The European Health Examination Survey

Pilot Study 2010

Ministry of Health, the Elderly and Community Care
Department of Health
Directorate for Health Information and Research
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www.healthsurveys.gov.mt
Foreword

During the last years, the Ministry for Health, the Elderly and Community Care (MHEC) has increasingly recognised the value of research in the generation of intelligent information that feeds into the policy making process.

The Directorate for Health Information & Research (DHIR) has a longstanding tradition of health surveillance through high quality registries that are being increasingly recognised as some of the most comprehensive and reliable within the European region. However, in 2007, the MHEC recognised an information gap that could only be filled by a research arm running health surveys. This function has been added to the remit of the Department of Health Information back then. Indeed, since then, the Directorate has become increasingly responsive to departmental and ministerial needs and the intelligence generated from the data warehouse maintained by this directorate has become pivotal in shaping the Ministry’s strategic direction.

The Ministry’s investment into this health survey infrastructure is already bearing fruit. A number of decisions and targets forming the pillars of the health strategies published and implemented by the MHEC are based on information generated from these health surveys. These include the Non-Communicable Disease Strategy, the National Cancer Plan, the Sexual Health Strategy and the Obesity Strategy. Further testament to the Ministry’s research philosophy is the inclusion of a research pillar in each of these strategies.

The findings of this pilot European Health Examination Strategy (EHES) further support the priorities chosen by the MHEC. Indeed, these findings give us a more accurate picture of known afflictions of the Maltese population, such as the obesity epidemic, while also showing encouraging progress, such as the lowering of cholesterol levels in the Maltese population, which is probably a consequence of the continuing investment of the Maltese government in the provision of lipid lowering drugs.

DHIR’s health surveillance system is now being entrusted with the monitoring of the implementation of the abovementioned strategies and their respective targets in order to enable the evaluation of each strategy’s effectiveness at the end of their term.

The experience of the pilot EHES, together with numerous other European funded research projects, is enabling DHIR to maintain its expertise up to date with state of the art methodologies in a bid to keep up the quality of the epidemiological information available for Maltese policy makers.

Hon. Dr. Joseph Cassar

Minister for Health, the Elderly and Community Care
Preface

During the last ten years, Malta has continually developed its health survey system. The pilot European Health Examination Survey (EHES) carried out in 2010 builds on the experience of two editions of the national health interview survey in 2002 and 2008. It also evaluates and follows up the findings of the MONICA health examination survey in 1984. The parallels between the two surveys were not limited to the nature of the surveys. Both surveys established standards for harmonisation of methodologies across Europe, under the expert guidance of our established partners in Finland, THL. Our collaboration with THL also extended to the processing of the 1984 MONICA dataset to permit the comparative analyses presented in this report.

This report concentrates on two elements: the establishment of the real extent of the burden of major common chronic non-communicable diseases and the prevalence of major risk factors, and the validation of self-reported survey data. The latter becomes particular important when considering that the health interview survey is EUROSTAT’s preferred method for data collection of a number of health indicators, and a regulation to make this survey obligatory across the EU is currently at an advanced drafting stage.

Comparisons of the prevalence of diseases and lifestyle factors are presented in this report, using both the MONICA survey estimates and estimates from the latest available health interview survey data. Evaluation of health inequalities in each of these conditions is carried out as far as possible, in order to identify which specific population subgroups require more focused intervention in an attempt to address any of these conditions.

In addition, follow-up of a thirty year surveillance programme of blood lead levels was incorporated into the survey, in order to evaluate the effectiveness of lead exposure reducing policies and legislation that has been implemented during this period.

Finally the pilot EHES also establishes two new baselines: one for respiratory health function and another for visual acuity. The true value of these measurements is likely to materialise in the future when the study is followed up and compared to these baseline data.

We trust that this survey and report serves to inform the policy making process more accurately and to lay the foundations for the organisation of more effective health surveys, not only for strategic planning, but also for the monitoring of existing and future policies.

Dr. Neville Calleja
Director
Directorate for Health Information and Research

Dr. Natasha Azzopardi Muscat
Chief Medical Officer
Department of Health
Acknowledgements

The Directorate of Health Information and Research wishes to take this opportunity to thank all survey respondents who participated in the survey. We would like to thank the project leaders, the National Institute for Health and Welfare Finland for their expertise, feedback and all the work they put into making this European collaboration a success.

Locally we are very grateful for all the support given to us by the following institutions and their collaboration in this project:

- Mater Dei Hospital Pathology and Toxicology Department for their expertise and laboratory analysis.
- Mater Dei Hospital Medical Supplies for the equipment required for the examinations.
- The Department of Primary Healthcare and staff at Paola Health Centre, Mosta Health Centre, Qormi Health Centre, Birkirkara Health Centre and Floriana Health Centre for supplying us with their facilities to set up our clinic.
- Gozo General Hospital for supplying us with their facilities to set up our clinic.
- Health Examination Survey strategy group – Professor J. Vassallo, Professor J. Cacciottolo and Dr. J. Mamo

We also would like to thank the Directorate of Health Promotion and Disease Prevention for supplying us with health promotional material which was given to each participant and our sponsors Zammit & Cachia and Alf Mizzi and Sons.

DHIR is indebted to the National Statistics Office, particularly to Mr. Silvan Zammit for carrying out the sampling and, the Chief Medical Officer, Dr. Natasha Azzopardi Muscat, and the Ministry of Health, the Elderly and Community Care for funding this project and ensuring it was a success.

Finally, this project would have not materialised without the unstinting efforts of the project team and several staff members who shouldered this survey over and above their normal routine duties.

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This report has been compiled by Ms. Dorothy Gauci.
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1. Introduction

1.1 The burden of non-communicable diseases

The burden of non-communicable diseases has grown into a silent epidemic. This relatively small group of diseases has caused the largest burden of disease in Europe. Of all the six WHO regions, Europe is faced with the greatest burden related to non-communicable diseases. There are five major non-communicable diseases having the greatest impact on health in Europe – Cancer, Diabetes, Cardio-vascular Disease, Chronic Respiratory Diseases and Mental Health Disorders. These diseases account for approximately 77% of the disease burden in Europe and 86% of deaths in the region1.

