cities
changing
diabetes

RULE OF HALVES ANALYSIS

HOW-TO GUIDE

novo nordisk®

REGION H
Steno Diabetes Center
Copenhagen

UCL

CITIES ARE A FOCAL POINT FOR **TACKLING DIABETES**

415 MILLION PEOPLE HAVE DIABETES WORLDWIDE[1]

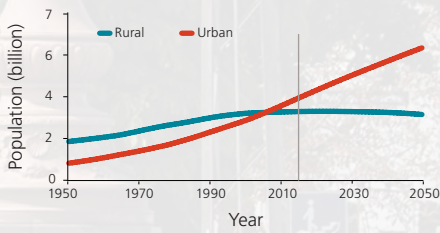**2/3** OF PEOPLE WITH DIABETES **LIVE IN CITIES**[1]

BY 2040, **642 MILLION PEOPLE** WILL HAVE DIABETES[1]

74% OF THEM WILL LIVE IN CITIES[1]

URBANISATION IS ONE OF THE **MOST SIGNIFICANT DEMOGRAPHIC SHIFTS** OF THE PAST CENTURY[2]

COPENHAGEN
Denmark

CONTENTS

INTRODUCTION

THE INCREASE IN DIABETES IS ONE OF TODAY'S MAJOR HEALTH CHALLENGES, A GLOBAL EMERGENCY IN SLOW MOTION.
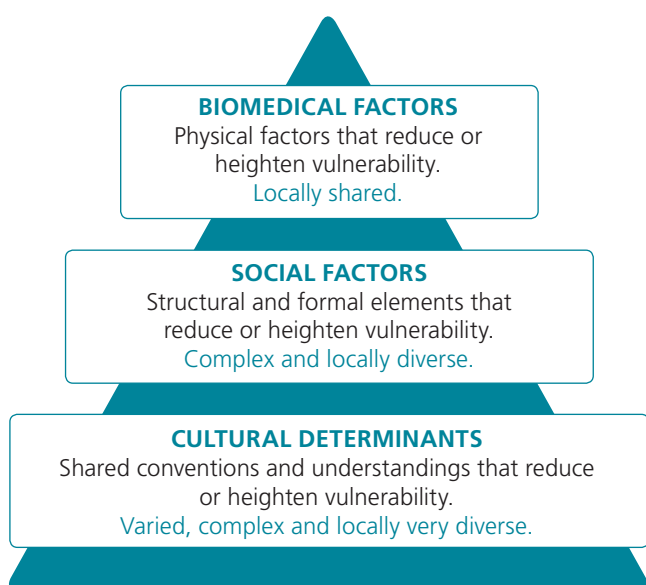
Worldwide, 415 million people are living with diabetes.[1] Without concerted action this is estimated to rise to 642 million by 2040.[1] Today, more than half of the world's population live in urban areas,[2] including two-thirds of people with diabetes.[1] This makes cities an important focal point for studying and tackling diabetes. However, taking action requires a better understanding of what drives diabetes in urban areas.

DRIVERS OF THE DIABETES PANDEMIC

Although each person starts out with their own genetic health profile, several social factors and cultural determinants come into play in an individual's overall health throughout their life (Figure 1). 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 recognised for their relationship with the soaring incidence of type 2 diabetes, as well as the opportunities they present for us to counter it.

FIGURE 1 THE UNDERLYING DRIVERS OF THE DIABETES PANDEMIC[3]

BIOMEDICAL FACTORS
Physical factors that reduce or heighten vulnerability.
Locally shared.

SOCIAL FACTORS
Structural and formal elements that reduce or heighten vulnerability.
Complex and locally diverse.

CULTURAL DETERMINANTS
Shared conventions and understandings that reduce or heighten vulnerability.
Varied, complex and locally very diverse.

CITIES CHANGING DIABETES PROGRAMME

Cities Changing Diabetes is a commitment to push for urgent action against diabetes on a global scale. The programme is mapping the extent of the diabetes challenge in cities and working to generate an understanding of the drivers behind this pandemic.

The aim of the programme is to map the problem, share solutions and drive concrete actions to fight the diabetes challenge in cities around the world.

RESEARCH METHODS

RULE OF HALVES
QUANTITATIVE METHOD FOR MAPPING THE EXTENT OF THE CHALLENGE
The Rule of Halves analysis is a quantitative estimation of the diabetes burden in a specific population or community.

DIABETES VULNERABILITY ASSESSMENT
QUALITATIVE METHOD FOR UNVEILING THE SOCIAL FACTORS AND CULTURAL DETERMINANTS
The Diabetes Vulnerability Assessment identifies the social factors and cultural determinants of diabetes among people living with the condition.

URBAN DIABETES RISK ASSESSMENT
MIXED METHOD FOR PRIORITISING SOCIAL FACTORS AND CULTURAL DETERMINANTS FOR INTERVENTION
The Urban Diabetes Risk Assessment is a comprehensive data collection and analysis instrument developed to explore priorities, attitudes, and shared points of views about diabetes, health, and wellbeing of people living with diabetes.

