Weighing the Costs of Obesity in Malta
Kevin Valenzia
Territory Senior Partner
Being the leading professional services firm in Malta, at PwC we embrace the fundamental principle of doing right for our clients, our people and our society. It is for this reason that we have the health of our stakeholders at heart.

The healthcare industry is one of the pillars of the country. The obesogenic environment characterising Malta, coupled by our hectic lifestyles, technology, infrastructure and the increase in chronic diseases, all contribute towards a quarter of the population being obese. Thus, addressing the problem of obesity in Malta is undoubtedly a key national priority in 2017.

Obesity adversely affects the quality of life of individuals. Overweight and obesity generally translate into a number of diseases, disorders and/ or conditions, thereby leaving an impact on one’s health and possibly leading to premature mortality.

Recognising the implications and effects of obesity on society, PwC has issued this publication, with an attempt to identifying and estimating the direct and indirect costs of obesity. Obesity poses a challenge, in that it leads to increased spending on healthcare, whilst also resulting in a number of opportunity costs to Government, individuals and society as a whole.

Furthermore, obesity poses constraints on the population’s health and wellbeing.

This deep-rooted problem is likely to become unmanageable should the prevalence of obesity continue increasing. This publication aims at presenting an opportunity to understand what obesity is costing the country, with a hope to a concerted effort from different stakeholders to achieving a more active and healthy population. There is therefore a need for additional efforts and resources to be directed towards addressing this reality.

Kevin Valenzia
Executive Summary
Malta has one of the highest rates of adult and childhood obesity worldwide. Obesity tends to lead to a number of non-communicable diseases and leaves lasting impacts on individuals through a lower quality and length of life, as well as adverse effects on mental wellbeing. Concurrently, obesity translates into additional cost burdens on the health system of the country and on society in general.

The Body Mass Index (BMI) is used as a measure of obesity throughout this publication. An individual is classified obese if s/he has a BMI of 30.00 kg/m$^2$ or higher. Based on self-reported data of weight and height, 2015 European Health Interview Survey (EHIS) results are used in estimating the impact of obesity on the Maltese adult population.

Over a quarter of the Maltese adult population over 15 years of age is obese. The prevalence of obesity has increased from 23% in 2002 to 25% in 2015. Recently measured rates of BMI for the adult population aged between 18 and 70 report an even more profound problem, with 34% of the population being obese in 2016. These data suggest that Malta has been moving even farther away from the 2020 target rate of obesity set at 18%.

A conservative estimate of the obesity-related costs for Malta for 2016 (based on 2015 EHIS results) presents a figure of €36.3 million. This is composed of seven direct and five indirect costs of obesity. Of these, 66% of the costs are direct, including the cost of pharmaceuticals, hospital care and primary care. Despite the fact that costs are quite evenly distributed between the public and private sectors, the majority of these costs are borne by the private sector, i.e. individuals and private sector employers. The effects are even more pronounced when measured rates of BMI are used (34%). It is estimated that costs relating to obesity would increase by €20 million.

The excess costs emanating from obesity for 2016 (based on 2015 EHIS results) are estimated at c. €97 on a per capita basis. This report shows that the costs of obesity are absorbing 8.1% of annual public recurrent health expenditure or 5.6% of national healthcare expenditure. Furthermore, such costs represent 0.4% of the country’s Gross Domestic Product (GDP).

Further costs, such as those from mental illness and reduction of the quality and length of life have been assessed but not included in the cost estimate, as they are more conceptual in nature. Although not costed, they are ever more prevalent in the Maltese society. In fact, it is estimated that 29% of the total Maltese adult population has reported depressive symptoms as a result of obesity. Premature mortality directly attributable to overweight and obesity is estimated at 17% of total deaths in Malta.

The effect of obesity is expected to be more widespread in the future. It is a long-term problem, which is projected to generate an additional €5.1 million in costs by 2022. on the assumption that the 2015 rate of obesity is maintained. This is a very conservative estimate, as obesity in Malta is expected to continue increasing from current levels, implying significantly higher costs and a serious burden to society.

In light of its pronounced effects, it is inarguable that obesity is a societal challenge, which is expected to result in higher economic and social costs as obesity rates continue in their trajectory. Intervention is required on a global level in different facets of life, be it on a personal, family, community and national level. For interventions to yield effective results, they need to entice sustained behavioural change among individuals. Interventions may include educational and media campaigns, fiscal incentives provided to individuals, employers and industry, and incentives encouraging wellness activities at the place of work. A number of interventions are already in place through ongoing policies within the health arena. However, more efforts and resources are required for these policies to be enforced, with an aim to yielding desired outcomes. Effective interventions are expected to improve the health and quality of life of the population, whilst resulting in cost savings on health spending. Future research is yet to focus on assessing the cost effectiveness and impact of any new obesity-related interventions to be implemented in Malta.
Acknowledgements

Weighing the Costs of Obesity in Malta publication represents the efforts and ideas of many individuals within PwC and outside the firm.

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Other contributors to this publication include Mr Etienne Caruana from the National Statistics Office, Dr Sarah Cuschieri from the University of Malta and Ms Joanna Chetcuti from Advanced Allied Healthcare Professionals.
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<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI</td>
<td>Body Mass Index</td>
</tr>
<tr>
<td>CPSU</td>
<td>Central Procurement and Supplies Unit</td>
</tr>
<tr>
<td>DALY(s)</td>
<td>Disability Adjusted Life Year(s)</td>
</tr>
<tr>
<td>DHIR</td>
<td>Directorate for Health Information and Research</td>
</tr>
<tr>
<td>EHIS</td>
<td>European Health Interview Survey</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>GP</td>
<td>General Practitioner</td>
</tr>
<tr>
<td>NSO</td>
<td>National Statistics Office</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>SSC(s)</td>
<td>Social Security Contribution(s)</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
</tbody>
</table>
Obesity: Taking stock of Malta’s position
Obesity: Taking stock of Malta’s position

The rise in obesity and overweight levels has increasingly become more pertinent across the globe over the past few decades [1-2]. In fact, the World Health Organisation (WHO) [1] reports that obesity rates in 2014 were almost double those in 1980. The global obesity epidemic is even more relevant in Malta as the country has one of the highest levels of childhood and adult obesity worldwide [3-5]. Further to being a causal factor of a number of non-communicable diseases, including type 2 diabetes, cardiovascular diseases and several types of cancer [2, 6-7], obesity is creating a higher expenditure burden on both individual members of society, as well as on Government [3, 8]. Against this backdrop, this report focuses on the costs emanating from adult obesity in Malta.

Defining obesity

Obesity is defined by the WHO [9] as the “disease in which excess body fat has accumulated to such an extent that health may be adversely affected”. Typically, the Body Mass Index (BMI) (being an index of weight-for-height) is used to measure population-level obesity, this in turn enabling the categorisation of individuals depending on their BMI levels. Table 1 delineates the classification system for adults according to BMI levels, compiled by the WHO [9]. Included are also the risks of comorbidities, these varying with BMI classification.

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI (kg/m²)</th>
<th>Risk of Comorbidities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.50</td>
<td>Low (but risk of other clinical problems increased)</td>
</tr>
<tr>
<td>Normal range</td>
<td>18.50 – 24.99</td>
<td>Average</td>
</tr>
<tr>
<td>Overweight:</td>
<td>≥ 25.00</td>
<td></td>
</tr>
<tr>
<td>Pre-obese</td>
<td>25.00 – 29.99</td>
<td>Increased</td>
</tr>
<tr>
<td>Obese Class I</td>
<td>30.00 – 34.99</td>
<td>Moderate</td>
</tr>
<tr>
<td>Obese Class II</td>
<td>35.00 – 39.99</td>
<td>Severe</td>
</tr>
<tr>
<td>Obese Class III</td>
<td>≥ 40.00</td>
<td>Very Severe</td>
</tr>
</tbody>
</table>

The Prevalence of Obesity in Malta

Obesity has been found to be the result of a chronic energy imbalance, involving physical activity patterns, as well as dietary intake [10]. Obesity is mainly driven by the food consumed. Recently, increased processed, cheap and energy-dense foods have started being produced as a response to people’s preferences, status and hectic lifestyles. Persuasive marketing has tended to become more successful in increasing the demand for such types of food [11]. Furthermore, the environments within a country, together with socio-economic factors, cultural norms, transport systems and recreation spaces also have a bearing on the prevalence of obesity within a population [10]. For instance, families with lower socio-economic status have a propensity to consume more energy-dense foods than their higher income counterparts. High education and income have been found to lead to healthier food intake [12]. Such factors and dynamics have largely shaped the obesity epidemic across the globe over the past few decades [13].

