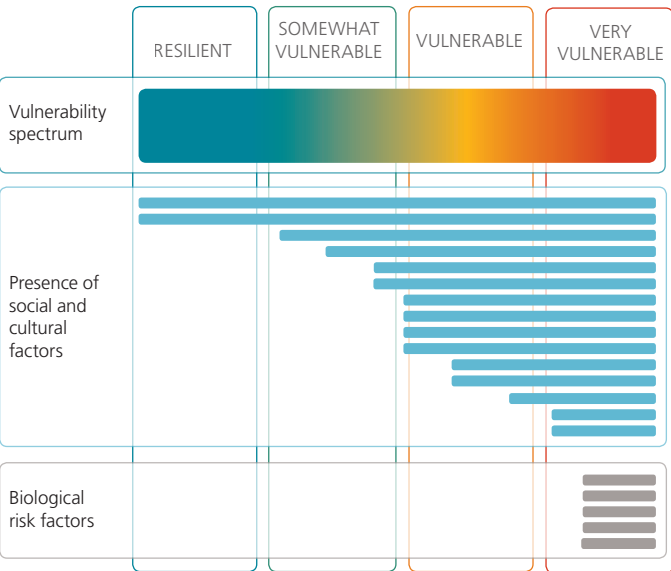
Some factors that impact diabetes vulnerability are shared by many urban environments around the globe. We can identify and analyse these factors, even if they manifest themselves in unique ways locally.

However, attempting to address each one of the factors in isolation will not have a major impact on diabetes prevention or improve diabetes management.

Rather, we must understand the local admixture of various social factors and cultural determinants in order to identify where on the vulnerability spectrum individuals and populations are in a specific city (Figure 29). Doing so allows us to conceptualise what limits the negative impacts of social factors and cultural determinants on diabetes and what fosters their positive influences that enhance resilience.

FIGURE 29 THE MODEL OF THE VULNERABILITY SPECTRUM

We introduce here the model of the vulnerability spectrum to emphasise that vulnerability to diabetes, though measurable and concrete, is not limited to a fixed set of values but can be expressed within a continuum.



## SOCIAL FACTORS IN URBAN DIABETES

The social determinants of health are defined as the “conditions in which individuals are born, grow, live, work, and age”, and are commonly accepted as relating to and determining structural oppression and disadvantage. The social determinants of health, in turn, affect factors related to health outcomes.<sup>118</sup> We refer to these factors as social factors.

The social factors for diabetes vulnerability are thus linked to the general social determinants of health and, based on our studies of urban diabetes in the context of the Cities Changing Diabetes programme, are an extension of these basic principles.

Importantly, the social factors for urban diabetes described below are recognisable, locally expressed and shared across the globe; and they can be measured and assessed as a fundamental component of diabetes vulnerability.

### FINANCIAL CONSTRAINTS DO I HAVE THE FINANCIAL ABILITY TO TAKE CARE OF MY HEALTH?

This factor is relative to circumstance. We move away from straightforward ‘poverty’, for example, as a known social risk factor, because it is both the perceived and the actual impact of *financial constraints* that shape vulnerability to diabetes. Clearly, *financial constraints* affect a person’s ability to function in daily life – to access basic care, or to eat regularly and to eat well. However, *financial constraints* also impact any health-supporting activities that may not be regarded as essential. There are also psychological consequences of feeling constrained that affect mental health and reduce a sense of wellbeing. Perceived *financial constraints*, therefore, can make us vulnerable by limiting our capacity to feel positive and hopeful about the future. Financial constraints are closely linked to *time constraints*.



## TIME CONSTRAINTS

### DO I HAVE TIME FOR HEALTHY LIVING?

Having to operate under significant *time constraints* means that a person has to prioritise needs and wants according to available time for essential and nonessential activities. *Time constraints* are usually related to workload (linked again to *financial constraints*) as well as to social responsibilities (such as caring for family and dependents). *Time constraints* have a direct impact on diabetes vulnerability, as they dictate what is feasible in terms of prevention and management of the disease at both individual and population levels. Furthermore, like *financial constraints* and *geographical constraints*, *time constraints* fuel urban stressors that affect human health and wellbeing negatively.

## RESOURCE CONSTRAINTS

### DO I HAVE THE RESOURCES I NEED?

*Resource constraints* limit what is possible in terms of what an individual can do to improve personal health. *Resource constraints* apply to basic amenities (eg the absence of local healthcare provision), practical resources (including lack of access to medicines, good foods and the possibility to exercise) as well as educational resources that enable health-enhancing decision-making. The latter includes basic educational resources (such as schools), health-related educational resources (such as health-oriented community programmes) and, today, also online resources (to which online illiteracy and technological disadvantage are known barriers).