INFOBOX A MULTI-PARTNER INITIATIVE

Cities Changing Diabetes is a partnership programme to address the urban diabetes challenge. Initiated by Novo Nordisk in 2014, the programme is a response to the dramatic rise of urban diabetes. The programme has been developed in partnership with University College London and Steno Diabetes Center Copenhagen, as well as a range of local partners including the diabetes and public health community, city governments, academic institutions, city experts from a variety of fields and civil society organisations.

To learn more about the Cities Changing Diabetes programme visit CitiesChangingDiabetes.com

THE RULE OF HALVES ANALYSIS

The Rule of Halves is a theoretical framework used to describe the burden of diabetes and the unmet clinical needs along the diabetes treatment pathway. The framework dates back to a published article by Hart in 1992.[4]

The Rule of Halves states that (Figure 2):

- Half the people with diabetes are not diagnosed
- Half of those diagnosed are not receiving care
- Half of those receiving care are not achieving treatment targets
- Half of those achieving treatment targets are not achieving desired outcomes, ie, living a life free of complications
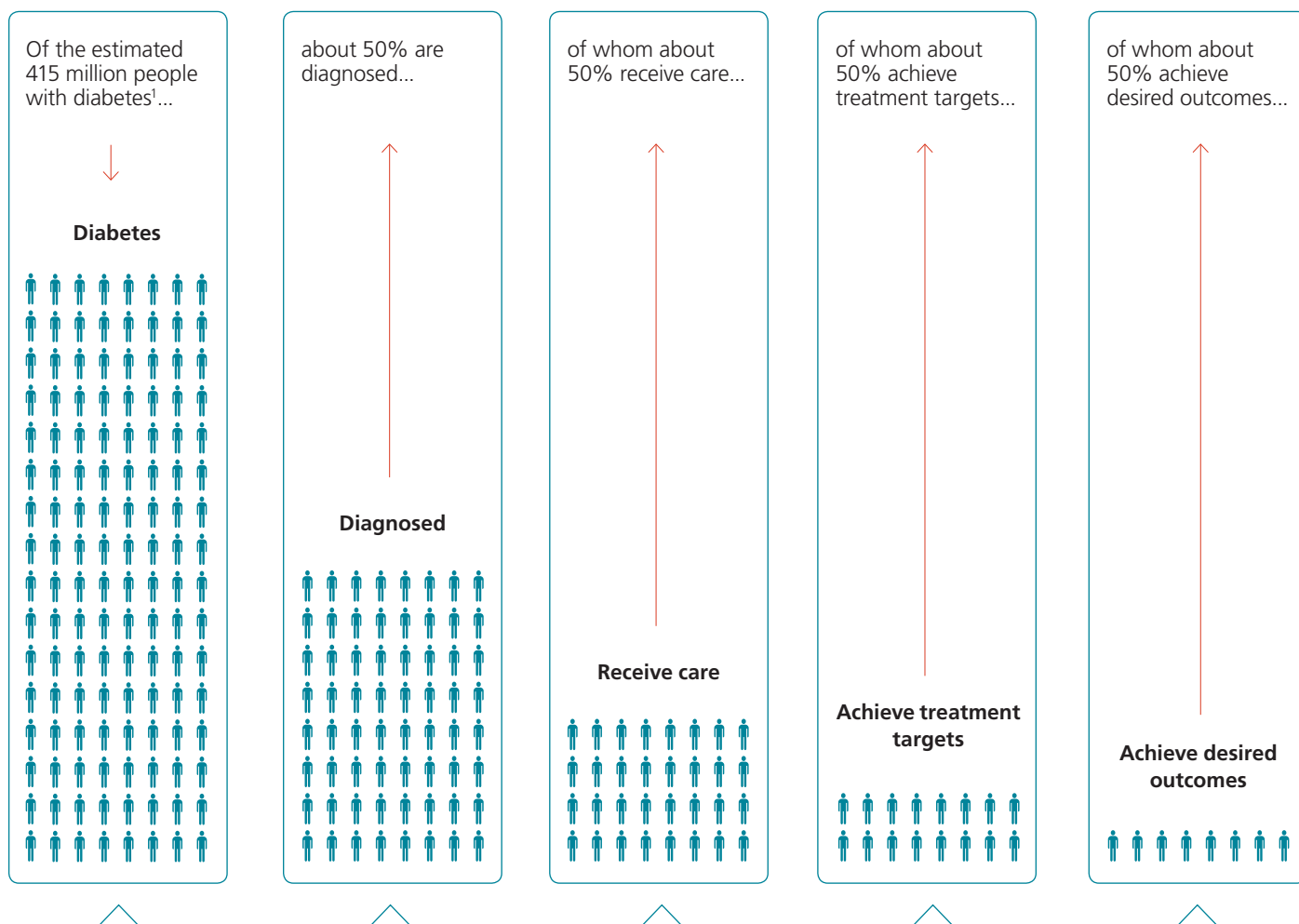
In an ideal world, the Rule of Halves framework would show only marginal differences between the five pillars, as this would mean that the clinical needs of people with diabetes are being met and that diabetes-related complications were being avoided or delayed.