Although the scope of this publication is not intended to cover childhood obesity, these problems seem to start at a very young age. The energy-dense food supply available in Malta, coupled by the small-scale infrastructure available for active living, characterise Malta’s obesogenic environment, which in turn impinges on the greater tendency for the population to be obese [14].

Obesity rates in 2014 are almost double those in 1980
Additionally, research shows that aside from genetic defects, lifestyle choices and non-genetic influences (which are in turn shaped by the environment) partially account for the apparent hereditary predisposition towards obesity and associated disease. Self-reported data related to health and weight have been collected in Malta through three main surveys, these being the 2002 National Health Interview Survey, the 2008 European Health Interview Survey (EHIS) and the 2015 EHIS. There is international evidence (in Italy, The Netherlands, North America and Malta) that self-reported data on weight and height may be biased, with data on weight being underestimated and data on height being overestimated, this owing to social desirability and the fact that individuals may be unaware or insufficiently aware of their weight problem. There is a similar trend in Malta as confirmed through a pilot study carried out in 2010, with the discrepancy in self-reported measures of weight and height being more pronounced in the female population. Furthermore, results from the recent study by Cuschieri et al. (2016), based on measured BMI data, also confirm this trend.

The most recent estimates of obesity rates in Malta for the adult population aged 15 years and older are shown in Figure 1. It is alarming that the majority of the population (60%) is either pre-obese (35%) or obese (25%). On the other hand, only 38% and 2% of the population surveyed comprise lean and underweight individuals, respectively.

In comparison with the remaining 27 European Union countries, Malta reports the highest rates of obesity, followed by Latvia and Hungary.

As outlined in Figure 2 overleaf, 70% of the obese population have a BMI ranging between 30.00 kg/m² and 34.99 kg/m², 21% fall within the Obese Class II category and 9% are categorised as severely obese (BMI ≥ 40.00 kg/m²).

According to the latest local study reporting measured rates of BMI, almost 70% of the Maltese adult population aged 18 to 70 years is either overweight or obese, with the former representing 36% and the latter representing 34% of the population.
Based on the 2015 EHIS, women are less likely to be obese than males in all categories except for Obesity Class III, as is evident in Figure 3. In Malta, only obese women within the third obese class follow the global trend. Globally, women tend to have higher rates of obesity than men across all categories. To a certain extent, this could be partially attributed to the fact that data used is based on self-reported measures. However, an analysis of measured rates of BMI locally also reflects a similar trend, whereby men have higher rates of both overweight and obesity prevalence than women. This confirms the situation in the Southern European region, where there is evidence that men report the highest rates of overweight and obesity.
Obesity has increasingly become more pertinent among the older age groups, with the highest rates being recorded among individuals aged 55 to 74 as shown in Figure 4. Cusieri et al. (2016) also report similar trends in their study [22].

![Figure 4: Percentage of Obese Population by Age (2015)](image)

Malta leads trends when it comes to childhood obesity [20, 28-29], as is evident from the recent Health Behaviour in School-Aged Children study [4]. From this study, it emerges that 32% and 38% of Maltese 11-year-olds are obese or overweight, respectively. Although the scope of this report ventures beyond childhood obesity, it is worth recalling that obese children tend to become obese adults [41], further aggravating the problem.
Analyzing Trends
An analysis of the trend over the years indicates that the percentage of obese individuals has increased from 23% in 2002 to 25% in 2015. The pre-obese category failed to register improvements as the percentage of pre-obese individuals remained steady at 34% between 2002 and 2015.

Figure 5: Increase in the Percentage of Obese Individuals between 2002 and 2015

In line with global trends \[^{[26]}\], females registered lower percentages than males in the pre-obese category, as can be observed through Figure 6 overleaf. However, both genders have experienced an increase in the percentage of obese individuals. Obese males reached a high of 27.1% in 2015, having increased from 25.0% in 2002, while the proportion of obese females increased from 21.3% in 2002 to 23.5% in 2015. In terms of overweight, males registered some improvement, with the percentage increasing from 40.5% in 2002 to 44.7% in 2008, but declining to a low of 38.1% in 2015. Conversely, the percentage of pre-obese females has increased from 28.7% in 2002 to 30.6% in 2015.
Further trends emerge upon analysing the percentage of obese males and females within each obesity class level over the years. Obese males have tended to move from Obese Class I to Class II and III, as illustrated in Table 2. As regards females, there has been no movement through the years in the Obese Class III category, but there tended to be a shift away from Class II to Class I, resulting in an improvement.


<table>
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</thead>
<tbody>
<tr>
<td>I</td>
<td>76%</td>
<td>66%</td>
<td>74%</td>
<td>64%</td>
<td>74%</td>
<td>69%</td>
</tr>
<tr>
<td>II</td>
<td>19%</td>
<td>24%</td>
<td>20%</td>
<td>26%</td>
<td>22%</td>
<td>21%</td>
</tr>
<tr>
<td>III</td>
<td>5%</td>
<td>10%</td>
<td>6%</td>
<td>10%</td>
<td>8%</td>
<td>10%</td>
</tr>
</tbody>
</table>
BMI categories can be analysed further by age. Data presented reveals that the likelihood of being overweight and obese increases with age, and generally, has been on the rise over time, in line with trends occurring within Organisation for Economic Co-operation and Development (OECD) countries and countries within the WHO European region\textsuperscript{13, 23}.

The older an individual is, the more likely it is for him/her to develop weight problems\textsuperscript{23}. Table 3 indicates that whereas out of the population surveyed aged 15 to 24, only 22.6% and 10.4% are pre-obese and obese respectively, the same figures rise to 40.6% and 33.7% for those individuals between 65 and 74 years of age\textsuperscript{18}. A striking difference is evident in the obesity levels registered over time within the age groups of 35 to 44 and 55 to 74. For instance, whereas in 2002, 29.7% of the 55-64 age group were obese, this percentage has increased to 35.2% in 2015.

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Pre - Obese</th>
<th>Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 - 24</td>
<td>22.1</td>
<td>23.2</td>
</tr>
<tr>
<td>25 - 34</td>
<td>31.6</td>
<td>29.6</td>
</tr>
<tr>
<td>35 - 44</td>
<td>36.5</td>
<td>37.7</td>
</tr>
<tr>
<td>45 - 54</td>
<td>38.2</td>
<td>43.7</td>
</tr>
<tr>
<td>55 - 64</td>
<td>38.0</td>
<td>41.3</td>
</tr>
<tr>
<td>65 - 74</td>
<td>39.5</td>
<td>41.4</td>
</tr>
<tr>
<td>75+</td>
<td>37.3</td>
<td>38.9</td>
</tr>
</tbody>
</table>

These trends are of concern in light of the number of conditions and diseases being associated with overweight and obesity. Increased BMI levels lead to a heightened risk of developing type 2 diabetes, hypertension, coronary artery disease and stroke, cancers, osteoarthritis and dyslipidaemia, among other diseases. Moreover, being overweight or obese lends to negative respiratory effects, whilst also having adverse impacts on the reproductive functions\textsuperscript{30}. Such diseases and disorders can be experienced concurrently, thereby becoming known as comorbidities\textsuperscript{31}. In turn, these comorbidities negatively affect the health-related quality of life, whilst also leading to premature mortality\textsuperscript{32}. At the same time, comorbidities have wider indirect effects, not only on the health and mental wellbeing of the individual\textsuperscript{33}, but also on private and national expenditure\textsuperscript{32, 34}.