## GEOGRAPHICAL CONSTRAINTS

### DO I LIVE IN AN ENVIRONMENT THAT ENABLES HEALTHY LIVING?

*Geographical constraints* relate to multiple risk factors, such as unfavourable local climate and/or environmental pollution, local crime levels and safety, and lack of local infrastructure. Importantly, the impact of *geographical constraints* on diabetes vulnerability here is both practical and psychological, as perceived and actual isolation, and community integration more generally, are directly affected by concrete environmental conditions.

By examining the impact of the four social factors, we can assess quickly what is feasible at a basic level for a specific person, as well as for a group of people sharing similar needs. Moreover, we can visualise how a person's diabetes vulnerability increases the more of the above factors are present, and the more pronounced their presence is. However, we are also able to see how a person might move from 'more vulnerable' to 'less vulnerable' on the Diabetes Vulnerability Spectrum when single or combined social factors are ameliorated.



# CULTURAL DETERMINANTS IN URBAN DIABETES

We may define 'culture' as 'shared conventions manifest in act and artefact'. In a health context, cultural determinants affect how shared conventions, understandings and practices impact health and wellbeing. An awareness of cultural determinants and how they relate to diabetes requires an understanding and appreciation of the value systems that motivate human actions and behaviours.

For example, people who migrate to cities have shorter life expectancies if they migrate alone, while those who migrate as part of a group with the same customs and conventions generally have better health outcomes. However, cultural conventions (food-sharing practices, attitudes to gender, language barriers, beliefs about healthcare, etc) can also have negative impacts on health. Although culture can enhance resilience, it can also fuel vulnerability. That is why the complex ways in which vulnerability manifests itself locally must be assessed and understood.

Here, we list five major cultural determinants of diabetes vulnerability and illustrate them through specific local examples from the cities.

## AGENCY AND OPPORTUNITY

### ARE CHANGES IN MY LIFE FEASIBLE?

Though human behaviour is constrained by any and all of the social factors described above, the actual ability of a person to effect change in his or her life and to make independent choices is crucial for understanding vulnerability. In the social sciences, this is commonly referred to as 'agency'. Promoters and limiters of agency affect health behaviours and health outcomes. Understanding perceived levels of agency is a first essential step in understanding what is actually possible for individuals, and why they might behave in certain ways.

For example:

- **IN MEXICO CITY**, we see that agency is profoundly limited simply by a lack of access to basic resources needed for a healthy life. On the other hand, some innovative strategies to overcome individual hardship were shown to augment agency and counteract some of its limiting effects (eg where food was home-grown in a small urban space and traded for other essentials).
- **IN HOUSTON**, we see that agency is limited by the geographical constraints of the city (long commutes and long working hours restrict individual choices and possibilities at a basic level), and by a lack of resources and misconceptions about how to enhance health and resist illness.
- **IN TIANJIN**, we see how mental health impacts a person's ability to act and effect change in their life, and how receiving care in a tertiary setting can limit a person's sense of belonging to a community of care.
- **IN SHANGHAI**, we see how family and community lives can be both enhancers (people are supported and feel well-integrated) and limiters of individual agency (societal expectations pressure people into acting in certain ways that are not always beneficial to health).

## TRADITIONS AND CONVENTIONS

One of the most important cultural determinants in the assessment of urban diabetes vulnerability is the way local traditions and conventions shape action at an individual level. For example, when certain foods and beverages that are of low nutritional/high calorific value play an important part in creating social bonds, diabetes vulnerability emerges in behaviours that limit the choice of healthy foods. Here, recommending a change in diet may be ineffective, as it can create resistance and mistrust and is not impactful for either individuals or, by extension, populations. Equally, if local conventions encourage individuals to seek out healthcare only in emergency situations, community-based prevention measures may prove ineffective, even if there are good local care providers present.

For example:

- **IN MEXICO CITY**, we see how traditional gender roles limit effective self-care in men when there is no female household member present, and how some men are unable or unwilling to provide diabetes support to others.
- **IN COPENHAGEN**, we see how standard medical referral practices can act as barriers to preventive care and services.
- **IN HOUSTON**, we see how food traditions are interwoven with heritage and culture, and therefore carry meaning beyond nutrition and diet. Food rituals are often perceived as providing 'comfort' central to a common culture and heritage.
- **IN TIANJIN**, we see how belief in 'miracle cures' among some in the population can create biological risks and psychological ill health.
- **IN SHANGHAI**, we see how denying hardship is culturally valorised. This attitude prevents people from seeking help from family, friends and healthcare professionals.