In 2010 deaths due to diseases of the circulatory system, mainly ischemic heart disease, stroke and heart failure were the leading causes of death in Malta accounting for 38% of all deaths. Diabetes is an important risk factor associated to these conditions and on its own was the underlying cause of death for 3.8% of deaths in this year. The second most common cause of death was cancer which accounted for 29% of deaths in the population. Cancer of the lung, colon/rectum and pancreas were the most common types of cancer leading to death in males while cancer of the breast, colon/rectum and lung were the most common types of cancer leading to death in females2.

The increase in NCDs leads to increased burden on economies impacting countries productivity and competitiveness, increased burden on the health system as demand for long term chronic care increases and increased health and financial burdens on the individual. The impact of NCD’s on country GDP can range from 1% to 7%3.

It is well established that the four major chronic diseases – cancer, diabetes, cardiovascular disease and chronic respiratory disease share a common group of risk factors. Exposure to tobacco smoke through smoking and through second hand smoke increases ones risk of cardiovascular disease, cancer and chronic respiratory disease. Maintaining an unhealthy diet and being overweight or obese are major causes of non-communicable diseases especially cardiovascular disease, type 2 diabetes and some cancers. Coupled with this, harmful use of alcohol can damage many organs in the body and is also a risk factor for cardiovascular diseases and certain cancers4.

There is a vast body of knowledge outlining prevention strategies targeting the major NCDs. In April 2010 the Ministry of Health, the Elderly and Community Care launched the Non-communicable Disease Strategy outlining major targets for the next ten years. The goal of this strategy is to address the major NCDs and reduce the burden they cause by focusing on the major lifestyle risk factors

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1 World Health Organisation Europe Region http://www.euro.who.int/en/what-we-do/health-topics/noncommunicable-diseases
2 Department of Health Information and Research, National Mortality Registry Annual Report 2010
4 The NCD Alliance - http://www.ncdalliance.org/node/41
(diet, physical activity, smoking and alcohol) and biological risk factors (obesity, high blood pressure, blood cholesterol and abnormalities in carbohydrate metabolism). A key component of non-communicable disease strategy implementation is adequate monitoring of the risk factors associated with the diseases as well as the diseases themselves. This surveillance can be achieved through collation of multiple sources such as activity databases from healthcare institutions, administrative and financial sources, ad hoc research initiatives and national health surveys. National health surveys are a major and important source of data about the health of the population as a whole and help to establish trends in health status over time thus monitoring the progress in light of the implementation of new strategies. While other administrative sources such as hospital databases shed light on the burden on the health system due to NCDs as those with chronic illnesses require medical treatment, health surveys give a holistic picture of the trends relating to the underlying risk factors and behaviours that may lead to the development of NCDs as well as the prevalence of NCDs in the population that may be underestimated by looking at only the severe cases requiring medical treatment.

1.2 Health Examination Surveys

Health examination surveys are comprehensive tools that normally incorporate two types of data collection methodologies to collect high quality data on the health of individuals in the study sample. Usually the survey comprises a health questionnaire which collects information on the health status of the participant and socio-demographic details. The second component of the survey comprises of a health examination that can consist of a variety of measurements such as weight and height measurement, hypertension, blood sampling and others. Examination surveys give added value to health interview surveys by measuring health outcomes that are normally only gathered through self-reporting. Self-reported health outcomes such as weight and disease status may be underreported as participants may, for example, be unaware of their present weight or may have never measured their blood cholesterol or blood pressure. Examination surveys may also give an indication of how well participants are managing their condition if they report taking medication for diseases such as diabetes. All this data gives key information on:

- Discrepancies between a person’s perceived and actual health status.
- Approximate proportion of undiagnosed conditions that emerge through the examination results.
- Monitoring of health conditions that are already being treated.

This present study is not the first health examination survey to be implemented in Malta. In 1984 Malta participated in the data collection for the WHO MONICA study which was a health examination survey monitoring risk factors for cardiovascular diseases in those aged 25 to 64. The study collected data on weight, height, blood cholesterol, blood pressure, smoking status and demographic details.

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When compared to health interview surveys, examination surveys are expensive and logistically require more manpower, equipment and staff that includes a number of health care professionals trained to conduct the examinations. Recently two National Health Interview Surveys were conducted in Malta in 2002 and 2008 respectively. These outlined a number of trends in the health status of the population which when compared to examination data remain consistent if underestimated. The goal for future data collection activities would be to use both interview surveys and examination surveys to collect data on health. It is planned that every 5 years that the national health interview survey will be conducted on a representative sample of the population with an examination component being conducted on a representative sub-group of this larger sample.
2. The European Health Examination Survey Pilot Study 2010

The European Health Examination Survey pilot study is a project involving 13 EU countries collecting high quality health data which is comparable across all EU countries and aims to test the tools and protocols which would be put into place in the coming years for the implementation of a full-scale study. For the purposes of the pilot study analysis each country had to collect data for a minimum of 200 participants. It is projected that for the full-scale study 2,500 participants would be examined. The study comprised of core measurements and a health questionnaire which were collected by all participating countries while each country was also free to add other measurements which were of interest at a national level. A clear protocol for the survey implementation was outlined to ensure that the data collection methods were similar across the countries. Training sessions were held for staff from each country to further ensure that protocols were followed and all the data collected was comparable. The project was headed by a reference centre composed of three institutions: National Institute for Health and Welfare – Finland, Statistics Norway – Norway and Istituto Superiore di Sanita – Italy. All three institutions have experience in the field of Health Examination Surveys and members of the reference group visited each country during the field work phase to conduct site visits. The project was part funded by the European Commission through a Joint Action.