It has been estimated that the cost of non-communicable diseases and their associated risk factors generally range from 1% to 7% of a country’s Gross Domestic Product (GDP)\textsuperscript{35}. Other noteworthy consequences of obesity may include greater fiscal pressures, additional costs to employers, lower tax revenues, increased disabilities, demand for more effective treatments and fewer opportunities for individuals, households and society in general\textsuperscript{30}. The effects seem to be even more widespread the longer the duration of obesity\textsuperscript{36}. There is in fact evidence that health and mortality risks are positively related to the number of years someone is obese\textsuperscript{32}. By way of example, the longer the duration of obesity, the more one is likely to develop chronic diseases such as type 2 diabetes, cardiovascular disease and cancer\textsuperscript{37-38}.
Halting Obesity Rates – The WHO Target

Diabetes and non-communicable diseases, including cardiovascular disease, pose the greatest health threats to the human race globally. It is for this reason that the WHO has developed a Global Action Plan for the prevention and control of non-communicable diseases, with the main aim of achieving a 25% reduction in premature mortality from non-communicable diseases by 2025. One of the voluntary global targets outlined in this action plan is to halt the rise in diabetes and obesity. The Global Action Plan highlights that countries following the plan must select specific indicators, these being the most appropriate in their national context.

Having said that, most countries have agreed on halting the rates of obesity prevalence, with the year 2010 being the basis year.

The Maltese Government is a signatory to this global action plan. To this effect, targets were set in 2010 through 'A Strategy for the Prevention and Control of Non-communicable Disease in Malta', in order to reduce the prevalence of obesity in the Maltese population over the age of 15 years from 22% to 18%.

Prior to setting this target, Malta had set targets for 2005 in the publication entitled, 'Health Vision 2000'. Targets differed by gender and also by age (≤35 years and >35 years). In 2008, Malta did not meet the obesity target level set in 2005.

Malta’s position has worsened over the years, as indicated in Figure 7. The percentage of obese individuals increased from 22.4% in 2008 to 25.3% in 2015, making the achievement of the 18% target even more challenging, especially also in light of the measured rate of obesity standing at 34%. Thus, more needs to be done at a national and inter-sectoral level to address the obesity problem in Malta.

A target was set in 2010 to reduce the prevalence of obesity in Malta from 22% to 18% by 2020.

Figure 7: Malta’s Position in terms of the 2020 Obesity Target

- 2008: 22.4%
- 2015: 25.3%
- 2016: 34.0%
- 2020: 18.0%
In light of Malta’s position in terms of obesity, the Government has implemented a number of policies with an aim to address this reality. The crux of the policies is the ‘A Healthy Weight for Life: A National Strategy for Malta’ to be implemented between 2012 and 2020. This policy centres on obesity and how this can be reduced through healthy choices and healthy eating.

One of the priorities of action in this strategy has been reinforced through the ‘National Breastfeeding Policy and Action Plan 2015 – 2020’ which seeks to instigate a supportive environment whilst nurturing a culture that facilitates one’s choice for breastfeeding. The Healthy Lifestyle Promotion and Care of Non-Communicable Diseases Act, Act III of 2016, Chapter 550 of the Laws of Malta, was enacted in 2016 with the aim of fostering an inter-ministerial lifelong approach supporting physical education and healthy eating, as well as with the intention of reducing the incidence of non-communicable diseases throughout all age groups.

Complementing the WHO’s Global Action Plan, the Steering Committee, supported by the Parliamentary Working Group on Diabetes, has set out a national strategy for diabetes through ‘Diabetes: A National Public Health Priority 2016 – 2020’ since obesity tends to lead to an increased risk of developing type 2 diabetes. Furthermore, the Government, through the Ministry for Education and Employment, also devised a ‘Whole School Approach to a Healthy Lifestyle: Healthy Eating and Physical Activity Strategy’ in 2015, accompanying this with a specific policy of action on the subject. This is important since schools are in a position to offer a number of opportunities to promote healthy food nutrition among children, while potentially acting as a point of reference between parents and the community.
Weighing the Costs of Obesity
Weighing the Costs of Obesity

Obesity has a number of wide-ranging implications on society, not only through the direct and indirect costs it generates, but also by affecting the health and quality of life of individuals. Costs associated with obesity are borne by multiple stakeholders including Government, the obese population, employers and society at large.

This study focuses on a mixture of twelve direct and indirect costs related to obesity (as set out in Figure 8) and attaches a monetary value to each of these costs. An estimate is made of the costs associated with obesity beyond those incurred normally, that is the excess costs incurred by the obese over the normal weight segment of the population. This follows on an adaptation of a model (through peer analysis) already applied by PwC in Australia [48].

Figure 8: Selected Costs of Obesity

Costs having the highest causal association to obesity and for which quality research is available have been selected for inclusion in this costing exercise. The list of costs included is not exhaustive, since several other obesity-related costs exist; however, these either cannot be reliably measured owing to insufficient information available, or they are inherently non-quantifiable. Examples of other obesity-related costs include financial, health and wellbeing costs, such as depression, discrimination and lower educational attainment.

It is important to note that the estimates of costs presented in this report underestimate the true picture of obesity-related costs.
**Direct and Indirect Costs**

The total cost of obesity in Malta (based on 2015 EHIS results) for the year 2016 has been estimated at €36.3 million. The modelling underlying this report estimates that €23.8 million represent the total direct costs and €12.5 million comprise indirect costs. A summary of the different costs incorporated within the model, also analysed into public and private expenditure, is presented in Table 4. Public expenditure on obesity represents that portion of obesity-related costs incurred by Government. Private expenditure represents out-of-pocket expenses incurred by obese individuals primarily because of their weight problem, as well as the obesity-related costs borne by employers within the private sector.

### Table 4: Additional Costs arising from Obesity in 2016 for Adults aged 15 years and over (based on 2015 EHIS results)

<table>
<thead>
<tr>
<th>Cost Categories</th>
<th>Cost Type</th>
<th>Public Sector</th>
<th>Private Sector</th>
<th>National Costs</th>
</tr>
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<tbody>
<tr>
<td>Direct Costs</td>
<td>Primary Care</td>
<td>1.3</td>
<td>1.8</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>Specialist Care</td>
<td>2.7</td>
<td>0.2</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>Hospital Care</td>
<td>3.1</td>
<td>1.4</td>
<td>4.5</td>
</tr>
<tr>
<td></td>
<td>Cost of Allied Healthcare Professionals</td>
<td>0.2</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>Pharmaceutical Care</td>
<td>4.0</td>
<td>6.7</td>
<td>10.7</td>
</tr>
<tr>
<td></td>
<td>Weight Loss Interventions</td>
<td>0.4</td>
<td>1.5</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>Public Interventions</td>
<td>0.4</td>
<td>N/A</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Subtotal (Direct Costs)</strong></td>
<td></td>
<td><strong>12.1</strong></td>
<td><strong>11.7</strong></td>
<td><strong>23.8</strong></td>
</tr>
<tr>
<td>Indirect Costs</td>
<td>Absenteeism</td>
<td>1.8</td>
<td>4.7</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>Presenteeism</td>
<td>0.9</td>
<td>2.3</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Government Subsidies</td>
<td>0.9</td>
<td>N/A</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>Forgone Earnings</td>
<td>N/A</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>Forgone Taxes</td>
<td>0.5</td>
<td>N/A</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Subtotal (Indirect Costs)</strong></td>
<td></td>
<td><strong>4.1</strong></td>
<td><strong>8.4</strong></td>
<td><strong>12.5</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>16.2</strong></td>
<td><strong>20.1</strong></td>
<td><strong>36.3</strong></td>
</tr>
</tbody>
</table>

Figure 9 and Figure 10 overleaf are a visual representation of the apportionment of direct and indirect costs (respectively) between the public and the private sector.
Figure 9: Direct Costs of Obesity Analysed by Sector (2016)

- **Public Sector**
- **Private Sector**

Figure 10: Indirect Costs of Obesity Analysed by Sector (2016)
A high-level analysis of the total bill of obesity-related costs in Malta has also been made in light of the recent examined BMI data in the study conducted by Cuschieri et al. (2016) [22]. This resulted in €20 million additional costs. On this basis, the re-estimated total cost of obesity in Malta for the year 2016 would be €56.4 million, instead of €36.3 million, assuming that the same estimated differences between an obese and a normal weight individual for the various factors discussed throughout the publication emerge.

The most substantial increases in costs occur with respect to indirect costs. For instance, the cost of absenteeism rises by 124%, whilst forgone earnings increase from €1.4 million to c. €3.0 million when measured BMI rates are used. On the other hand, the most profound effects within direct costs seem to arise from the cost of allied healthcare professionals, which increases by €0.3 million, and specialist care, which experience a 92% increase in costs.