Why perform a Rule of Halves analysis?
The Rule of Halves still largely holds true for many chronic diseases[4] and thus serves as a good indicator for mapping the unmet clinical needs in diabetes of a specific population. It analyses the status of diabetes in a population and can indicate along which pillars interventions are likely to have the greatest impact. Thus, a Rule of Halves analysis can serve as a prioritisation tool for decision-makers and other stakeholders.

FIGURE 2 THE RULE OF HALVES FRAMEWORK[4]

The Rule of Halves framework illustrates the global diabetes burden and indicates where the largest unmet clinical needs are.

Of the estimated 415 million people with diabetes[1]...

Diabetes

about 50% are diagnosed...

Diagnosed

of whom about 50% receive care...

Receive care

of whom about 50% achieve treatment targets...

Achieve treatment targets

of whom about 50% achieve desired outcomes...

Achieve desired outcomes

Pillar one
The first pillar shows the number of people with diabetes – diagnosed and undiagnosed.

Pillar two
The second pillar estimates that only half of all people with diabetes are diagnosed.

Pillar three
The third pillar states that of all people with diagnosed diabetes, only half receive care.

Pillar four
The fourth pillar shows that only half of the people receiving treatment for diabetes achieve treatment targets.

Pillar five
The fifth pillar shows that only half of the people with diabetes achieving targets achieve desired outcomes.

STEP-BY-STEP GUIDE
TO PERFORMING A
RULE OF HALVES ANALYSIS

Performing a Rule of Halves analysis requires valid and scientifically sound epidemiological data on diabetes and diabetes-related health services and outcomes.

To perform a Rule of Halves analysis the size of each of the five pillars should be estimated as an absolute number of people. Then, the relative proportion of each pillar needs to be calculated in relation to the antecedent pillar.

There are four phases to conducting a Rule of Halves analysis. Phase one, deals with planning, while phase two involves data collection. Phase three has to do with analysing the data and populating the Rule of Halves. Lastly, phase four is about reporting the data. This manual provides guidance and examples for each of the four phases.

COPENHAGEN
Denmark

ROADMAP
TO PERFORMING A RULE OF HALVES ANALYSIS
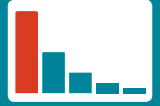
1 PHASE ONE
Study planning

DEFINE THE TARGET POPULATION

Define the target population for the analysis

DEFINE THE GEOGRAPHIC SCOPE

Define the geographical area that the analysis will apply to

DETERMINE THE DATA NEEDED TO POPULATE A RULE OF HALVES

Consider how, and from where, data will be collected and if any ethnic approvals are required

2 PHASE TWO
Data collection

COLLECT NEW DATA

Collect new data for any of the data points where existing data is not available

USE EXISTING DATA

Where possible, use the existing data for each of the data points across the rule of halves

EVALUATE THE AVAILABILITY OF DATA

A Rule of Halves analysis can be based on existing data, new data (specifically collected for the analysis) or a combination of both

3 PHASE THREE
Data analysis

ANALYSE THE DATA

Analyse the data in preparation to populate the Rule of Halves

POPULATE THE RULE OF HALVES

PILLAR 1
How many people have diabetes?

PILLAR 2
Of all the people with diabetes, what percentage have been diagnosed?

PILLAR 3
Of all the people with diagnosed diabetes, what percentage receive treatment?

PILLAR 4
Of all the people with diabetes receiving treatment, what percentage achieve treatment targets?

PILLAR 5
Of all the people with diabetes achieving treatment targets, what percentage have good health outcomes?

4 PHASE FOUR
Reporting

PUBLISH

Consider publishing the results in a scientific peer-reviewed journal and presenting the findings at conferences and meetings

PRODUCE A REPORT

On completion of the analysis produce a report, which can be used to record and share the findings

▶1 PHASE ONE
PLAN THE STUDY

👤 DEFINE THE TARGET POPULATION

Defining the target population for the analysis includes elements such as:

* Attributes of the population (age range, diabetes status and type of diabetes)
* Type of diabetes (type 1, type 2 or both)

🌐 DEFINE THE GEOGRAPHIC SCOPE OF THE ANALYSIS

Define the geographic scope of the area that will form the basis for the analysis. There can be considerable confusion over the term "city" and urban terms, such as "urban area" and "metropolitan area." This can result in misleading comparisons and inaccurate academic research. Therefore, it is important to define the geographic area and the population that the analysis will apply to up front, before collecting or analysing any data.