2.1 Methodology

A random sample of the resident population aged 18 years and over stratified by gender, 5 year age group and region of residence was selected. The sample was taken from a population register maintained by the National Statistics Office. A sample of 400 participants was selected with 221 participants accepting the invitation to participate. Due to the nature of the sampling method no substitution of respondents was allowed. Since the survey involves questions on self-reported health and an examination, no proxy interviewing was allowed. After participants were selected they were sent an invitation letter and information leaflet and were informed that they would be contacted to set up an appointment in the following days. To ensure maximum participation, three attempts were made to contact the sampled individuals by telephone after the first initial letter was sent. If no contact could be made, a reminder letter was sent to the participants asking them to contact the directorate to set up an appointment. The fieldwork was conducted between November and December 2010 over an 8 week period. Most of the examinations were held at a central clinic on weekdays between 8am and 12pm to ensure as many of the participants were fasted before their examination. Apart from this, on three afternoons of the week, sessions were planned between 4pm and 7pm at 5 health centres collaborating in the project so that participants who could not attend during the mornings were able to attend in the afternoon in the health centre most accessible to them. Apart from these weekday clinics, the main clinic in G’mangia was opened on three Saturday mornings. To cater for Gozo, the project team set up a clinic at the Gozo General Hospital outpatients section over a weekend in November. Where participants were unable to attend any of the centres due to illness or immobility but still wished to participate, the option of a home visit was offered.
The survey process was made up of two parts. In the first part participants went through a short interview where they were asked general questions about their health, lifestyle habits and socio-demographic details. After this, all respondents were guided by the interviewer through an informed consent form specifically designed for this project. This was to ensure that the respondent had understood all components of the examination and was freely consenting to participate in the measurements to be undertaken. All participants were allowed to refuse any component of the examination process should they wish to do so.

The interviewer escorted the participant into the examination room after the questionnaire was complete. The examination consisted of participants having their weight, height, waist circumference, blood pressure and visual acuity measured. Participants also had their blood taken to measure blood glucose, HbA1c and blood cholesterol. A blood sample was taken for lead analysis on the request of the Environmental Health Directorate for their ongoing analysis of lead levels in the blood. Apart from these samples for blood testing, upon consent, a blood sample was taken and stored in a bio-bank for future research. Participants also underwent a spirometry test to measure their lung functioning.

All participants were given a copy of the data collected during the interview and were also given a referral letter for their doctor if any results warranted further medical follow-up. Once blood samples were processed, participants received their results in the post.

2.2 Participation

Of the 400 persons sampled, 221 participated in the survey. The chart below shows the number of refusals, non-contacts and ineligible participants in the study. Of the 310 individuals successfully contacted during the fieldwork, 89 refused while 221 agreed to participate giving a cooperation rate of 71.3%.
2.3 Data Analysis

To ensure that the analysis resulting from this study is representative of the total Maltese population since this was only a pilot study with a small sample, the data was weighted against a larger national health survey, the European Health Interview Survey (EHIS) conducted in 2008 which had 3,680 participants. This method involves calculating the weight each person in the sample contributes to the population based on certain demographic features. In this way one ensures that if, for example, in the true population there is an equal gender distribution one ensures that both genders receive equal weights in the analysis even if the sample population is not representative of this gender distribution.

Analysis was conducted on all the measured variables by gender and three broad age groups. Due to the small numbers, further breakdown could not be conducted. The data from the survey will be compared to the measured data available from the MONICA study conducted in 1984; mainly BMI, hypertension and cholesterol. Comparison is restricted to the age group between 25 and 64 as this was the population addressed in the MONICA study. This comparison highlights shifts in cardiovascular risk factors over a 26 year period. To compare between self-reported and measured results, the data from this survey is being compared to data from the European Health Interview Survey (EHIS) conducted in 2008 where comparable measures are available.

The report covers the following topics:

- Body Mass Index and Waist Circumference
- Blood Glucose and HbA1c
- Blood Pressure
- Blood Cholesterol
- Lung Functioning
- Visual Acuity
3. Body Mass Index (BMI) and Waist Circumference

Body mass index (BMI) is a measure calculated from a person’s weight and height. It is a simple way of creating a proxy indicator of a person’s body fat\(^6\). BMI is defined as a person’s weight in kilograms over their height in metres squared (kg/m\(^2\)) and can be classified into broad categories to define an adult person as normal, overweight or obese. The World Health Organisation (WHO) outlines the three broad categories as follows\(^7\):

<table>
<thead>
<tr>
<th>BMI Range (kg/m(^2))</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Range</td>
<td>18.50 – 24.99</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.00 – 29.99</td>
</tr>
<tr>
<td>Obese</td>
<td>≥30.00</td>
</tr>
</tbody>
</table>

As BMI increases, the risk for certain diseases such as heart disease, diabetes and high blood pressure also increases. Long-term cohort studies have shown that becoming obese by middle age has significant effects on mortality and life expectancy. Average life expectancy is reduced by 2 to 4 years in those with a BMI between 30 and 35 while life expectancy is reduced by 8 to 10 years in those with a BMI of 40 to 50 (morbidly obese)\(^8\).

3.1 Measured BMI in 1984 and 2010 population 25 to 64 – MONICA and EHES comparison

In 1984 28.6% of the population aged 25 to 64 was obese with a further 38.5% being overweight. In 2010 the proportions have remained relatively unchanged with only a drop of 1% in the overweight proportion. When examining gender differences one sees major changes in the BMI distribution in this age group.

Since 1984 men between 25 and 64 have become more obese with less men being of normal weight and more men being overweight and obese when compared to 1984. In fact when compared to 1984, in 2010 the proportion of obese men aged 25 to 64 is 6% greater and the proportion of overweight men is 2% greater.

The pattern for women is different. Amongst women aged 25 to 64 we see a shift of the BMI proportion towards normal weight when compared to 1984. While in the MONICA study 35% of the female study population were obese, by 2010 this has reduced to 28% in the same age group. There has also been a considerable increase in the proportion of women who are of normal weight from 33% in 1984 to 45% in 2010.

These patterns in BMI distribution in the Maltese population aged 25 to 64 indicate that over a 26 year period males have become more obese while BMI in females has improved. The two genders are therefore now at a stage of having comparable figures.
3.2 Self-reported and measured BMI in population 18+ – EHIS 2008 and EHES 2010

According to data from the European Health Interview Survey, in 2008 Maltese residents aged 15 and over were one of the most obese in Europe. In fact the proportion of obese men in Malta is the highest in Europe while the proportion of obese women in Malta is third highest. A similar survey conducted amongst school aged children in 2006 also shows that the proportion of obese and overweight Maltese children aged 11, 13 and 15 is one of the highest when compared to children in 41 other countries. This data is based on self-reported measures of weight and height and it has been shown in a number of studies that self-reported weight tends to be underestimated by respondents while self-reported height may be overestimated. Using this data to calculate BMI may then lead to an underestimation of the proportion of the population that are overweight and obese.