## HEALTH AND ILLNESS

### IS DIABETES MY BIGGEST PROBLEM?

The way health and illness are understood locally shapes vulnerability to diabetes. Across the globe, individuals act according to existing social norms and conventional understandings of what health and illness are, and according to what a person thinks medical (biomedical or otherwise) interventions achieve. If a consensus exists that illnesses can be treated well by a good existing medical system, for example, such consensus may have a detrimental impact on public health initiatives, because individuals feel less responsible for their own care. Conversely, where no formal systems are in place, individuals may develop their own understandings of health and illness (and diabetes) detrimental to clinical care provision. Importantly, mistrust in healthcare and insurance providers or local and federal governments shapes individual action as it relates to healthcare, creating the potential for vulnerability.

For example:

- **IN MEXICO CITY**, we see how diabetes-related complications are congruent with financial constraints, barriers to access and a lack of understanding of the disease.
- **IN COPENHAGEN**, we see how diabetes is perceived as less severe than other diseases. Given the many other social and health issues encountered in everyday life, diabetes is often not highest in a person's hierarchy of need.
- **IN HOUSTON**, we see people who are at increased risk of developing diabetes but do not think so. They believe that they live a healthy life in comparison to others, meaning they do not see their own health concerns as significant.
- **IN TIANJIN AND SHANGHAI**, we see how diabetes stigma can shape individual perceptions and behaviour negatively, to the detriment of health and wellbeing.



## CHANGE AND TRANSITION

### HOW DO I ADAPT WHEN MY ENVIRONMENT CHANGES?

Experiencing change and transition have practical and psychological consequences. For those migrating from rural to urban settings, for example, adapting to a different 'cultural' environment is often stressful and can have major negative health outcomes, especially if there is no community or social support available. Furthermore, in urban areas, where neighbourhoods undergo constant change, health resources also change. Such structural instability has concrete practical consequences. Where instability is perceived, existing urban stressors are exacerbated and create both practical and psychological vulnerabilities that are culturally mediated.

For example:

- **IN MEXICO CITY**, the city's incredible growth is having an impact on an already hard-pressed infrastructure, putting high demands on local resources. At the same time, traditional gender and social roles are evolving due to societal change, with some finding it difficult to adapt.
- **IN HOUSTON**, we see how change and transition at both community and societal levels worry many participants, at times with concrete practical and psychological implications.
- **IN TIANJIN AND SHANGHAI**, we see that the recent memory of hunger and resource shortage can create an environment that is obesogenic.

## SELF AND OTHER

### TO WHOM AM I COMPARING MY OWN HEALTH?

The way a person integrates within his or her social environment and evaluates what is normative in comparison with others can create explicit vulnerabilities. For example, environments where large body size is either accepted as normal, or even as desirable (especially when based on previous experience of malnourishment and hunger), can have a significant and negative effect on various biological risk factors for diabetes. Perceptions of relative health or wellbeing also have a profound influence on both health-enhancing and health-limiting behaviours and conventions. When normative body images change, so do perceptions regarding what a 'healthy body' might look like.

For example:

- **IN MEXICO CITY**, current body image and dietary behaviours are impacted by demographic, epidemiologic and nutritional transitions.
- **IN HOUSTON**, we see how comparing your own body size and physical shape favourably to others creates a scenario where change is perceived as unnecessary.
- **IN COPENHAGEN**, we see how some people do not go to gyms and fitness clubs because they perceive themselves as 'bigger than average' and feel uncomfortable.
- **IN SHANGHAI**, we see how observance of societal conventions limits talk about having diabetes, to the extent that some people with diabetes do not know any fellow sufferers in their communities.

# A NEW UNDERSTANDING OF DIABETES

THE SOCIAL FACTORS AND CULTURAL DETERMINANTS OUTLINED HERE ARE BASED ON FINDINGS FROM LARGE-SCALE STUDIES IN FIVE EXTREMELY DIVERSE, CHALLENGING AND INTERESTING CITIES ACROSS THE GLOBE.