❓ DETERMINE THE DATA NEEDED TO POPULATE THE RULE OF HALVES

Some critical questions that should be considered before initiating a data collection process include:

PILLAR 1 PEOPLE WITH DIABETES IN TOTAL
(diagnosed and undiagnosed)
Are there existing estimates or data that indicate the number of people with diabetes for the population and geographical area in scope?

PILLAR 2 PEOPLE WITH DIAGNOSED DIABETES
Are there existing estimates or data that indicate the level of diagnosis of diabetes for the population and geographical area in scope?

PILLAR 3 PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED AND RECEIVE CARE
How will "receive care" be defined, ie, does the pillar include people receiving pharmacological intervention exclusively or does it also includes lifestyle intervention?

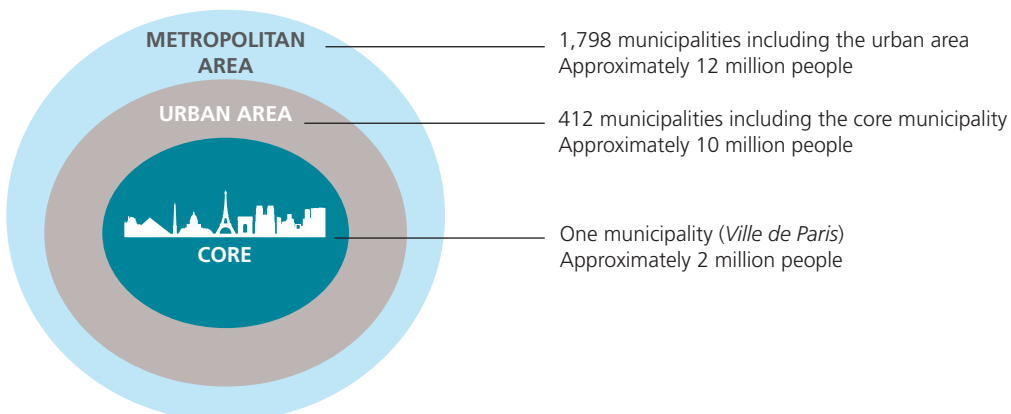**PILLAR 4** PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED, RECEIVE CARE AND ACHIEVE TREATMENT TARGETS
How will "treatment targets" be defined? In many cases treatment targets are defined as follows:
* Adults with type 1 diabetes is $HbA_{1c} < 6.5\%$
* Adults with type 2 diabetes $HbA_{1c} < 7.0\%$

PILLAR 5 PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED, RECEIVE CARE, ACHIEVE TREATMENT TARGETS AND WHO HAVE NO COMPLICATIONS
How will "desired outcomes" be defined, ie, are there specific diabetes-related complications that will be included or excluded (for example: hypertension or hypoglycaemic events)?

FIGURE 3 ILLUSTRATIVE EXAMPLE OF AN URBAN AREA (PARIS, FRANCE)

METROPOLITAN AREA — 1,798 municipalities including the urban area
Approximately 12 million people

URBAN AREA — 412 municipalities including the core municipality
Approximately 10 million people

CORE — One municipality (*Ville de Paris*)
Approximately 2 million people

SOURCE: Adapted from *Demographia – Definition of Urban Terms, 2012*.

▶2 PHASE TWO
DATA COLLECTION

EVALUATE THE AVAILABILITY OF DATA

A Rule of Halves analysis can be based on existing data, new data (specifically collected for the analysis) or a combination of both.

Consider conducting a literature review to determine what published data are available and if there is a need to collect new data.

USE EXISTING DATA

Based on the decisions made in phase one regarding target population, geographic area and scope of the pillars, identify what data are available to estimate the five pillars. For each of the five Rule of Halves pillars, more than one data source could be relevant to get the most reliable and valid estimation. Optimally, the different pillars should be estimated based on the same source. However, often it is not possible to use a single source for all pillars. Therefore, the methodology and sources used to calculate each pillar must be documented.

Possible data sources include:
- Registries/databases/health surveys/population statistics/health service data/disease registries/prescription data/claims data/
- Peer-review publications
- Reports

Where possible, use only the most recent published data, preferably from the last five years. Be aware that publications may rely on data preceding the actual publication date.

The analysis should critically assess and report on the quality of the data sources, and the reliability and validity of the data.

NOTE: *Refer to Appendix 1 and the example of the Rule of Halves from Copenhagen for more detail on using existing data.*

COLLECT NEW DATA

If existing data for the defined population is not available, or insufficient to complete a Rule of Halves analysis, it may be necessary to collect new data. Depending on which pillars of the Rule of Halves require additional data, data collection can take the form of either:

- The collection and analysis of blood samples
- A questionnaire about diabetes status, treatment, treatment outcomes and presence of diabetes-related complications
- A combination of both

Ethics approval
A formal ethics approval process is typically required to collect blood samples. Furthermore, all blood samples should be collected by trained personnel and materials should be handled according to national regulations.