When using measured weight and height variables the percentage of the population aged 18 and over that are obese is 29.8% compared to the 23.0% calculated from the self-reported data in 2008. This shows an underestimation of the actual proportion of the obese population by 6.8%. As a consequence of this, the self-reported measures overestimate the proportion of normal individuals by 3.2% and overweight individuals by 3.6%. This discrepancy between self-reported and measured BMI calculations is more pronounced in females when compared to males. In fact there is a 10.6% increase in the proportion of females who are obese when comparing the measured data to the self-reported data.

![Figure 4: Underestimation and over estimation of BMI in self reported (2008) data compared to measured (2010) data by gender in population aged 18+](image-url)

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9 European Health Interview Survey 2008 – Lifestyle, Department of Health Information and Research, Ministry of Health, the Elderly and Community Care.

10 The Validity of Obesity Based on Self-reported Weight and Height: Implications for Population Studies- [http://www.nature.com/oby/journal/v15/n1/full/oby2007536a.html#bib14](http://www.nature.com/oby/journal/v15/n1/full/oby2007536a.html#bib14)
Age and gender are known to be significantly associated with BMI. In both men and women the prevalence of obesity increases with age most strikingly after the age of 24. Women are more likely to be obese while men are more likely to be overweight.\textsuperscript{11} The data from this study shows similar patterns of obesity amongst the Maltese population, overall there is a higher proportion of obese females when compared to males while there is a higher proportion of overweight males when compared to females.

BMI distribution across age groups also highlights pronounced shifts in weight over the lifespan. During middle-age there is an increase in the proportion of the population who are obese; in fact between the age of 41 and 60 the proportion of obese individuals is equal to the proportion having a normal weight at 36%. When factoring in the overweight proportion nearly 65% of the population aged 41 to 60 are overweight or obese and this increases to 75.5% in those above the age of 60.

\textsuperscript{11} National Obesity Observatory, http://www.noo.org.uk
3.3 Waist Circumference in population 18+ - EHES 2010

Although BMI can be used for most men and women it is limited by the fact that it may underestimate the percentage of body fat in athletes or those who have a muscular build and it also may underestimate the percentage of body fat in older persons and those who have lost muscle mass. BMI also does not account for the wide variety of differences that may be present between different populations, ethnic groups and gender. A simple and convenient measure that correlates well with BMI is waist circumference. Measuring waist circumference provides important information on the distribution of body fat. Carrying most body fat around the waist is associated with a greater risk for cardiovascular disease, metabolic syndrome and other chronic diseases\textsuperscript{12,13}.

The waist circumference measurements that outline increased risk for cardiovascular disease and other chronic diseases for men and women are the following:

<table>
<thead>
<tr>
<th></th>
<th>Increased Risk</th>
<th>Substantial Increased Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Men</strong></td>
<td>≥94cm</td>
<td>≥102cm</td>
</tr>
<tr>
<td><strong>Women</strong></td>
<td>≥80cm</td>
<td>≥88cm</td>
</tr>
</tbody>
</table>

The average waist circumference amongst males was 96.6cm. This means the average for the male population is above the range for increased risk but well below the threshold for substantial risk. For women the average waist circumference is 89.3 cm this shows that the average waist circumference for the female population is well above the increased risk threshold and also above the substantial risk threshold.

When categorising the waist circumference measurements according to the risk thresholds, 50% of the females in the sample had a waist circumference over the substantial increased risk threshold for females while 38% of males had a waist circumference over the substantial increased risk threshold for males. The proportion of males with a waist circumference within normal range was 10% greater than women showing that overall men are at lower risk.


\textsuperscript{13} World Health Organisation - [http://www.who.int/nutrition/topics/5_population_nutrient/en/index5.html](http://www.who.int/nutrition/topics/5_population_nutrient/en/index5.html)
4. Blood glucose and HbA1c

Diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin produced. Insulin is the hormone the body uses to control the amount of glucose in the blood and convert glucose into energy. There are two main types of diabetes, Type 1 diabetes usually develops in childhood or adolescence and patients usually require lifelong insulin injections to replace the insulin not being produced by the body. Non-Insulin Dependent Diabetes Mellitus (NIDDM) or Type 2 diabetes usually develops in adulthood and is related to obesity, lack of physical activity and an unhealthy diet. Treatment for NIDDM may require changes in diet and lifestyle habits or oral medications and even insulin injections. Type 2 diabetes is the more common type of the two and accounts for approximately 90% of cases worldwide\(^\text{14}\). The International Diabetes Federation (IDF) has developed a diabetes atlas to map out the burden of diabetes around the world. The federation has estimated a national prevalence for 2010 using examined data from a study by Shranz et al conducted in 1989. When comparing the estimates for the 27 EU member states Malta ranks \(^8\) highest with an estimated national prevalence for those aged 20 to 79 of 9.8\(^\%\)\(^\text{15}\).

\[\text{Figure 10 IDF estimates of diabetes prevalence in Europe in 2010}\]


In 2008 the European Health Interview Survey found a self-reported prevalence of diabetes of 8.3% in the similar population aged 20 to 79. The estimates developed by the International Diabetes Federation projected an increase in this prevalence by 2010.

A way of diagnosing diabetes is by measuring the blood glucose level after fasting for 8 hours. A value above 7.0mmol/l (hyperglycaemia) indicates possible diabetes. When patients are not fasted the threshold value 11.1mmol/l is used as a cut off to indicate the possibility of a patient being diabetic. Using these two value ranges a prevalence of diabetes for 2010 can be calculated from this study.

**4.1 Blood Glucose in population 18+ - EHES 2010**

When looking at the measurement of blood glucose from the survey the prevalence of diabetes in 2010 amongst the population aged 20 to 79 (the age range used by the IDF) is 10.1%. This figure is slightly higher than the prevalence projected by the IDF. The prevalence for the whole study population, which is the population aged 18 years and over, is 9.8%.