A more recent paper issued by Cuschieri et al. (2016) [49] quotes a figure of €23.7 million for overweight and obesity in Malta, this comprising hospital costs and the cost of visits to general practitioners (GPs) and specialists. This estimate is based on the 2008 costings published in the ‘A Healthy Weight for Life: A National Strategy for Malta 2012 – 2020’ publication [43], inflated to 2016 prices using an inflation rate of 2% per annum. The figures outlined in Cuschieri et al.’s (2016) study [49] is based on a sample of direct costs that also includes the overweight population.

There is evidence that per capita healthcare expenditures tend to increase proportionately with the increase in BMI levels [8]. In fact, research shows that the largest increase in costs occurs for obese individuals within the Obese Class II and Class III categories [50 - 51]. Based on the estimates outlined in this publication, the excess cost per capita in Malta stemming from obesity for individuals over 15 years of age is €97.

‘Conceptual’ Costs involving Health and Wellbeing

The total cost figure shown in Table 4 on page 22 is underestimated to the extent that there are more ‘conceptual costs’ borne by obese individuals in the form of health and wellbeing impacts. These costs are reported separately from the direct and indirect costs as they are of a different nature. Conceptual costs are based on the obesity impact on quality and length of life, including depression and discrimination.

The remaining sections of this report will delve into further detail with regards to the selected direct and indirect costs. This is then followed by a brief outline of health and wellbeing costs. An explanation as to the methodology and technical detail used in arriving at the results of the direct and indirect cost estimates is included within the appendices section.
Direct Costs
**Direct Costs**

Costs directly relating to obesity are generally made up of both medical costs incurred in treating obese individuals and related comorbidities, as well as public expenditure incurred with the aim of reducing obesity levels. A sample of formulae explaining each component of the direct costs estimates are outlined in Appendix A.

**Primary Care**

Primary care generally refers to one’s main source of regular medical care. In this study, primary care refers to general practitioner (GP) visits. A direct comparison of the number of visits in four weeks to a public and a private GP for obese and normal weight individuals has been possible through an analysis of two particular questions within the 2015 EHIS [18]. A detailed explanation of a sample of the formulae applied in calculating direct costs is set out in Appendix A.

Generally, the mean number of GP visits increases with rising BMI levels, as evidenced in Table 5. This data supports the literature, in that increasing levels of BMI are directly related to the frequency of visits to a GP [51], which in turn contribute towards increased GP costs. For example, in a peer report, it has been estimated that obese individuals have between 19% to 37% higher GP costs than lean individuals, with costs varying by obesity class level [52].

Applying each resultant difference to the cost per visit and then to the extrapolated population within each BMI group results in the total excess cost per BMI group over the normal weight class.

<table>
<thead>
<tr>
<th>Table 5: Mean number of visits to public GP and private GP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BMI Category</strong></td>
</tr>
<tr>
<td>Normal weight</td>
</tr>
<tr>
<td>Overweight</td>
</tr>
<tr>
<td>Obese Class:</td>
</tr>
<tr>
<td>I</td>
</tr>
<tr>
<td>II</td>
</tr>
<tr>
<td>III</td>
</tr>
</tbody>
</table>

The total estimated annual GP costs for 2016 amount to €3.1 million, comprising c. €1.3 million in public GP costs and €1.8 million in private GP costs. Higher public GP costs result from Obesity Class I since this is the largest obesity category. In the case of private GP costs, the lowest costs are borne by Obese Class II as both the mean difference in GP visits, as well as the proportion of obese individuals within this BMI group are lower than those for Obese Class I.
Weighing the Costs of Obesity in Malta

Based on the data outlined above, obese individuals have higher referrals to medical specialists. Similarly, findings from an Australian study [53] and a study conducted by PwC [48] estimate that obese individuals suffer between 24% to 57% higher specialist visit costs than lean individuals.

A similar methodology to the estimation of primary cost is applied in calculating specialist care costs relating to obesity. In terms of the number of visits to public specialists, differences emerge between obese individuals and normal weight individuals across all obese classes.

In the case of private consultations, differences emerge only with respect to Obese Class III. Table 6 summarises the mean number of visits by BMI category analysed by visits to public and private specialists.

### Table 6: Mean number of visits to public specialist and private specialist

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>Public Specialist</th>
<th>Private GP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight</td>
<td>0.061</td>
<td>0.094</td>
</tr>
<tr>
<td>Overweight</td>
<td>0.084</td>
<td>0.095</td>
</tr>
<tr>
<td>Obese Class:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>0.107</td>
<td>0.094</td>
</tr>
<tr>
<td>II</td>
<td>0.096</td>
<td>0.094</td>
</tr>
<tr>
<td>III</td>
<td>0.246</td>
<td>0.147</td>
</tr>
</tbody>
</table>

This has also been confirmed in the study by Colagiuri et al. (2010) [53] and that conducted by PwC [48]. The frequency of visits to allied healthcare professionals has not been captured in the EHIS. For this reason, proxies from the PwC peer report [48] have been applied. On this basis, the additional costs due to obesity emanating from care provided by allied healthcare professionals in Malta are estimated at c. €0.3 million, of which the Government covers about 75%.

**Care provided by Allied Healthcare Professionals**

The 2015 EHIS [18] indicates differences between the occurrence of visits to dietitians and podiatrists by obese versus the normal weight population. Results partially confirm a study by Valenti (2008) [54], which reveals that obese and overweight individuals generate most referrals to allied healthcare professionals, namely to nutritionists and dietitians.

**Specialist Care**

The total annual additional cost of specialist consultations due to obesity amount to €2.9 million, of which the Government covers €2.7 million. The fact that only 8% of the obese population reverts to private specialists implies that most consultations are in effect funded by Government.
Hospital Care

Literature from Australia and the United States reveals that obesity leads to increased healthcare costs, including hospital costs [55-56] which tend to emanate from a higher average length of stay in hospitals, especially in the case of medically treated obese patients [57].

Essentially, higher costs are generally experienced with rising BMI rates. Hospital stays for obese patients are generally longer than in the case of normal weight individuals [57], as is also the case in Malta. The difference in the mean number of inpatient and day patient stays between obese and normal weight individuals has been extracted from the 2015 EHiS [18]. Table 7 presents the mean number of inpatient nights and day patient stays in a year for each BMI category, respectively.

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>Inpatient stays (nights)</th>
<th>Day patient stays (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight</td>
<td>0.481</td>
<td>0.217</td>
</tr>
<tr>
<td>Overweight</td>
<td>0.578</td>
<td>0.217</td>
</tr>
<tr>
<td>Obese</td>
<td>0.619</td>
<td>0.283</td>
</tr>
</tbody>
</table>

The cost of hospital care is divided into the cost of inpatient stays and day patient stays, both excluding the cost of pharmaceuticals consumed and/or dispensed. The total estimated excess hospital care costs due to obesity amount to €4.5 million in 2016, of which €3.1 million is attributable to the Government and the remaining €1.4 million to the private sector. The apportionment is in accordance with the national health expenditure analysis in the WHO Global Health Expenditure Database [58], where 69% of the total expenditure is attributed to Government and the rest to the private sector. Inpatient costs, whether private or public, contribute around €3.5 million to the total excess cost, whereas €1.0 million are attributable to day patient costs.

In addition, hospitals may incur additional expenditure by investing in specialised equipment for the morbidly obese, such as pressure mattresses, reinforced beds, specialised wheelchairs, specific ambulances designed to transport severely obese individuals and the cost of additional staff members required to assist such individuals [59-62].

Although these costs have not been included in the financial model underlying this study, due to insufficient information, they are worth mentioning given that treatment to severely obese patients would necessitate the use of specialised equipment.

Pharmaceutical Care

Average pharmaceutical care costs per year are higher for obese individuals than non-obese individuals. The annual cost of pharmaceutical consumption due to obesity is estimated at €10.7 million, of which 37% is financed by Government. These figures confirm the evidence that obese individuals contribute towards higher expenditure on prescription drugs [53, 55]. In fact, it is estimated that obese individuals spend between 23% to 54% more on pharmaceuticals than lean individuals, the percentages varying depending on obesity class level [52].

In estimating the cost of pharmaceuticals purchased by Government, the percentage excess consumed by the obese over the normal weight population is calculated for each obesity-related comorbidity.