NOTE: *Refer to the Appendix 1 and the Rule of Halves from Mexico City for more detail on collecting new data.*

NOTES:

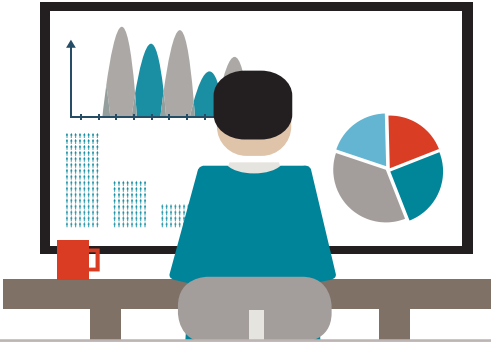_____

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ANALYSE THE DATA

On completion of the data collection phase, the data should be analysed and the Rule of Halves pillars populated. Conduct the analysis by combining the various data sources to determine the overall population number for each of the five pillars.

For some geographical areas, it may not be possible to calculate all pillars of the Rule of Halves based on new or existing data. In these cases, it should be carefully considered whether to apply the general Rule of Halves framework (ie, half the value of the antecedent pillar) to estimate the size of a pillar. One should carefully consider the following:

• The objective of the Rule of Halves is to inform stakeholders of gaps in diabetes care in the chosen geographic area. Therefore, to have a meaningful dialogue with stakeholders, it is important to have populated the Rule of Halves using local data that is representative of the target population. A Rule of Halves calculated following the general framework will carry less weight when being used to inform stakeholders of gaps in diabetes care.

• If there is a lack of publicly available data on the diabetes burden for the chosen population, then consider using the gap in data as a platform to engage with stakeholders. Quantifying the burden of diabetes is an important first step to understanding where to invest in interventions. One possibility is to advocate for further research into the burden of diabetes in your city, which could, in turn, inform future interventions.

POPULATE THE RULE OF HALVES

The size of each of the pillars should be estimated as an absolute number of people based on the data. Then the relative proportion of each pillar needs to be calculated in relation to the antecedent pillar.

NOTES:

PRODUCE A REPORT

Following the completion of the Rule of Halves analysis, it is recommended that an internal research report is produced. This can serve as a basis for further communication of the findings to local stakeholders, scientific dissemination and publication planning, follow-up research and intervention design.

The report should follow a standard scientific publication outline:

1. Introduction
   - Including background to topic
   - Existing data on the city of interest (eg, summary of a Rule-of-Halves analysis)
   - Background on the Cities Changing Diabetes collaboration

2. Methods
   - Rationale for study
   - Objectives
   - Outline of methodological principles
   - Overview study protocol and methodology

3. Results
   - Description of the participants
   - Description of major themes and factors that have emerged from the research
   - Impact of local factors on diabetes and health vulnerabilities
   - New insights

4. Discussion
   - Synthesis of results
   - Limitations
   - Next steps

PUBLISH

Consider how the findings can be made accessible and shared broadly with stakeholders. Writing an article for a scientific peer-reviewed journal and presenting an abstract and poster at a relevant scientific conference are good ways of sharing the Rule of Halves results and making them accessible to other stakeholders.
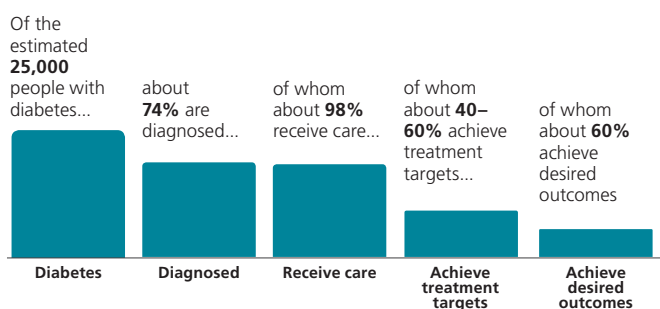
NOTES:

APPENDIX
RULE OF HALVES EXAMPLES FROM CITIES CHANGING DIABETES

COPENHAGEN RULE OF HALVES ANALYSIS BASED ON EXISTING DATA[5]

FIGURE 4 RULE OF HALVES FOR COPENHAGEN, DENMARK

Of the estimated **25,000** people with diabetes... about **74%** are diagnosed... of whom about **98%** receive care... of whom about **40–60%** achieve treatment targets... of whom about **60%** achieve desired outcomes

Diabetes | Diagnosed | Receive care | Achieve treatment targets | Achieve desired outcomes

PHASE ONE: PLAN THE STUDY

For Copenhagen, the Rule of Halves is based on existing published research, registries, and databases and covers type 1 and type 2 diabetes among adults over the age of 16 in the Municipality of Copenhagen. The research was performed by University of Copenhagen, Department of Public Health, and Steno Diabetes Center Copenhagen.