The prevalence of elevated blood glucose is higher in women when compared to men with 9% of males having elevated blood glucose when compared to 10.7% of females. This is in contrast with the pattern observed in the self-reported data which showed a higher proportion of diabetes in males when compared to females. As shown in the previous chapter, obesity more common in women especially morbid obesity and this may be influencing the proportion of diabetics within the female population.

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The prevalence of elevated blood glucose increases sharply after the age of 40. Between the ages of 41 and 60, 12.2% of the study sample had elevated blood glucose, while this rises to 21.6% of the population older than 60. The greatest underestimation was in the middle age group where there was a difference of approximately 5% in the measured elevated blood glucose level when compared to the self-reported prevalence of diabetes. There was no one in the HES sample between 18 and 40 years of age who had diabetes.

![Figure 12: Self-reported (2008) and measured (2010) prevalence of elevated blood glucose by age](image)

The measured blood glucose also gives an indication at how well diabetics are managing their condition. If a diabetic is properly following their treatment protocol and maintaining an appropriate diet; their fasting blood glucose should be within normal range. Of those in the survey who reported being diabetic, 38.5% had a blood glucose level that was above the threshold value. Women seem to manage their disease slightly better than men with 30.8% of women with diabetes having a high level of blood glucose when compared to 41.6% of men.

### 4.2 HbA1C in population 18+ - EHES 2010

Another measure used to detect possible diabetes is glycated haemoglobin or HbA1c. Glucose sticks to haemoglobin in the blood stream to form glycated haemoglobin, the greater the glucose level in the blood the higher the concentration of glycated haemoglobin. This measure gives the average plasma glucose concentration in the blood over a three month period unlike fasting blood glucose which gives a snapshot of the glucose level at one point in time. While the measurement of HbA1c is not recommended to be used as the sole tool to diagnose diabetes due to its variability[^17]; it is the recommended way to check whether diabetes is being controlled. While measured blood glucose can be reduced somewhat if the patient controls their diet and manages their medication correctly a

few days before blood sampling, the HBa1c calculates an average over a span of time thus giving a better picture of long term management of disease. The threshold for normal HbA1c is 6.5%.

Of those in the sample who reported being diabetic 57.1% had an HbA1c level higher than the threshold value. Approximately 62% of the female diabetics had an HbA1c reading above 6.5% while 53% of males had a reading above the threshold value. This may indicate that men in the long term manage their diabetes better than women.
5. Blood Pressure

Blood pressure is the force against the arterial wall created as blood circulates through the body. Hypertension or high blood pressure occurs when blood is pumped with excessive force as the heart must work harder to circulate the blood around the body. Blood pressure tends to rise as people get older so with increasing age the risk for hypertension increases. Behaviour and lifestyle factors also increase the risk of hypertension such as consuming too much salt, low physical activity, high BMI, smoking and alcohol consumption\(^\text{18}\). Hypertension is found to be the single biggest risk for stroke. It also is a significant risk factor for heart attacks. Hypertension can be treated successfully if medication is taken correctly and lifestyle and diet management is maintained\(^\text{19}\).

Elevated blood pressure (hypertension) is clinically defined as having a systolic measure greater than 140mmHg over a diastolic measure greater than 90mmHg. Hypertension itself can be further subdivided into two levels of severity known as stage 1 hypertension and stage 2 hypertension\(^\text{20}\). The cut-offs for these categories are listed below.

<table>
<thead>
<tr>
<th>Normal Blood Pressure</th>
<th>Systolic</th>
<th>Diastolic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;140mmHg</td>
<td>AND &lt;90mmHg</td>
</tr>
<tr>
<td>Hypertension</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>≥140 – 159mmHg</td>
<td>OR ≥90 – 99mmHg</td>
</tr>
<tr>
<td>Stage 2</td>
<td>≤160mmHg</td>
<td>OR ≤100mmHg</td>
</tr>
</tbody>
</table>

5.1 Measured blood pressure in 1984 and 2010 population 25 to 64 – MONICA and EHES

In 1984 nearly half of the population aged 15 to 64 had an elevated blood pressure reading (48%). Of these the majority had a measured blood pressure at stage 1 hypertension while the remaining 8.5% were classified as stage 2 hypertension. By 2010 the number of participants with normal blood pressure increased by 15% with drops of approximately 8% in the proportion of stage 1 hypertension and stage 2 hypertension.

\(^{18}\) World Health Organisation – Hypertension fact sheet - [http://www.searo.who.int/linkfiles/non_communicable_diseases_hypertension-fs.pdf](http://www.searo.who.int/linkfiles/non_communicable_diseases_hypertension-fs.pdf)


\(^{20}\) American Heart Association – Understanding Blood Pressure Reading - [http://www.heart.org/HEARTORG/Conditions/HighBloodPressure/AboutHighBloodPressure/Understanding-Blood-Pressure-Readings_UCM_301764_Article.jsp](http://www.heart.org/HEARTORG/Conditions/HighBloodPressure/AboutHighBloodPressure/Understanding-Blood-Pressure-Readings_UCM_301764_Article.jsp)
In 1984 there were no gender differences in the distribution of blood pressure status. When looking at those having elevated blood pressure in 2010, there is a large reduction in the proportion of men with stage 2 hypertension with a drop of 13% in this category while amongst women there is only a slight drop of 1% in this category. On the other hand in women there is a drop of 14% in the proportion with stage 1 hypertension and a little over 1% drop amongst men. So while blood pressure has improved overall from 1984 to 2010 amongst those with hypertension, the condition has become less severe in men when compared to women with considerable reduction in stage 2 hypertension.
5.2 Self-reported and measured blood pressure in population 18+ – EHIS 2008 and EHES 2010

In 2008 23.7% of the population aged 18 and over reported suffering from hypertension. When looking at the measured data and including those on hypertension medication, 41.8% of the study population had an elevated blood pressure reading this shows nearly a doubling of the prevalence. When comparing men to women, 6% more men had an elevated blood pressure reading which shows a contrast to the self-reported prevalence which was slightly higher amongst women.