A difference has been noted in pharmaceutical intake between obese and normal weight individuals through the 2015 EHiS [18]. In 2016, Government’s additional spend on pharmaceuticals due to obesity has been estimated at €4.0 million, with the highest total spend being on individuals within Obese Class II.

The average out-of-pocket spend on pharmaceuticals by the obese population is estimated at €6.7 million. High-level estimates (on the basis of the 2008 Household Budgetary Survey [53]) indicate that individuals fund the majority of pharmaceuticals purchased in Malta, out-of-pocket. Compared with other European countries, public expenditure on healthcare in Malta as a proportion of total health expenditure seems to be on the low side [64].
Nevertheless, it is important to recall that Government benefits from certain economies when purchasing pharmaceuticals, in contrast with the private sector. In other countries, the mix between public and private expenditure on pharmaceuticals differs, at times, with private insurers also funding a proportion of expenditure on pharmaceuticals\cite{48, 64}. High-level estimates for the excess pharmaceutical costs due to obesity per capita indicate that Malta fares fairly in comparison with other countries, with around €25 per capita and €28 per capita being spent in Malta and Australia, respectively\cite{52, 65}.

**Weight Loss Interventions**

The cost of weight loss interventions is estimated at €1.9 million, this including the cost of bariatric surgery, as well as the expenditure by the obese population and Government within the weight loss industry.

Expenditure on the weight loss industry includes gym memberships, sports equipment, low-calorie foods and beverages, weight loss supplements, and the cost of nutritional support for weight loss\cite{48}. Given the difficulty in obtaining such data for Malta, the excess average spend per overweight or obese individual on the weight loss industry in Australia (estimated through the PwC peer report\cite{48}) has been converted to Malta prices using the purchasing power parity factor\cite{66-67} and applied as a proxy in the underlying financial model. On this basis, the estimated excess cost by individuals on the weight loss industry is €1.5 million.

Bariatric surgery has become increasingly popular worldwide, this proving the most effective evidence-based method for reducing and sustaining weight loss, whilst ameliorating or reducing obesity-related comorbidities, such as type 2 diabetes\cite{68-72}. Bariatric surgery is a procedure which is generally carried out on the morbidly obese, these being patients with a BMI over 40.00 kg/m\(^2\), or those with a BMI over 35.00 kg/m\(^2\) and having one or more obesity-related comorbidity\cite{73-74}. Over the years, there has been an exponential increase in the number of bariatric surgeries carried out globally\cite{75}, with the total number reaching c. 500,000 in 2013\cite{76}. This procedure started to be performed in Malta in 2014. In 2015, a total of 11 bariatric surgeries were carried out at an estimated total cost of c. €0.1 million.

Dar Kenn Għal Saħtek and Lifestyle Clinics represent other services financed by Government intended to assist inter alia obese individuals. Dar Kenn Għal Saħtek is namely a residential and semi-residential facility, whereas Lifestyle Clinics are located within the community. Both of these set-ups are intended to provide treatment and assistance to obese people and other individuals suffering from eating disorders. Experts working within these set-ups have indicated that Government contribution amounts to c. €0.4 million.

Public Interventions

Public obesity interventions comprise public campaigns and strategies intended to raise awareness relating to the importance of a healthy diet and physical activity. It is estimated that the cost of public obesity interventions in 2016 is c. €0.4 million, with €0.08 million relating to the Obesity Strategy Intervention, and the rest relating to the apportionment of obesity-related costs within other votes.

The cost of public interventions therefore, does not only comprise the cost of raising awareness about obesity and its intended consequences, but also the cost of providing training to professionals working in the field so as to enhance their skills, as well as the cost of services being offered to the obese.

Government contributes actively towards addressing the problem of obesity in Malta, with 93% of the cost of specialist care, 69% of hospital care costs and 75% of the cost of allied healthcare professionals being funded by Government.
Indirect Costs
**Indirect Costs**

The indirect, or hidden, costs of obesity include productivity losses through absenteeism and presenteeism, and the cost of Government transfers in the form of invalidity pensions and forgone taxes. A detailed explanation of a sample of the formulae applied in calculating indirect costs is set out in Appendix A.

**Absenteeism**

Absenteeism refers to the time one spends away from work due to illness. Absenteeism tends to lead to increased costs through lost productivity and increased payments for sick leave [8]. Generally, the presence of a number of health conditions and the risk of developing further health problems result in higher productivity losses through absenteeism[77]. Being associated with a number of related comorbidities, obesity may explain the increased likelihood of absenteeism. In fact, there is evidence that increasing rates of obesity lead to increased risk of sick leave [78-79]. Furthermore, there is also an association between obesity and long-term sick leave [80-81]. Through the 2015 EHIS [18], it is evident that on average, obese individuals within the working age population and working for pay or profit are generally absent from work due to sickness for more hours than lean individuals. As shown in Table 8, there is a direct relationship between the BMI of obese individuals and the average number of hours of sick leave taken in a year. Individuals within Obese Class III are absent from work due to health problems for more hours than individuals in Class II and Class I, respectively.

### Table 8: Average number of hours of absence from work due to personal health problems in the past year

<table>
<thead>
<tr>
<th>Classification</th>
<th>Average number of hours of absence from work due to personal health problems in the past year amongst those working for pay or profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight</td>
<td>26.9</td>
</tr>
<tr>
<td>Pre- Obese</td>
<td>25.4</td>
</tr>
<tr>
<td>Obese Class:</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>30.2</td>
</tr>
<tr>
<td>II</td>
<td>58.7</td>
</tr>
<tr>
<td>III</td>
<td>74.2</td>
</tr>
</tbody>
</table>

The economic cost of absenteeism is generally borne by the employer through payments for sick leave availed of. Generally, the higher the number of hours taken in terms of sick leave, the more pronounced is the cost of absenteeism. In Malta, the cost of absenteeism in 2016 is estimated at €6.5 million.
Presenteeism

Presenteeism refers to those occasions whereby employees attend work, but as a consequence of their medical conditions or illness, they may not perform to the best of their ability \(^\text{[82]}\). It is assumed that presenteeism is positively associated with obesity since obese individuals tend to suffer from a number of obesity-related comorbidities. This follows on the finding that presenteeism leads to reduced productivity, especially among obese workers having a BMI of 35.00 kg/m\(^2\) and over \(^\text{[83]}\).

**Presenteeism is positively associated with obesity**

The annual percentage labour productivity loss due to presenteeism in the workplace is based on a study undertaken by Econtech in 2007 \(^\text{[84]}\), whereby the cost of productivity losses due to presenteeism in the workplace has been estimated, taking into consideration twelve different medical conditions. This research has been conducted in Australia.

Five of these conditions, namely: diabetes, heart disease, hypertension, cancer and back, neck or spinal problems, are obesity-related comorbidities. These percentages have been applied in the absence of similar information for Malta. Using such estimates along with estimates on the extent to which high BMI levels are responsible for the burden of disease (extracted from the 2015 EHIS \(^\text{[18]}\)), it is estimated that 0.31% of total labour productivity loss due to presenteeism is attributable to obesity. This results in a total cost of presenteeism due to obesity of €3.2 million in 2016.

There is evidence in literature from the United States and Canada that presenteeism has harsher consequences in terms of productivity losses than absenteeism \(^\text{[82, 85 - 86]}\). These findings are not supported in Malta, as the costs of absenteeism are substantially higher than those of presenteeism.

**Government Subsidies**

Obesity has recently been formally associated to disability through a ruling by the European Union Court of Justice in 2014. It has been ruled that obesity can be classified as a disability if it impacts an individual’s professional activity \(^\text{[87]}\). Essentially, extreme obesity levels can have negative implications on a person’s mobility and in turn, on a person’s ability to work.

It has been suggested through this court case that an individual falling within Obese Class III would be in such a limited position to work that it would amount to disability. In turn, this could have repercussions on anti-discrimination legislation \(^\text{[88]}\) as there is evidence that obesity leads to prejudicial treatment within the work environment \(^\text{[89]}\). In addition, it has been claimed that there is a greater likelihood for obese persons to suffer disability and, as a consequence, claim disability or invalidity pensions \(^\text{[78]}\).