To quantify the prevalence of diabetes risk factors and pre-diabetes in Copenhagen an additional pillar (pillar zero) was added to the Rule of Halves.

To determine which data points were required, the researchers identified key research questions for each pillar. Overall, 13 research questions were formulated to guide the selection of data sources and analysis (Table 1).

TABLE 1 RULE OF HALVES RESEARCH QUESTIONS FOR COPENHAGEN

RESEARCH QUESTION	DATA SOURCES
PILLAR 0: PEOPLE AT RISK OF DEVELOPING TYPE 2 DIABETES	
What is the prevalence of type 2 diabetes risk factors across demographic, socioeconomic and Copenhagen-subareas?	• Health Profile 2010 & 2013 • CAMB
What is the prevalence of prediabetes across demographic and socioeconomic groups?	• CAMB
What proportion of those with high diabetes risk receive general preventive care?	• Health Profile 2010 & 2013

PILLAR 1: PEOPLE WITH DIABETES IN TOTAL (DIAGNOSED AND UNDIAGNOSED)	
What is the prevalence of type 2 diabetes and what is the proportion of undiagnosed disease across demographic and socioeconomic groups?	• CAMB
PILLAR 2: PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED	
What is the prevalence of self-reported diabetes across demographic, socioeconomic and Copenhagen-subareas?	• Health Profile 2010 & 2013 • CAMB
PILLAR 3: PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED AND RECEIVE CARE	
What is the proportion of those diagnosed with type 2 diabetes receiving care in the primary sector?	• DVDD
What is the prevalence of pharmaceutical diabetes treatment and which demographic and socioeconomic factors determine treatment?	• LSR
What is the prevalence of diabetes treatment in the secondary sector and which demographic and socioeconomic factors determine treatment?	• LPR
What is the proportion of those with type 2 diabetes receiving appropriate (diabetes-specific) care?	• DVDD
What is the proportion of those with type 2 diabetes receiving general (non-diabetes specific) preventive guidance or interventions?	• Health Profile 2010 & 2013
PILLAR 4: PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED, RECEIVE CARE AND ACHIEVE TREATMENT TARGETS	
What proportion of those treated for type 2 diabetes have well-regulated HbA_{1c}, cholesterol and blood pressure levels?	• DVDD • CAMB
PILLAR 5: PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED, RECEIVE CARE, ACHIEVE TREATMENT TARGETS AND WHO HAVE NO COMPLICATIONS	
What are the incidence rate and proportion of those treated for type 2 diabetes without microvascular complications (retinopathy, nephropathy and neuropathy)?	• DVDD
What are the incidence rate and proportion of those treated for type 2 diabetes without macrovascular complications (ischaemic heart disease, peripheral arterial disease and cardiovascular disease)?	• Health Profile 2010 & 2013 • CAMB • DVDD • LPR • LSR

CAMB - Copenhagen Ageing and Midlife Biobank

National Patient Register (Danish abbreviation LPR)

DVDD - The Danish Adult Diabetes Database

LSR - Register of Medicinal Product Statistics (Danish abbreviation LSR)

PHASE TWO: DATA COLLECTION

Below is an overview of the data sources used:

HEALTH PROFILE 2010 AND 2013

The Regional Health Profile is a recurring postal questionnaire survey conducted among a representative sample of citizens aged 16 or above. The Health Profile presents self-reported data on the health, sickness and health behaviour.

For the Rule of Halves analysis, data from the surveys limited to respondents living in the Municipality of Copenhagen were used. A range of variables was taken from the datasets, including diabetes outcomes, physiological and behavioural risk factors, demographics and socioeconomic status, and diabetes complications.

CAMB – COPENHAGEN AGEING AND MIDLIFE BIOBANK

The Copenhagen Ageing and Midlife Biobank (CAMB) is a Danish population-based study, combining detailed life-course information with measures of physiological functioning and health. CAMB is based on three existing Danish cohorts: the Metropolit 1953 Male Birth Cohort, the Danish Longitudinal Study of Work, Unemployment and Health, and the Copenhagen Perinatal Cohort. All cohorts included participants from the Greater Copenhagen area, and all participants were between the ages of 49 and 63.

For the Rule of Halves analysis, a range of variables was taken from the datasets including diabetes outcomes, physiological and behavioural risk factors and demographics and socioeconomic status.

NATIONAL HEALTH REGISTER DATA (LPR AND LSR)

The National Patient Register (Danish abbreviation LPR) covers all admissions and outpatient treatments at public somatic hospital departments during each calendar year for the entire Danish population. The register stores information on admission and discharge, type of hospitalisation, and main diagnosis.

The Register of Medicinal Product Statistics (Danish abbreviation LSR) contains information about the total sales of medicinal products in Denmark.

For the Rule of Halves analysis, a range of variables was taken from the registries including diabetes outcomes, demographics and socioeconomic status and diabetes complications.