In all age groups the prevalence of hypertension as measured by the blood pressure reading is underestimated in the self-reported data. In nearly all age groups the measured prevalence was double the reported prevalence. By the age of 41 to 60, 46% of the sample could be classified as having possible hypertension while in those aged over 60, 85.5% could be classified possibly hypertensive.
Of those stating they are on medication for hypertension, 50.8% had a measured blood pressure above the upper limit of normal. This means that half the respondents having treatment for hypertension were not controlled well. When looking at the gender differences in hypertension control, women in the study population had a higher proportion of uncontrolled hypertension when compared to men. In fact 61.8% of women on hypertensive medication had a measured blood pressure above normal while 37.8% of men on hypertensive medication had a measured blood pressure above normal.
6. Blood Cholesterol

Cholesterol is a fatty substance that is found in the blood and is made naturally by the liver and intestines. Cholesterol plays an essential role in cell functioning as it is a structural component in the membrane of cells. Cholesterol is transported through the blood stream by combining to proteins to form lipoproteins. There are two main types of lipoproteins high density lipoproteins (HDL) which is a protective type of cholesterol and low density lipoproteins (LDL) which is a harmful type of cholesterol. Having too much harmful cholesterol in the blood can increase your risk of cardiovascular diseases as it can deposit on the walls of blood vessels which by time can become blocked thus preventing flow of blood to major organs. A common cause of high cholesterol is consuming food with large quantities of saturated fats such as butter, cheese, cakes and fatty meat products such as sausages. High cholesterol can also be inherited through a condition called familial hyperlipidaemia 21, 22

Total cholesterol serum is a measure of the total cholesterol levels in the blood and a measure above 5.0 mmol/l is indicated as high in medical lab testing. The American Heart Association further breaks down total serum cholesterol into categories which signal increasing risk of a heart attack 23.

The categories are as follows:

<table>
<thead>
<tr>
<th>Total Cholesterol Serum (mmol/l)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Desirable (lower risk)</td>
<td>≤5.00</td>
</tr>
<tr>
<td>Borderline High (higher risk)</td>
<td>&gt;5.00 – 6.18</td>
</tr>
<tr>
<td>High (more than twice the risk as that for the desirable level)</td>
<td>&gt;6.18</td>
</tr>
</tbody>
</table>

6.1 Measured blood cholesterol in 1984 and 2010 population 25 to 64 – MONICA and EHES

In 1984 48% of the population aged 25 to 64 had measured blood serum cholesterol that was high while a further 30% of the population had measured serum blood cholesterol that was borderline high. By 2010, the proportion of the population aged 25 to 64 with a high level of serum cholesterol had gone down by 26%.

21 British Heart Foundation - http://www.bhf.org.uk/heart-health/conditions/high-cholesterol.aspx
The greatest improvement can be seen amongst females. In 1984, 49% of women aged between 25 and 64 had a blood serum cholesterol measurement that was high (>6.18). By 2010 this had gone down to 14.7%. There has also been a doubling of the proportion of females with desirable blood serum cholesterol. A similar trend is seen for males although the improvement is less pronounced. In 1984, 47% of males had blood serum cholesterol that was high, by 2010 this had gone down to 29.7%. The proportion of those with a desirable level had increased by approximately 10%.
6.2 Blood Serum Cholesterol and LDL in 2010 in population 18+ - EHES 2010

When looking at the measured cholesterol levels of the sample studied 39% had a measurement within the desirable range, 40% had a range that was borderline high with the final 20.8% being in the highest risk group. This shows that approximately 60% of the population aged 18 and over had a cholesterol reading that gave them a measure of elevated risk of heart attack and stroke.

Elevated risk for cardiovascular diseases can also be measured when looking at the level of LDL in the blood. As mentioned previously, LDL is known as the harmful form of cholesterol and a high level of it in the blood means there is a higher risk of heart disease and stroke. LDL in the blood is estimated using the level of HDL, total cholesterol and triglyceride level in the blood and therefore patients need to be fasted. Following recommendations outlined by the European Health Risk Monitoring project for LDL calculations, participants must have been fasted for a minimal of 10 hours for the measurement to be valid. The American Heart Association classifies LDL into categories of elevated risk as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>LDL (mmol/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal or Near Optimal</td>
<td>&lt;3.4</td>
</tr>
<tr>
<td>Borderline High</td>
<td>&gt;3.4 – 4.1</td>
</tr>
<tr>
<td>High</td>
<td>&gt;4.1 – 4.9</td>
</tr>
<tr>
<td>Very High</td>
<td>&gt;4.9</td>
</tr>
</tbody>
</table>

Approximately 58% of the study population who were fasted had an LDL level within the desirable range. A further 30% fell within the borderline high range giving them a higher risk for cardiovascular disease. When looking at the categories holding most risk 11.3% of the sample had an LDL that can be classified as high while 1.6% had a reading that is classified as very high.

![Figure 21 Measured LDL in population 18+](http://www.ktl.fi/publications/ehrmandex/product2/title.htm)

7. Lung Function

Chronic respiratory diseases are chronic diseases of the lung airways and other structures of the lung. Some of the most common respiratory diseases are asthma, chronic obstructive pulmonary diseases (COPD), respiratory allergies, occupational lung diseases and pulmonary hypertension. The major risk factors for developing chronic respiratory diseases are tobacco smoking, indoor air pollution, outdoor air pollution, allergens and occupational exposures. In 2005 3 million people died of COPD which equates to 5% of all deaths globally that year\textsuperscript{25}.

Spirometry is a diagnostic test that measures how much air a person can inhale and exhale, and how fast air can move into and out of the lungs. Forced expiratory volume (FEV1) is the amount of air that can be blown out within one second. With normal lungs and airways, one can normally blow out most of the air from the lungs within one second. Falaschetti et al\textsuperscript{26} derived spirometric reference equations for the English population using data from the 1995/1996 Health Survey for England. These equations incorporate gender, age and height to calculate the optimal lung functioning for healthy individuals (individuals who do not smoke and do not have a chronic lung condition).