We are so impressed with the level of commitment from our academic partners. In record time, between continents and across cultures, we have created a network of collaboration that has already yielded some fantastic insights and, perhaps even more than that, initiated a movement that gives concrete shape to our collective desire to change urban diabetes permanently.

In-depth local analyses are currently ongoing, as we begin to build a completely new kind of knowledge database. But already our enhanced understanding of social factors and cultural determinants has made it possible to paint a more refined 'portrait of urban diabetes' as evidenced in the city-specific findings discussed throughout this document.

Most importantly, these social factors and cultural determinants allow us to understand where individuals and, by extension, populations appear on the vulnerability spectrum. While further analyses will make it possible to specify new case definitions of vulnerability for each city, our assessment of the impact of the various local and cultural determinants is already providing a first glimpse of what we can learn globally.

What, then, makes an individual vulnerable to developing diabetes and to suffering from its consequences? Importantly, vulnerability to urban diabetes is not something a person either has or does not have; it is a complex state continuously shaped by the negative and positive impacts of various external and personal factors. However, we can now answer confidently that it is the combination of the specific social factors and cultural determinants discussed here that together place a person higher (more vulnerable) or lower (less vulnerable) on the vulnerability spectrum.

Our vulnerabilities model is sensitive to local variation, while structuring experience systematically in a way that allows for global comparison. We can now create a database that is founded on solid evidence and that provides a platform for action – in Mexico City, Houston, Copenhagen, Tianjin and Shanghai, and potentially in other cities across the globe.