DVDD – THE DANISH ADULT DIABETES DATABASE

The Danish Adult Diabetes Database (Danish abbreviation DVDD) is a nationwide clinical quality database on Diabetes treatment. Results of yearly clinical assessments of diagnosed type 1 and type 2 diabetes patients are reported to DVDD from hospital outpatient clinics and general practitioners (GPs).

For the Rule of Halves analysis, a range of variables were taken from the database including background information, health systems data, clinical data and clinical quality indicators.

PHASE THREE: ANALYSIS

ALL PILLARS: To calculate and populate the overall population prevalence for each pillar, frequency counts, means, medians and standard deviations were calculated.

PILLARS 1 TO 5: For the Copenhagen report further analyses were conducted to determine the importance of demographic, clinical and vulnerability variables. These analyses were completed by stratifying the results and performing bivariate and multivariate logistic regression analysis with diabetes outcomes as the dependent variables. The main outcome of these analyses was presented as odds ratio (OR) estimates with 95% confidence intervals (CI95%).

PILLAR 4: Differences in the number of people receiving appropriate care and the number of people achieving the national treatment targets are described in proportions and compared using logistic regression to account for confounding factors.

PILLAR 5: Differences in crude incidence rates, based on incident events and person-years at risk, were used to calculate the incidence of micro- and macro-vascular complications in analyses based on the DVDD database, and Cox regression models with adjustment for covariates were used to compare differences in incident complications across subgroups.

PHASE FOUR: REPORT THE RESEARCH FINDINGS

The Rule of Halves analysis for Copenhagen was published in a publicly available report, which describes in detail the data sources, research methods, results and conclusions.

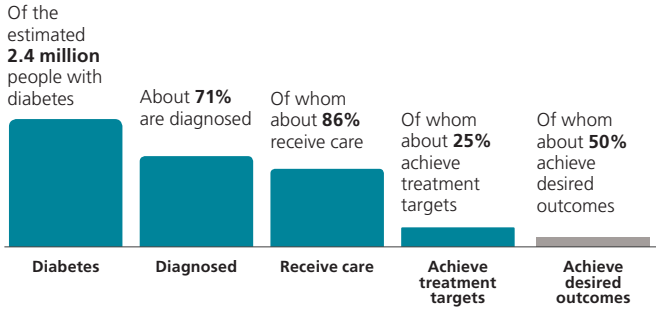THE FINAL RULE OF HALVES REPORT FOR COPENHAGEN CAN BE ACCESSED AT:
https://www.kk.dk/sites/default/files/edoc/0e147196-7f69-4b1d-88d8-3c22a49b677c/ccb83816-ce5f-44f7-a825-1324f9e18b6f/Attachments/14223678-16474820-1.PDF

MEXICO CITY RULE OF HALVES ANALYSIS BASED ON NEW DATA[6]

FIGURE 5 RULE OF HALVES FOR MEXICO CITY, MEXICO

Of the estimated **2.4 million** people with diabetes

About **71%** are diagnosed

Of whom about **86%** receive care

Of whom about **25%** achieve treatment targets

Of whom about **50%** achieve desired outcomes

| Diabetes | Diagnosed | Receive care | Achieve treatment targets | Achieve desired outcomes |

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

PHASE ONE: PLAN THE STUDY

The target population in Mexico City was the type 2 diabetes adult population (ages 20 to 69) living in urban areas of the Federal District. The research was performed by the National Institute of Public Health of Mexico.

For Mexico City, it was decided to collect new data through a questionnaire and the collection of blood samples. Data was obtained by a group of 80 specialists of the Instituto Nacional de Salud Pública (INSP), who visited all 16 delegations of the capital, gathering information of a representative sample of its inhabitants. The same methodologies the National Health and Nutrition Survey (Spanish acronym, ENSANUT) used were followed.

TABLE 2 OVERVIEW OF THE KEY CONSIDERATIONS FOR CALCULATING EACH PILLAR OF THE RULE OF HALVES

CONSIDERATIONS	DATA SOURCE
PILLAR 1: PEOPLE WITH DIABETES IN TOTAL (DIAGNOSED AND UNDIAGNOSED)	
Calculation includes those who met the diagnostic criteria based on the blood sampling. Diagnosis criteria: • Adults with type 2 diabetes: HbA_{1c} ≥ 7.0% indicates diabetes	• HbA_{1c} measurements from blood samples
PILLAR 2: PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED	
Calculation includes those who have diabetes based on the HbA_{1c} results of those indicating a prior diabetes diagnosis in the questionnaire.	• HbA_{1c} measurements from blood samples • Questionnaire