Although it is generally difficult to classify the level of disability directly related to obesity, data from the 2015 EHIS \(^\text{[18]}\) has been used to classify persons within the working age population (that is, between 16 and 65 years of age) as disabled. Results represent those having difficulty in walking 500 metres on flat terrain without a stick or walking aid or assistance, and/ or those having difficulty in walking up or down twelve steps without a stick, other walking aid or assistance. It is estimated that 160 obese individuals have registered this disability, thus resulting in an additional cost of c. €0.9 million to the Government through the payment of invalidity pensions.
Forgone Earnings

Individuals within the working age population who could be working had they not been obese suffer an opportunity cost in terms of the salary they could be earning had they been working, less the invalidity pension received from Government. Forgone earnings arise since a morbidly obese individual may not be in a position to work productively due to physical and/or mental impairment, merely as a result of his or her weight. There is evidence that obesity, independent of its related comorbidities, significantly affects workforce productivity and employment [90-91]. From an analysis of 2015 EHIS data [18], no differences have been noted in employment between obese and normal weight individuals. For this reason, forgone earnings are calculated on that proportion of the obese population who receive disability payments. Based on the average annual net income per person for 2016 (€13,974 [92]), there is a potential forgone earnings cost of €1.4 million. The cost of invalidity pensions paid by Government to the aforementioned obese individuals has been deducted to avoid double counting. This is likely to be a conservative estimate because it does not include the effects of educational and workplace discrimination on the working obese population’s salary potential.

Forgone Taxes

The obese population is generally associated with lower employment and labour force participation rates, as already discussed in the previous subsection. In turn, this imposes a further economic burden on Government, given its inability to collect income tax and Social Security Contributions (SSC) from those obese individuals not currently working for pay or profit, but who could potentially be working had they not been obese. An estimate of the forgone taxes suffered by Government is €0.5 million.
Health and Wellbeing
Costs
Health and Wellbeing Costs

Obesity negatively impacts an individual’s health and wellbeing. There are direct links to healthcare issues, such as lower quality and length of life, and mental wellness complications.

Disability Adjusted Life Years
Disability adjusted life years (DALYs), which refer to the loss of one year of healthy life, are used as measures of the burden of disease capturing these effects. DALYs for a disease or health condition are calculated as the summation of the years of life lost (YLL) due to premature mortality in the population and the years of life lost due to disability (YLD) for that proportion of the population living with the particular health condition or its consequences [93]. In 2010, 3.4 million deaths, 3.9% of years of life lost and 3.8% of DALYs worldwide were attributable to overweight and obesity [94].

Furthermore, a study in the United States has forecast that increasing levels of obesity threaten to reduce the health and life expectancy of future generations in the coming decades [95]. There is evidence that overweight and obesity are associated with higher all-cause mortality. High BMI is in fact the reason behind one in seven premature deaths in Europe, with the risk of premature deaths among men being around three times as much in women [96].

Through a meta-analysis of international studies, it emerges that excess weight is responsible for overall death among obese individuals 1.22 times more than normal weight individuals [97]. It has also been claimed that moderately obese individuals tend to lose circa three years of life expectancy, in comparison with normal weight individuals [98]. Mortality risks heighten with higher levels of BMI. It is estimated that between 6.5 to 13.7 years of life are lost by obese individuals having a BMI ranging from 40.00 kg/m$^2$ to 59.00 kg/m$^2$. The majority of the excess mortality burden among the morbidly obese is related to the increased likelihood of contracting diseases such as hypertension and diabetes. If the global obesity trend is to continue, increased mortality rates are expected in the future [99]. On the other hand, maintaining a healthy lifestyle by engaging in physical activity, having a healthy BMI, consuming a healthy diet and not smoking result in a lower disease burden, with individuals living a minimum of two additional years in good health when compared to those who do not maintain a healthy lifestyle [100].

Obesity may be causal of a number of diseases and comorbidities, such as cardiovascular diseases, diabetes, cancer and respiratory problems. In Malta, circulatory diseases were the leading causes of death in 2014, these being responsible for 37.6% of deaths. Such diseases were mainly contracted as ischaemic heart disease, heart failure and strokes. Diabetes, cholesterol and smoking are major risk factors of arteriosclerosis, the latter being a cardiovascular disease. Neoplasms (28.5%), respiratory diseases (9.5%) and diabetes (4.8%) ranked after circulatory diseases as other causes of death [101], as shown in Figure 11. A marked increase in stroke, cancers and ischaemic heart diseases is to be expected if the current obesity trends in Malta continue, these leading not only to reduced health and quality of life, but also to increased healthcare costs [102].

Figure 11: Causes of death among Maltese residents in 2014

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulatory diseases</td>
<td>37.6%</td>
</tr>
<tr>
<td>Neoplasms</td>
<td>28.5%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>4.8%</td>
</tr>
<tr>
<td>Respiratory conditions</td>
<td>9.5%</td>
</tr>
<tr>
<td>Dementia</td>
<td>4.4%</td>
</tr>
<tr>
<td>Other causes</td>
<td>15.1%</td>
</tr>
</tbody>
</table>
Overweight and obesity, coupled by physical inactivity are key risk factors for the WHO European region [102]. In fact, a study published by the WHO in 2009 reveals that 7.8% of the global burden of disease (as a percentage of total DALYs) in the WHO European region is attributable to overweight and obesity [103]. There exist insufficient data at present to be able to arrive at an accurate estimate for Malta. However, following on the methodology adopted by the WHO in this report, we estimate that 17% of total deaths in Malta are attributable to overweight and obesity.

Psychological Wellbeing

There is evidence of a causal reciprocal link between obesity and mental health [104]. On the one hand, obesity leads to the increased likelihood of suffering mental disorders such as depression, and on the other, mental disorders lead to an increased risk of becoming obese [105]. Obesity can have consequences on an individual's perceived body image, self-esteem and weight-related stigma, which in turn lead to the consumption of additional (unhealthy) foods due to a mixture of intense emotions [106-107]. Furthermore, although medication can be taken to treat mental disorders, weight gain may arise as a side effect, thereby contributing further to this vicious cycle [108].

Increasing BMI levels generally tend to be associated with poorer mental health [109]. Obese individuals tend to report higher psychiatric problems, depression levels, body image distress and binge eating than normal weight individuals [109]. Furthermore, the effects of emotional disorders arising from obesity may be more pronounced amongst females and the morbidly obese population [109].

The obesity problem tends to worsen as obese individuals start losing their confidence, leading for instance, to shopping online in order to avoid being seen in public [111]. The psychological wellbeing impacts the indirect costs outlined in the previous section, leading to productivity losses, forgone earnings and forgone taxes. Although the costs of psychological health and wellbeing have not been quantified, it is important to note that these costs may have an impact both at the microeconomic level – on the obese population itself – and at the macroeconomic level – on the economy as a whole.

Despite the causality of the relationship being difficult to define, it has been estimated from 2015 EHIS data [18] that obese individuals are 1.3 times more likely to report depressive symptoms than normal weight individuals. Moreover, around 7% of the total Maltese population aged 15 and over take prescribed medication to treat anxiety and/or depression.

Injustice and Prejudicial Treatment

Injustice and prejudice is found in several facets of an obese person’s life, in the form of physical abuse, verbal remarks, public situations, as well as through day-to-day physical environments and objects, which are not designed in such a way as to accommodate obese persons [112]. Marketing literature may inadvertently glorify the thinner body, while retail establishments may offer a limited selection of clothes suitable for obese individuals [113]. Discrimination and stigma towards obese persons pose a number of consequences on an obese individual’s physical and psychological health [107]. Such consequences may be even more pronounced amongst women rather than men [114].

Discrimination may start from a very young age, since within educational settings, youths may be teased by their peers [109]. Obesity in children is also associated with poor academic performance [115], thus contributing to the fact that obese adolescents have a lower chance of being accepted at university [112]. Stigma can also be experienced at home, with family members and friends [116]. Medical settings may too pose discrimination to obese individuals, in that stigma towards obese patients arises among physicians and medical students [116-120].

Such encounters in the life of an obese person may result in emotional or psychological harm, in addition to potential lower earnings resulting from educational and employment discrimination. However, financial effects of injustice and prejudicial treatment have not been estimated for the purpose of this publication, since they are inherently not quantifiable.