## REFERENCES

1. IDF. International Diabetes Federation. IDF Diabetes Atlas. 7th edn. Brussels, Belgium: *International Diabetes Federation*. 2015.
2. UNDESA. United Nations Department of Economic and Social Affairs. World Urbanization Prospects, the 2014 Revision, Highlights. 2014. 978-92-1-151517-6.
3. IDF. International Diabetes Federation. IDF Diabetes Atlas, 2nd edn. Brussels, Belgium: *International Diabetes Federation*. 2003.
4. Dyson T. The role of the demographic transition in the process of urbanization. *Popul Dev Rev*. 2011;37(Suppl 1):34–54.
5. Seto KC, Fragkias M, Guneralp B, Reilly MK. A meta-analysis of global urban land expansion. *PLoS One*. 2011;6(8):e23777.
6. Cohen B. Urbanization in developing countries: Current trends, future projections, and key challenges for sustainability. *Technology in Society*. 2006;28(1–2):63–80.
7. UNDESA. United Nations Department of Economic and Social Affairs. World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241. 2015.
8. World Bank. Fertility rate, total (births per woman) | Data | Table. 2015; <http://data.worldbank.org/indicator/SP.DYN.TFRT.IN>.
9. Mortality GBD, Causes of Death C. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015;385(9963):117–171.
10. Bunker JP. The role of medical care in contributing to health improvements within societies. *International Journal of Epidemiology*. 2001;30(6):1260–1263.
11. Puja M. Relationship between Urbanisation and Industrialisation (Essay). 2014.
12. Vlahov D, Freudenberg N, Proietti F, et al. Urban as a determinant of health. *Journal of Urban Health*. 2007;84(1):16–26.
13. McMichael AJ. The urban environment and health in a world of increasing globalization: issues for developing countries. *Bull World Health Organ*. 2000;78(9):1117–1126.
14. Bloom DE, Canning D, Fink G. Urbanization and the wealth of nations. *Science*. 2008;319(5864):772–775.
15. Tellnes G. Urbanisation and health. New challenges in health promotion and prevention. Oslo: *Unipub forlag*. 2005.
16. Bai X, Nath I, Capon A, Hasan N, Jaron D. Health and wellbeing in the changing urban environment: complex challenges, scientific responses, and the way forward. *Current Opinion in Environmental Sustainability*. 2012;4(4):465–472.
17. Kyobutungi C, Ziraba AK, Ezech A, Ye Y. The burden of disease profile of residents of Nairobi's slums: results from a demographic surveillance system. *Popul Health Metr*. 2008;6(1):1.
18. Merzel C. Gender differences in health care access indicators in an urban, low-income community. *American Journal of Public Health*. 2000;90(6):909.
19. WHO. World Health Organization. Centre for Health Development. Hidden cities: unmasking and overcoming health inequities in urban settings. *World Health Organization*; 2010.
20. Vlahov D, Galea S. Urbanization, urbanicity, and health. *J Urban Health*. 2002;79(4 Suppl 1):S1–S12.
21. Perdue WC, Gostin LO, Stone LA. Public health and the built environment: historical, empirical, and theoretical foundations for an expanded role. *J Law Med Ethics*. 2003;31(4):557–566.
22. Peterson JA. The impact of sanitary reform upon American urban planning, 1840-1890. *Journal of Social History*. 1979;83–103.
23. WHO. Prevention of diabetes mellitus. Geneva: *WHO Study Group*;1994.
24. IDF. International Diabetes Federation. Global Diabetes Plan 2011-2021. Brussels, Belgium: *International Diabetes Federation*;2012.
25. IDF. International Diabetes Federation. IDF Diabetes Atlas, 6th edn. Brussels, Belgium: *International Diabetes Federation*;2013.
26. WHO. World Health Organization. *Global health and aging (2011)*. 2012.
27. Han T, Richmond P, Avenell A, Lean M. Waist circumference reduction and cardiovascular benefits during weight loss in women. *International journal of obesity and related metabolic disorders: journal of the International Association for the Study of Obesity*. 1997;21(2):127–134.
28. Astrup A, Finer N. Redefining type 2 diabetes: 'diabesity' or 'obesity dependent diabetes mellitus'? *Obesity Reviews*. 2000;1(2):57–59.
29. Wallach JB, Rey MJ. A socioeconomic analysis of obesity and diabetes in New York City. *Prev Chronic Dis*. 2009;6(3):A108.
30. Dattilo AM, Kris-Etherton PM. Effects of weight reduction on blood lipids and lipoproteins: a meta-analysis. *The American Journal of Clinical Nutrition*. 1992;56(2):320–328.
31. Dengo AL, Dennis EA, Orr JS, et al. Arterial destiffening with weight loss in overweight and obese middle-aged and older adults. *Hypertension*. 2010;55(4):855–861.
32. Foster GD, Borradaile KE, Sanders MH, et al. A randomized study on the effect of weight loss on obstructive sleep apnea among obese patients with type 2 diabetes: the Sleep AHEAD study. *Archives of Internal Medicine*. 2009;169(17):1619–1626.
33. Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *The New England Journal of Medicine*. 2002;346(6):393–403.
34. Tuomilehto J, Lindstrom J, Eriksson JG, et al. Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *The New England Journal of Medicine*. 2001;344(18):1343–1350.