CONSIDERATIONS	DATA SOURCE
PILLAR 3: PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED AND RECEIVE CARE	
Calculation includes those who have diabetes based on the HbA_{1c} results and those indicating a prior diabetes diagnosis and receiving care in the questionnaire.	• HbA_{1c} measurements from blood samples • Questionnaire
PILLAR 4: PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED, RECEIVE CARE AND ACHIEVE TREATMENT TARGETS	
Calculation includes those who have diabetes based on the HbA_{1c} results and those indicating a prior diabetes diagnosis, receiving medical diabetes treatment and achieving diabetes treatment target in the questionnaire. Definition of achieving targets: • Treatment target for adults with type 2 diabetes: Hba_{1c} < 7.0 %	• HbA_{1c} measurements from blood samples • Questionnaire
PILLAR 5: PEOPLE WITH DIABETES WHO HAVE BEEN DIAGNOSED, RECEIVE CARE, ACHIEVE TREATMENT TARGETS AND WHO HAVE NO COMPLICATIONS	
Calculation includes those who have diabetes based on the HbA_{1c} results of those indicating a prior diabetes diagnosis, indicating receiving care, indicating achieving diabetes treatment target and indicating no complications in the questionnaire.	• HbA_{1c} measurements from blood samples • Questionnaire

PHASE TWO: DATA COLLECTION

For Mexico City, two primary data sources were applied when collecting new data:

- Blood samples to measure blood glucose levels (HbA_{1c})
- A questionnaire addressing the following questions:
  - Is the respondent diagnosed with diabetes?
  - If yes, does the respondent receive medical treatment for diabetes?
  - If yes, does the respondent achieve treatment targets?
  - If yes, does the respondent have diabetes-related complications?

As a minimum, the questionnaire should include questions on the diagnosis of diabetes, use of diabetes treatments and medical care, ability to achieve treatment targets and history of diabetes-related complications. The questionnaire may also include questions regarding risk factors, at an individual and a community level, and the socio-demographic characteristics of the household members. Questions regarding patient education, healthcare availability, diet and excursive patterns, among others, should also be considered. The questionnaires can be based on ones created for existing health surveys.

INDIVIDUAL QUESTIONNAIRE

An individual questionnaire should potentially consist of the following sections, which would allow for a more detailed understanding of the health situation and health access of the individual participants:

- Socio-demographic data

- Disease history including diabetes and other diabetes-related complications

- Treatment for diabetes

- Involvement in diabetes prevention and treatment programmes

- Exposure to diabetes risk factors including overweight and obesity

- Quality of life (psycho-social measures)

- Anthropometric evaluation (height, weight, waist and hip circumference)

- Details about food intake

- Details about physical activity

HOUSEHOLD QUESTIONNAIRE

A household questionnaire could be included. The objective of a household questionnaire is to identify the socio-demographic characteristics of household members, the characteristics of the house, household goods and home spending patterns.

PHASE THREE: DATA ANALYSIS

The analysis was completed by combining data from the questionnaires and the blood samples. The below table provides an overview of the levels of analysis and application of the instruments.

TABLE 3 OVERVIEW OF THE LEVELS OF ANALYSIS AND APPLICATION OF THE INSTRUMENTS

HOUSEHOLD	2,500 ADULTS

The household questionnaire included questions on the socio-demographic characteristics and living habits of the people in each household.

INDIVIDUAL QUESTIONNAIRE	1,000 ADULTS, SUB-SAMPLE

The individual questionnaire evaluated the health of a selected adult. The questionnaire covered: height, weight, blood pressure, waist-hip circumference, cholesterol, HDLC, triglycerides and glucose levels (HbA_{1c}).

FOOD CONSUMPTION RATE

Information regarding the nutritional habits of the selected adult during the previous seven days.

PHYSICAL ACTIVITY

Data regarding the physical activity per selected adult during the previous seven days.

PHASE FOUR: REPORT THE RESEARCH FINDINGS

The Rule of Halves results from Mexico City are presented in a report: Barquera S, et al. *The Mexico City Diabetes Mellitus Representative Survey. Cities Changing Diabetes Program.* Cuernavaca Mor.: Instituto Nacional de Salud Publica;2015.

Scientific peer-reviewed articles presenting the results are pending final publication.

REFERENCES

1. International Diabetes Federation. *IDF Diabetes Atlas. 7th edn.* 2015. **2.** UNDESA. *World Urbanization Prospects, the 2014 Revision, Highlights.* United Nations Department of Economic and Social Affairs. 2014. 978-92-1-151517-6. **3.** Napier D. Diabetes Vulnerability Assessment Tool: Modifiable risk factors in urban areas. London: UCL; 2014. **4.** Hart JT. Rule of halves: implications of increasing diagnosis and reducing dropout for future workload and prescribing costs in primary care. *Brit J Gen Pract.* 1992;42:116–119. **5.** Holm A, Andersen G, Diderichsen F. Cities Changing Diabetes. Rule of Halves analysis for Copenhagen. Department of Public Health, University of Copenhagen and Steno Diabetes Center. 2015. **6.** Barquera S TM, López-Ridaura R, et al. *Preliminary report ERDM-DF.* Instituto Nacional de Salud Pública;2015.

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