Discrimination and stigma towards obese persons pose a number of consequences on an obese individual’s physical and psychological health
Conclusion
Where do we stand?
The effects of obesity on the world’s economy are startling. It has been estimated that obesity poses an almost equivalent burden on the global economy as smoking and armed conflict, with the economic costs amounting to c.$2.0 trillion, or 2.8% of global GDP\(^{119}\). Obesity ranks among the three principal human-generated economic burdens in most developed countries. The McKinsey Global Institute has estimated the economic impact of obesity in 2012 at $70 billion (or 3% of GDP) in the United Kingdom and $663 billion (or 4.1% of GDP) in the United States\(^{119}\). Through a peer PwC\(^{48}\) analysis, the costs of obesity for 2015 have been estimated at AUS8.6 billion (or 2.1% of GDP) in Australia. In Malta, the costs of obesity for 2016 have been approximated at €36.3 million (€35.8 million in 2015 prices), equivalent to 0.4% of GDP. Total healthcare expenditure accounted for 7.3% of GDP in 2015. It is estimated that 5.6% of national health expenditure in 2015, or 8.1% of annual public recurrent health expenditure is attributable to obesity.

The Future Impact
Obesity has been on the rise over time. Should the prevalence of obesity continue to increase, it is estimated that 50% of the world’s adult population could be either overweight or obese by 2030\(^{88}\). The prevalence of obesity in Malta based on self-reported data is 25%, increasing to 34% of the adult population based on measured data. Achieving the targets set in 2010, i.e. reducing obesity to 18%, is a daunting task. Even maintaining obesity levels as reported in the 2015 EHIS\(^{18}\), at least within the medium term is challenging, especially in light of the high rates of childhood obesity\(^{4, 20, 28, 120}\). The latter are of great concern as there are serious implications in the long-term, with obesity in children tending to predict obesity in adults\(^{4, 120}\).

We have attempted to project the excess cost of obesity by 2022, on the assumption that the 2015 EHIS level of obesity, and the respective age and gender distributions are maintained over the period. The estimated total cost of obesity in 2022 is c. €41.4 million, an increase of €5.1 million from current levels, over a span of six years. Movements reflect namely inflationary increases and an extrapolation of the obese population from the 2015 EHIS\(^{18}\) data to Eurostat population forecasts\(^{121}\). In comparison, Cuschieri et al. (2016)\(^{49}\) anticipate the costs of overweight and obesity (comprising hospital costs and the cost of visits to GPs and specialists) to rise to €46.5 million by 2050. Such costs are based on a projected population within the age group of 25 to 64, which is different from the age group (15 years and over) utilised for the purpose of our estimates. Analysing the estimated 2015 EHIS\(^{18}\) data further on a per capita basis, the annual excess cost of obesity is projected to peak at €110 per capita in 2022. It is worth recalling that even a minimal reduction in obesity rates could translate into substantial savings being made, both on the total bill of obesity-related costs, as well as on a per capita basis. Additional visits to GPs and specialists every four weeks are projected to increase by 3% over a six-year period. An increase of 5% in average total additional inpatient nights and day patient stays is also expected over the next six years. In terms of pharmaceuticals, an additional 690 obese individuals are expected to consume pharmaceuticals to treat anxiety and/or depression by 2022. The effects seem to be even more pronounced in the case of pharmaceutical consumption taken to treat hypertension, cholesterol and diabetes. Obese individuals reporting depressive symptoms over normal weight individuals are projected to increase from 29% to 33%. With the increased prevalence of obesity, a higher proportion of people are projected to suffer from disabilities that would impinge them from participating in the workforce and/or delivering their work effectively. High-level estimates indicate that almost an additional 90,000 hours would be lost from the total productivity generation, in the next six years.
A concerted effort

In light of this analysis, a concerted effort from Government, non-governmental organisations, employers, individuals and society as a whole is required as a matter of urgency. Obesity is a societal challenge, which is expected to result in higher economic and social costs as obesity rates continue in their trajectory. Intervention is required on a global level in different facets of life, be it on a personal, family, community and national level [34]. Interventions need to entice sustained behavioural change among individuals in order to yield effective results [119].

Obesity interventions can target different sectors of the population. For instance, a reformulation of the school curriculum to include more hours of physical activity and healthy nutrition in a week should encourage healthier daily habits. Restricting media pressures through high-calorie food advertising, providing nutritional labelling on food products, subsidising healthy foods or taxing unhealthy foods, as well as restricting promotional activity in high-calorie intake foods may help alter consumer behaviour. Additionally, promoting active transport, delivering public health campaigns and promoting weight management and wellness programs should also lead to positive action with respect to obesity [119].

In a number of countries, Government has been a key player in implementing measures aimed at reducing obesity. Examples of fiscal-induced incentives are tax credits for those individuals pursuing a sports activity or fitness classes at a number of recognised institutions. Industry may also incentivise physical activity if the rate of indirect tax on sports equipment and gym membership is reduced. Other potential interventions include granting subsidies to food producers or retailers, thus allowing the supply of healthy food products at a lower price.

Thorough food labelling, in line with Regulation (EU) No. 1169/2011 [122], should make it easier for consumers to choose the healthier option of a number of food products. Employers may also be encouraged to promote physical activity at the workplace by being provided with a fiscal incentive for offering wellness activities and physical activity classes during break time or after working hours. Moreover, healthier food options and fitness facilities can be made more accessible at the workplace and financial incentives can be provided to employees who participate in wellness activities [123]. Investing further in educational campaigns, promoting healthy eating and engaging in physical activity from a very young age, may be fruitful in the long-term. It would also be helpful to provide educational background on the subject to parents, so that the behaviour of adopting a healthy lifestyle is instilled even within the household. Strategies such as the School Fruit and Vegetables Scheme [124] which seeks to promote the consumption of fruit and vegetables among school children seem to serve their purpose, as around half of the parents surveyed noted that their children are asking to have fruit as part of their school lunches and meals at home [125].

Active media campaigns could also assist in promoting a healthy diet whilst also encouraging physical activity. Use can also be made of technology, to develop apps or games which enable individuals to keep track of their health and wellness on a daily basis. Most of the interventions mentioned are already outlined in a number of strategies and policies laid out by Government. The focal policy document centring on obesity is the ‘A Healthy Weight for Life: A National Strategy for Malta’ [42] which started being implemented in 2012 until 2020. In principal, the strategy sets out, among other priorities of action, to encourage the uptake of a healthy diet by the Maltese population through healthy public policies across Government and to support schools and families in preparing nutritious meals for children. Other priorities of action include regulating audio-visual advertising of unhealthy foods (especially adverts directed at children), promoting physical activity, setting up multidisciplinary clinics with the intention of managing excess weight in adults and children, and promoting exclusive breastfeeding during the first six months of life, whilst encourage continued breastfeeding in the first years of life. The latter priority of action has been reinforced through the ‘National Breastfeeding Policy and Action Plan 2015 – 2020’ [43]. This Action Plan seeks to instigate a supportive environment whilst nurturing a culture that facilitates a mother’s choice for breastfeeding, especially in view of conclusive evidence that children who are breastfed (for longer durations) have a lower likelihood of becoming overweight or obese [126, 127].
In support of healthy lifestyles and the reduction of non-communicable diseases, ‘The Healthy Lifestyle Promotion and Care of Non-Communicable Diseases Act’ [44] was enacted in 2016. The legislation seeks to foster an inter-ministerial lifelong approach supporting physical education and healthy eating, and intends to reduce the incidence of non-communicable diseases throughout all age groups. In view of said legislation, an Advisory Council on Healthy Lifestyles has been appointed to provide advice on issues relating to healthy lifestyles. Roles of the Advisory Council may include advising the Minister on health, physical activity and nutrition, advising the Minister on policies, action plans and regulations intended to reduce the occurrence of non-communicable diseases among the public, and encouraging a lifelong approach towards embracing a healthy lifestyle and physical activity.

The Ministry for Education and Employment has also devised a ‘Whole School Approach to a Healthy Lifestyle: Healthy Eating and Physical Activity Strategy’ in 2015 [46], coupling this with a specific policy of action on the subject [47]. It is suggested to adopt a life course approach to develop a sustainable school environment that supports healthy living and to make healthy food options more widely accessible. Schools are also encouraged to develop school grounds and playing facilities to support physical activity, and to promote the consumption of fruit and vegetables, whilst increasing their availability. The strategy also intends to enforce standards that require a recommended minimum number of hours in the National Curriculum Framework to be dedicated to physical activity per week. Moreover, collaboration between schools, parents and community members is encouraged, such that healthy cookery clubs and physical activity events can also be organised.