35. Wing RR, Lang W, Wadden TA, et al. Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes Care*. 2011;34(7):1481–1486.
36. Lake A, Townshend T. Obesogenic environments: exploring the built and food environments. *J R Soc Promot Health*. 2006;126(6):262–267.
37. Whiting D, Unwin N, Roglic G. Diabetes: equity and social determinants. Equity, social determinants and public health programmes. 2010;77.
38. Urban Versus Rural Health – Global Health University. <http://www.uniteforsight.org/global-health-university/urban-rural-health>.
39. Reardon T, Timmer CP, Barrett CB, Berdegue J. The rise of supermarkets in Africa, Asia, and Latin America. *American journal of agricultural economics*. 2003;85(5):1140–1146.
40. WHO. World Health Organization. Global strategy on diet, physical activity and health: a framework to monitor and evaluate implementation. 2006.
41. NIH. National Institutes of Health. Clinical guidelines on the identification, evaluation and treatment of overweight and obesity in adults. 1998; [http://www.nhlbi.nih.gov/guidelines/obesity/ob\\_gdlns.pdf](http://www.nhlbi.nih.gov/guidelines/obesity/ob_gdlns.pdf).
42. NHC. National Health Committee. The social, cultural and economic determinants of health in New Zealand: action to improve health. *Wellington: National Advisory Committee on Health and Disability*; 1998.
43. WHO. World Health Organization | What are social determinants of health? WHO. 2015.
44. Lowitja Institute. Cultural Determinants of Aboriginal and Torres Strait Islander Health Roundtable. Melbourne: *The Lowitja Institute*;2014.
45. Napier 2015, Berlin World Health Summit 2015. 2015.
46. Poulsen P, Grunnet LG, Pilgaard K, et al. Increased risk of type 2 diabetes in elderly twins. *Diabetes*. 2009;58(6):1350–1355.
47. Shai I, Jiang R, Manson JE, et al. Ethnicity, Obesity, and Risk of Type 2 Diabetes in Women A 20-year follow-up study. *Diabetes care*. 2006;29(7):1585–1590.
48. WHO. World Health Organization. Global recommendations on physical activity for health. 2010.
49. Kovacs Burns K, Nicolucci A, Holt R, et al. Diabetes Attitudes, Wishes and Needs second study (DAWN2™): Cross-national benchmarking indicators for family members living with people with diabetes. *Diabetic Medicine*. 2013;30(7):778–788.
50. Seuring T, Archangelidi O, Suhrcke M. The Economic Costs of Type 2 Diabetes: A Global Systematic Review. *Pharmacoeconomics*. 2015;33(8):811–831.
51. Weinger K, Lee J. Psychosocial and psychiatric challenges of diabetes mellitus. *Nurs Clin North Am*. 2006;41(4):667–680, viii.
52. GBD. Global Burden of Disease Study Collaborators. Mortality Causes of Death. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet*. 2015;385(9963):117–171.
53. Klein R. The epidemiology of diabetic retinopathy. *Diabetic Retinopathy: Springer*; 2008:67–107.
54. Satirapoj B. Nephropathy in diabetes. *Diabetes: Springer*; 2013:107–122.
55. NSA. National Stroke Association. Understanding the connection between diabetes and the increased risk of stroke. [www.stroke.org](http://www.stroke.org): *National Stroke Association*; 2013.
56. Roglic G, Unwin N, Bennett PH, et al. The burden of mortality attributable to diabetes: realistic estimates for the year 2000. *Diabetes Care*. 2005;28(9):2130–2135.
57. Unwin N. Epidemiology of lower extremity amputation in centres in Europe, North America and East Asia. *British Journal of Surgery*. 2000;87(3):328–337.
58. Hart JT. Rule of halves: implications of increasing diagnosis and reducing dropout for future workload and prescribing costs in primary care. *Br J Gen Pract*. 1992;42(356):116–119.
59. Napier D. Diabetes Vulnerability Assessment Tool: Modifiable risk factors in urban areas. London: UCL; 2014.
60. Texas: Institute for Health Policy, The University of Texas School of Public Health. Health of Houston Survey. HHS 2010 A First Look. Houston. 2011.
61. Sánchez-Barriga JJ. Mortality trends from diabetes mellitus in the seven socioeconomic regions of Mexico, 2000–2007. *Revista Panamericana de Salud Pública*. 2010;28(5):368–375.
62. Hammer-Helmich L, Buhelt LP, Hansen BH, Andreassen AH, Robinson KM, Glümer C. Uddrag af Sundhedsprofil 2010 for kommuner i Region Hovedstaden (i alt 29 kommuner). 2011.
63. Zhang Y, Wang J, Zhi X, Liu X, Zhu H. [An epidemiological investigation on overweight and obesity in adults from Tianjin city]. *Zhonghua Liu Xing Bing Xue Za Zhi*. 2009;30(11):1147–1151.
64. Hou X, Liu Y, Lu H, et al. Ten-year changes in the prevalence of overweight, obesity and central obesity among the Chinese adults in urban Shanghai, 1998–2007 – comparison of two cross-sectional surveys. *BMC public health*. 2013;13(1):1064.
65. Miller A, Ford K S. Mexico City Congestion.
66. Vergara-Castaneda A, Castillo-Martinez L, Colin-Ramirez E, Orea-Tejeda A. Overweight, obesity, high blood pressure and lifestyle factors among Mexican children and their parents. *Environ Health Prev Med*. 2010;15(6):358–366.