The difference between actual FEV1 using the data from the spirometry test and predicted FEV1 was calculated for each participant in the study. Mean difference was estimated by smoking status and region of residence adjusting for lung pathology, age, education and measured weight. A mean difference that is negative indicates that the actual lung function is lower than predicted and vice versa. A value of 0 indicates that the actual value was equal to the predicted value.

The data shows that in the pilot study there are no statistically significant differences between predicted and actual lung functioning between the six regions as all the confidence intervals around the means overlap. However the data shows that the mean for the Northern Harbour is comparatively lower than predicted which may be indicating a reduced lung function in this region. Also one can note that lung functioning appears to be better in Gozo when compared to the other regions. Since this survey is only a pilot study and the sample is small, one expects to find large confidence intervals around the means and limited statistical significance. However these results merit further research on a larger sample.

When looking at lung function by smoking status, lung function is comparably better in those who have never smoked with current smokers having comparably worse lung functioning. Those who were in the past smokers for at least a year also fared slightly worse off than never smokers. Similar to the analysis by region, due to the small sample, the confidence intervals around the means are large and overlap. However, due to smoking being a major risk factor for chronic respiratory disease, it is expected that with a larger sample this pattern will persist.

Figure 22 Difference between measured and predicted FEV1 by smoking status
8. Visual Acuity

There are four levels of visual functioning as classified by the International Classification of Diseases (ICD10): Normal vision, moderate visual impairment, severe visual impairment and blindness. Globally the major causes of visual impairment are uncorrected refractive errors (uncorrected nearsightedness, farsightedness or astigmatism) and cataracts. Visual acuity describes the eyes ability to make out details and can be measured through letter recognition charts such as the Snellen chart. Snellen fractions corresponding to the rows of letters on the chart are used to compare the subject performance against a standard. Some individuals can have good functional vision even if one or both eyes do not have 6/6 vision so functional vision measurement is taken as best-corrected vision in the better eye. Since the aim of this study was to see the functional vision of the population, the measurement was taken according to how participants see on a daily basis so they were asked to remain with corrective eye wear during the test if they use them on a daily basis.

Visual acuity can be subdivided into 3 broad categories – Near Normal/Normal Vision, Low Vision and Near Blindness/ Blindness. These categories can be further subdivided as follows and indicate the following Snellen fraction ranges:

<table>
<thead>
<tr>
<th>Category</th>
<th>Snellen Fraction Range (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Near-) Normal Vision</td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>6/4 – 6/8</td>
</tr>
<tr>
<td>Near Normal</td>
<td>6/10 – 6/20</td>
</tr>
<tr>
<td>Low Vision</td>
<td></td>
</tr>
<tr>
<td>Moderate Low Vision</td>
<td>6/25 – 6/50</td>
</tr>
<tr>
<td>Severe Low Vision</td>
<td>6/63 – 6/125</td>
</tr>
<tr>
<td>Profound Low Vision</td>
<td>6/160 – 6/320</td>
</tr>
<tr>
<td>(Near-) Blindness</td>
<td></td>
</tr>
<tr>
<td>Near Blindness</td>
<td>6/400 – 6/630</td>
</tr>
<tr>
<td>Total Blindness</td>
<td>No light perception</td>
</tr>
</tbody>
</table>

While vision of up to 6/20 (i.e. being 6 metres away to perceive something a normal eye sees 20 metres away) is considered within the range of near-normal vision, one must note that this still indicates some reduction in visual perception and acuity.

Overall the majority of participants had normal or near to normal vision with 69.8% having normal functional vision and 28.7% having near normal functional vision. Only 1.1% of the sample could be classified as having low functional vision. Men overall have better functional vision when compared to women with a higher proportion of them being in the normal vision category however there are no differences in the proportion of persons with low vision.

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When looking at those who used a visual correction (spectacles or contact lenses) the large majority had normal or near normal functional vision with a small percentage (2.9%) having low visual functioning.

Figure 23 Visual acuity subdivided by gender

Figure 24 Visual acuity amongst those with visual correction
9. Conclusion

This pilot examination survey has provided us with a new insight into the burden of major chronic diseases in Malta and the extent of the main contributory risk factors. It has also provided us with a validation of the self-reported data collected through the health interview survey system. While data exists in the international literature on the typical under- or over-reporting of weight and height and disease status, there has never been any work carried out in this area in the Maltese islands. So while the existence of such misclassification of data was expected, the extent was not known for the Maltese population.

One such example is obesity. BMI is one of the main indicators of obesity, and depends on weight and height data. Women have been found to under-report BMI, probably because an overestimation of one’s height and underestimation of one’s weight. This shift was only seen between overweight and obese individuals amongst men. While, currently, women still have a higher prevalence of obesity than men, a substantial improvement has been noted since 1984 amongst women, which cannot be said of men, whose prevalence of obesity has increased since 1984. Indeed, this is a major finding of the pilot study. Due to more pronounced underreporting of weight and overreporting of height among women in self-reported data, local interview survey data erroneously suggests that men have a bigger obesity problem than women. The prevalence of obesity is less pronounced in the elderly group, but, nevertheless, three-quarters of this group falls within the overweight or obese range.

A similar gender discrepancy in under-reporting is noted in diabetes, with women being less aware of having the condition. Indeed, contrary to what emerged from self-reported health surveys, a marginally higher proportion of women suffer from altered blood glucose metabolism, or diabetes. Once again, the middle aged population seem to have the least awareness of this condition, while very few elderly with diabetes were unaware of their condition. Males are, nonetheless, less aware of the presence of high blood pressure than women. Indeed, the examination survey suggested that men are more prone to this condition unlike what emerged from self-reported data. A substantial shift in the prevalence of high blood cholesterol was also noted between 1984 and 2010.

On a final note, the results of the lead survey have shown that substantial progress has been registered in the prevalence of this health hazard, thanks to specific legislation and policies introduced around twenty years ago.