67. Sistema de Transporte Colectivo de la Ciudad de México, Metro. 2015; <http://www.metro.df.gob.mx/operacion/cifrasoperacion.html>.
68. Demographia World Urban Areas: Built-Up Urban Areas or World Agglomerations. 2015; <http://www.demographia.com/db-worldua.pdf>.
69. Bender A. The World's Top 10 Cities For Street Food – Forbes. 2015.
70. UNDESA. United Nations Department of Economic and Social Affairs. World Urbanization Prospects: The 1999 Revision. Vol 194: *United Nations Publications*; 2001.
71. UNDESA. United Nations, Department of Economic and Social Affairs (DESA), Population Division. World urbanization prospects: the 2011 revision. *Population Estimates and Projections Section*, New York. 2014.
72. Izazola H. Migration to and from Mexico City, 1995–2000. *Environment and Urbanization*. 2004;16(1):211–230.
73. Curbanisation. Mexico City: Urban growth and urbanisation. 2015; <http://curbanisation.weebly.com/case-study-mexico-city.html>.
74. Taking control of air pollution in Mexico city. 2015; <http://www.idrc.ca/EN/Resources/Publications/Pages/ArticleDetails.aspx?PublicationID=740>.
75. Barquera S TM, López-Ridaura R, et al. Preliminary report ERDM-DF. *Instituto Nacional de Salud Pública*; 2015.
76. IDF. International Diabetes Federation. IDF Diabetes Atlas, 6th edn. 2014 Update. Brussels, Belgium: *International Diabetes Federation*; 2014.
77. Rivera Dommarco J, Campos-Nonato I, Barquera-Cervera S, et al. Epidemiología de la obesidad en México: magnitud, distribución, tendencias y factores de riesgo. Obesidad en México. Recomendaciones para una política de Estado. *Ciudad de México: UNAM*. 2012:79–98.
78. INSP. Instituto Nacional de Salud Pública. ENSANUT 2012: Evidence for public health policy – Obesity in adults: future challenges. Centro de Investigación en Nutrición y Salud. Instituto Nacional de Salud Pública. México; 2012.
79. Rivera JA, Barquera S, Gonzalez-Cossio T, Olaiz G, Sepulveda J. Nutrition transition in Mexico and in other Latin American countries. *Nutr Rev*. 2004;62(7 Pt 2):S149–157.
80. Bridle-Fitzpatrick S. Food deserts or food swamps?: A mixed-methods study of local food environments in a Mexican city. *Soc Sci Med*. 2015;142:202–213.
81. Barquera S, Campos I, Rivera JA. Mexico attempts to tackle obesity: the process, results, push backs and future challenges. *Obes Rev*. 2013;14 Suppl 2(S2):69–78.
82. Stern D, Piernas C, Barquera S, Rivera JA, Popkin BM. Caloric beverages were major sources of energy among children and adults in Mexico, 1999–2012. *The Journal of nutrition*. 2014;144(6):949–956.
83. IMCO. Instituto Mexicano para la Competitividad A.C. (IMCO). Kilos de más, pesos de menos: Los costos de la obesidad en México. 2014.
84. Meaney A, Ceballos-Reyes G, Gutierrez-Salmean G, et al. Cardiovascular risk factors in a Mexican middle-class urban population. The Lindavista Study. Baseline data. *Arch Cardiol Mex*. 2013;83(4):249–256.
85. Novo Nordisk, Data on file. 2015.
86. Rtveldadze K, Marsh T, Barquera S, et al. Obesity prevalence in Mexico: impact on health and economic burden. *Public health nutrition*. 2014;17(01):233–239.
87. Diderichsen F, Brønnum-Hansen H, Schnohr CW. *Folkesundheden i København 2014 – i korte træk*. Sundhedsforvaltningen, Københavns Kommune; 2014.
88. European Green Capital. 2015; <http://ec.europa.eu/environment/europeangreencapital/about-the-award/index.html> - Background%20to%20the%20European%20Green%20Capital%20Award.
89. Copenhagen-Short-Leaflet\_Web.pdf. 2015; [http://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2012/07/Copenhagen-Short-Leaflet\\_Web.pdf](http://ec.europa.eu/environment/europeangreencapital/wp-content/uploads/2012/07/Copenhagen-Short-Leaflet_Web.pdf).
90. Copenhagen-Bicycle-Account-2014.pdf. 2015; <http://www.cycling-embassy.dk/wp-content/uploads/2015/05/Copenhagen-Bicycle-Account-2014.pdf>.
91. Danmarks Statistik, Københavns Kommune (2014 befolkningsprognose). 2014.
92. Holm AL, Andersen GS, Jørgensen ME, Diderichsen F. Cities Changing Diabetes. Rule of Halves analysis for Copenhagen. Department of Public Health, University of Copenhagen and Steno Diabetes Center. 2015.
93. Robinson KM, Lykke M, Hansen BH, et al. Sundhedsprofil for region og kommuner 2013 – Sammenfatning. Region Hovedstaden, Koncern Plan, Udvikling og Kvalitet; 2014.
94. Houston – Downtown Commute Survey 2013. Central Houston Inc; 2013.
95. Houston Visitors Bureau. Houston Facts & Figures. 2015.
96. City of Houston. Official Site for Houston, Texas. Facts and Figures. 2015; <http://www.houstontx.gov/about/houston/houstonfacts.html>.