In conclusion, this pilot study has served to empower the MHEC with the expertise to run such surveys in the current setting. It has also established the need for periodic examination surveys in Malta, especially in conjunction with self-reported health interview surveys, in order to improve the quality of epidemiological data gathered through the obligatory European Health Interview Survey.
10. Annexes
Annex 1: Summary Tables for EHES 2010 Data (18+)

Table 1 Measured BMI by Gender

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>31.5%</td>
<td>42.4%</td>
<td>36.1%</td>
</tr>
<tr>
<td>Overweight</td>
<td>40.3%</td>
<td>25.6%</td>
<td>32.5%</td>
</tr>
<tr>
<td>Obese</td>
<td>28.2%</td>
<td>32.0%</td>
<td>29.8%</td>
</tr>
</tbody>
</table>

Table 2 Measured BMI by Age

<table>
<thead>
<tr>
<th></th>
<th>18 - 40</th>
<th>41 - 60</th>
<th>&gt;60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>51.2%</td>
<td>35.6%</td>
<td>24.1%</td>
</tr>
<tr>
<td>Overweight</td>
<td>31.0%</td>
<td>22.8%</td>
<td>41.4%</td>
</tr>
<tr>
<td>Obese</td>
<td>17.9%</td>
<td>35.6%</td>
<td>34.5%</td>
</tr>
</tbody>
</table>

Table 3 Measured waist circumference by Gender

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>40.0%</td>
<td>30.4%</td>
</tr>
<tr>
<td>Increased Risk</td>
<td>22.3%</td>
<td>19.5%</td>
</tr>
<tr>
<td>Substantial Risk</td>
<td>37.8%</td>
<td>50.0%</td>
</tr>
</tbody>
</table>

Table 4 Measured blood glucose by Gender

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>% with elevated blood glucose</td>
<td>9.0%</td>
<td>10.7%</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

Table 5 Measured blood glucose by Age

<table>
<thead>
<tr>
<th></th>
<th>18 - 40</th>
<th>41 - 60</th>
<th>&gt;60</th>
</tr>
</thead>
<tbody>
<tr>
<td>% with elevated blood glucose</td>
<td>0%</td>
<td>12.2%</td>
<td>21.6%</td>
</tr>
</tbody>
</table>
Table 6 Measured blood pressure by Gender

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>% with elevated blood pressure</td>
<td>41.4%</td>
<td>38.8%</td>
<td>41.7%</td>
</tr>
</tbody>
</table>

Table 7 Measured blood pressure by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>% with elevated blood pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 - 40</td>
<td>12.4%</td>
</tr>
<tr>
<td>41 - 60</td>
<td>46.0%</td>
</tr>
<tr>
<td>&gt;60</td>
<td>85.5%</td>
</tr>
</tbody>
</table>

Table 8 Measured serum blood cholesterol

<table>
<thead>
<tr>
<th>Classification</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desirable</td>
<td>39.0%</td>
</tr>
<tr>
<td>Borderline High</td>
<td>40.2%</td>
</tr>
<tr>
<td>High</td>
<td>20.8%</td>
</tr>
</tbody>
</table>

Table 9 Measured LDL

<table>
<thead>
<tr>
<th>Classification</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal or Near Optimal</td>
<td>57.6%</td>
</tr>
<tr>
<td>Borderline High</td>
<td>29.5%</td>
</tr>
<tr>
<td>High</td>
<td>11.3%</td>
</tr>
<tr>
<td>Very High</td>
<td>1.6%</td>
</tr>
</tbody>
</table>
Annex 2: Glossary of Terms

**Blood Pressure** – The force against the arterial wall created as blood circulates through the body.

**Body Mass Index (BMI)** – A person’s weight in kilograms over their height in metres, squared. It is a simple way of creating a proxy indicator of a person’s body fat.

**Cholesterol** – A fatty substance that is found in the blood and is made naturally by the liver and intestines. It plays an essential role in the cell functioning as it is a structural component of the cell membranes.

**Chronic Respiratory Diseases** – Chronic diseases of the lung airways and other structures in the lung such as asthma and chronic obstructive pulmonary disease (COPD).

**Diabetes** – A chronic disease that occurs when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin produced.

**Forced Expiratory Volume (FEV1)** – The amount of air that can be blown out from the lungs within one second. With normal lungs and airways, one can normally blow out most of the air from the lungs in one second.

**Glycated Haemoglobin (HbA1c)** – When glucose sticks to blood in the blood stream it becomes glycated haemoglobin. The greater the level of glucose in the blood the greater the level of HbA1c and therefore measuring the level of HbA1c gives an indication of whether glucose is being metabolised correctly in the body.

**High Density Lipoproteins (HDL)** – A protective type of cholesterol in the body.

**Hypertension** – Also known as high blood pressure occurs when blood is pumped with excessive force as the heart must work harder to circulate blood around the body.

**Insulin** – A hormone in the body used to control the amount of glucose in the blood and converts that glucose to energy.

**Insulin Dependent Diabetes Mellitus (IDDM)** – Also known as Type 1 diabetes usually develops in childhood or adolescence and patients usually require lifelong insulin injections to replace the insulin not being produced by the body.

**Low Density Lipoproteins (LDL)** – A harmful type of cholesterol in the body. Excessive amounts of LDL in the blood can increase the risk of cardiovascular disease as it deposits on the walls of blood vessels which can become blocked.

**Non-Insulin Dependent Diabetes Mellitus (NIDDM)** – Also known as Type 2 diabetes usually develops in adulthood and is related to obesity, lack of physical activity and an unhealthy diet. Treatment may require changes in diet and lifestyle habits or oral medications and even insulin injections. This is the most common type with approximately 90% of cases worldwide being Type 2 diabetes.
Obese – Having a BMI greater or equal to 30.00 kg/m² according to the World Health Organisation classification.

Overweight – Having a BMI between 25.00 – 29.99 kg/m² according to the World Health Organisation classification.

Self-reported – Information that is self-reported is gathered from the respondent through interviews and is not measured using any instruments.

Spirometry – A diagnostic test that measures how much air a person can inhale and exhale and how fast air can move into and out of the lungs.

Visual Acuity – The eyes ability to make out details even when using a visual aid and can be measured through letter recognition charts.

Waist Circumference – Waist circumference measurement is used to provide information on the distribution of fat around the waist which is associated with a greater risk of cardiovascular disease.