97. City Mayors: Largest 100 US cities. 2015; [http://www.citymayors.com/gratis/uscities\\_100.html](http://www.citymayors.com/gratis/uscities_100.html).
98. Carlyle E. America's Fastest-Growing Cities 2015 – Forbes. 2015.
99. GHP. Greater Houston Partnership. The Economy at a Glance: Houston. 2015.
100. WEF. World Economic Forum. The Future of Urban Development Initiative: Tianjin Champion City Strategy. 2013.
101. Tianjin the third Largest City in China. 2015; <http://english.enorth.com.cn/FnMM.htm>.
102. Tianjin – Live pollution and air quality report. 2015.
103. Newgeography. China's shifting population growth patterns. 2015; <http://www.newgeography.com/content/004904-chinas-shifting-population-growth-patterns>.
104. Chinatoday.com. Home – Chinese Cities and Province Information – Tianjin 2015; <http://www.chinatoday.com/city/tianjin.htm>.
105. Ning X, Zhan C, Yang Y, et al. Secular Trends in Prevalence of Overweight and Obesity among Adults in Rural Tianjin, China from 1991 to 2011: A Population-Based Study. *PLoS one*. 2014;9(12):e116019.
106. Planetizen.com. The Weight of Development: Could Shanghai be Sinking? 2013; <http://www.planetizen.com/node/63550>.
107. Shanghai List. Expats flock to Shanghai in greater numbers than ever. 2014; <http://shanghaiist.com/2014/09/11/expats-flock-to-shanghai-in-great-numbers-than-ever.php>, 2015.
108. WSC. World Shipping Council. Top 50 world container ports. 2015.
109. Wow Travel. 10 most extensive metro systems in the world. 2015; <http://wowtravel.me/10-most-extensive-metro-systems-in-the-world/>.
110. China.org. Negligible drop in Shanghai average life expectancy. 2015; [http://www.china.org.cn/china/2015-02/12/content\\_34803656.htm](http://www.china.org.cn/china/2015-02/12/content_34803656.htm).
111. Zhao S, Da L, Tang Z, Fang H, Song K, Fang J. Ecological consequences of rapid urban expansion: Shanghai, China. *Frontiers in Ecology and the Environment*. 2006;4(7):341–346.
112. Cui L, Shi J. Urbanization and its environmental effects in Shanghai, China. *Urban Climate*. 2012;2:1–15.
113. Kan H, Chen B. Particulate air pollution in urban areas of Shanghai, China: health-based economic assessment. *Sci Total Environ*. 2004;322(1–3):71–79.
114. Bloomberg News. Shanghai Warns Children to Stay Indoors on Haze, PM2.5 Surge. bloomberg.com: Bloomberg News; 2013.
115. Differencesbetween.com. Difference between Shanghai and Beijing. <http://www.differencesbetween.info/difference-between-shanghai-and-beijing>.
116. Centers for Disease Control and Prevention Shanghai. [The Chronic Disease Risk Factor Surveillance in Shanghai, 2013], Shanghai CDC. 2013.
117. Hou X, Liu Y, Lu H, et al. Ten-year changes in the prevalence of overweight, obesity and central obesity among the Chinese adults in urban Shanghai, 1998–2007 – comparison of two cross-sectional surveys. *BMC public health*. 2013;13(1):1064.
118. WHO. World Health Organization. Frequently Asked Questions | Social Determinants of Health | NCHSTP | CDC. (n.d.). Retrieved November 3, 2015, from <http://www.cdc.gov/nchstp/socialdeterminants/faq.html#>.

## PREVALENCE AND COST PROJECTIONS

The prevalence projections for each of the five cities for the years 2015 to 2040 are made in four scenarios:

- Baseline, where the projected background population is age- and gender-standardised and incidence and mortality rates for each age and gender group from 2015 to 2040 are kept constant.
- Ageing, where the population forecasts are used as they are, and incidence grows and mortality decreases in the five cities.
- Obesity, where projections of obesity rates for the five cities are factored into the age- and gender-specific incidence rates.
- Intervention, where a hypothetical 50% reduction in the projected growth of obesity rates throughout the projection through primary preventive measures is modelled.

For each of the scenarios in each of the five cities, average per patient indirect and direct cost estimates derived from published literature and discounted to 2015 are applied to prevalence forecasts to produce estimates of the cost implications of each scenario.

The baseline scenario projections still mean that the prevalence of diabetes is growing in all the five cities. The driver of the prevalence growth in the baseline scenarios is called epidemiological disequilibrium. It means that more people develop diabetes than die from diabetes every year.

So, even as incidence rates and mortality rates are kept constant throughout the projections, the prevalence of diabetes grows in all five cities.

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