Furthermore, the Steering Committee, supported by the Parliamentary Working Group on Diabetes, has set out a national strategy for diabetes through ‘Diabetes: A National Public Health Priority 2016 – 2020’ [45]. As remarked in the literature, obesity tends to lead to an increased risk of developing type 2 diabetes [2, 6- 7, 30, 37-38], this in turn being affected by an unhealthy diet and physical inactivity (among other factors). Thus, the onset of type 2 diabetes can be easily prevented by altering one’s behaviour [45].

Previously, Government also tried introducing a BMI screening programme at state hospitals, whereby patients could have their BMI calculated when they had a consultant visit. This was introduced in view of the fact that healthcare professionals may be influential over their patients and the broader community [128]. However, this proved partially ineffective as there were insufficient resources that could be utilised to monitor the patients’ diet and progress over time. Thus, for any selected interventions to yield desired outcomes, it is of utmost importance that they are backed up by the necessary resources.

In other territories, PwC [48] has estimated that the implementation of a number of interventions over a ten-year period results in a benefit-to-cost ratio of 1.7. The interventions being most beneficial have been identified as environmental interventions, these comprising reformulation of the nutrient content of processed foods, food labelling and the introduction of a tax on unhealthy food. Studies have indicated that there is a high correlation between fiscal incentives on unhealthy foods and a decrease in DALYs [129]. Preventative strategies tend to be the most effective at reducing obesity in the long-term [128]. Effective interventions are expected to improve the health and quality of life of the population, whilst resulting in numerous cost savings on health spending. In Malta, future research should focus on assessing the cost effectiveness and impact of any new interventions targeted at reducing the obese population. Nevertheless, at present, it would be best to focus on the strategies and policies already in place and to devote more efforts and resources towards successfully implementing them. Ultimately, their fruition is wholly dependent on adequate and sufficient resources.
Appendix A - Methodology
Methodology underlying the Modelling of the Costs of Obesity

This publication presents an analysis of the costs of obesity in Malta, by expanding on the costs presented in the ‘A Healthy Weight for Life: A National Strategy for Malta 2012 – 2020’ publication [42]. A bottom-up approach has been used in the compilation of this report and in calculating the direct and indirect costs of obesity, as well as in estimating other costs, where applicable. A bottom-up approach is generally deemed to be more robust than a top-down approach since costs are calculated per obese person and then, extrapolated to the total population [48]. This method is generally preferred in light of available data, given that it captures a wider range of costs than could otherwise be incorporated within a top-down analysis.

The model underlying this publication provides a financial estimate of the additional annual cost of adult obesity in Malta for 2016. For the purpose of this publication, an adult is defined as an individual being 15 years or older. The prevalence of obesity is based on 2015 EHIS [18] results. The latter is a comprehensive general health survey based on a random and representative sample of the Maltese population aged 15 and over. In total, 4,086 individuals were interviewed in this study. When considering data relating to BMI, 3,430 (83.9%) respondents reported the necessary information on weight and height, such that a BMI value could be derived.

The model is based on data relating to the following age brackets: 15 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64, 65 to 74, and 75 years and over. Where possible, we have tried to distinguish costs between the three different classes of obesity, as defined in the first section. The sample population has been weighted in terms of age and gender, such that the data is statistically representative of the total Maltese population. This has enabled us to extrapolate the survey data to the Maltese population, resulting in a total of 95,951 obese individuals being categorised into the three obese strata as shown in Figure 12:

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**Figure 12: The Maltese Obese Population by Class of Obesity**

<table>
<thead>
<tr>
<th>Obesity Class I</th>
<th>Obesity Class II</th>
<th>Obesity Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>67,064</td>
<td>20,514</td>
<td>8,373</td>
</tr>
</tbody>
</table>

Where costs have been estimated in relation to data based on the working age population, that proportion of the population aged 16 (inclusive) to 65 (not inclusive) has been considered.

The costs of obesity refer to the marginal costs of obesity incurred by obese adults over adults of normal weight. Thus, it is only the difference between the costs incurred by obese and normal weight individuals that is captured within this model, as this ultimately represents the impact of obesity on national expenditure.

Cost estimates have been treated consistently by adjusting cost assumptions to reflect nominal and/or real values to 2016 prices, accordingly. Where an inflation factor was required, the actual inflation rates throughout the years were sourced from the Central Bank of Malta website.

In projecting the costs of obesity to 2022 (based on 2015 EHIS results), costs have been assumed to increase at a projected inflation rate of 1.7% in 2017, 1.8% in 2018 (based on forecasts by the Central Bank of Malta [130]) and at 2% per annum thereafter. The European Central Bank expects countries within the euro area to converge to a rate of inflation, which is lower, but nonetheless close to 2% over the medium term [131].
Moreover, in estimating the proportion of GDP attributable to obesity-related costs in 2022, the projected GDP growth rates for 2016 to 2018 have been sourced from the Economic Projections of the Central Bank of Malta for 2016 to 2018 [130]. On the other hand, the forecast growth rates for 2019 to 2022 have been based on forecasts prepared by the United States Department of Agriculture Economic Research Service [132].

In conducting the necessary research, a literature scan has been made to obtain an understanding of the different costs of obesity and their respective impacts. Literature also helped in formulating certain assumptions in the absence of actual data from the 2015 EHIS [18]. In developing the financial model, the metrics utilised have been selected on the basis of their relative importance and the extent to which they could be reliably measured. The literature scan, coupled by experience regarding the subject matter and a number of expert opinions, facilitated the process of choosing which cost categories to estimate. Lastly, the costs of obesity in Malta have been estimated through a process of financial modelling, after having collected relevant data on both the direct and indirect costs of obesity, and after drawing on the literature to develop certain assumptions for input into the financial model, where raw data was not available. Experts on the area were consulted when any assumptions needed to be made.

A high-level estimate has also been made of the additional costs of obesity in 2016 based on BMI rates sourced from the recent article by Cuschieri et al. (2016) [22]. Such estimates have only been prepared with a view to show the effect of self-reported measures of BMI on the cost calculations. They have not been merely prepared to act as a direct comparison of costs based on different rates of BMI. Our analysis reveals that self-reported measures of BMI are under-reflective of the true picture of obesity prevalence in Malta, this leading to a highly underestimated total obesity cost bill.

The study by Cuschieri et al. (2016) [22] focuses on that proportion of the Maltese population aged 18 to 70. Thus, the BMI rates reported in the study have been extrapolated to the population aged 18 to 70 (based on the latest NSO Demographic Review [133]), such that the new age groups comprise the following: 18 to 24, 25 to 34, 35 to 44, 45 to 54, 55 to 64 and 65 to 70. Results reveal that a total of 103,911 Maltese individuals between the age of 18 and 70 are obese. We have resorted to certain data from the 2015 EHIS [18] results (other than BMI data) in order to make an estimate of the costs of obesity in Malta based on BMI rates from the recent local study. The survey contains the wealth of data needed to compile this publication – data that does not feature in Cuschieri et al.’s (2016) [22] study. In this case, given that BMI data for the obese population in the study is not categorised into different obese classes, we have resorted to an average of data from the three obese classes as reported in the 2015 EHIS to calculate certain costs, including the cost of primary care, specialist care and hospital care, among others. Furthermore, given the time limitation, data relating to the working age population as extracted from the 2015 EHIS (i.e. between 16 and 65 years of age) has also been applied in preparing these estimates.

We include hereunder, a sample of the formulae used in estimating the direct and indirect costs of obesity. The cost of pharmaceutical care and that of absenteeism have been selected by way of example. Where applicable, each of the estimated costs has been subdivided into Government and individual contribution.
Differences in pharmaceutical consumption for a number of comorbidities between obese and normal weight individuals within the surveyed population have been identified. Differences in the medication consumed within the previous two weeks (extracted from the 2015 EHIS [18]) could then be applied to the extrapolated population and to the Government spend on pharmaceuticals by comorbidity. Table 9 delineates the percentage of the population surveyed taking prescribed medication for those comorbidities for which a difference in pharmaceutical consumption by obese and normal weight individuals has been identified.
Table 9: Percentage of population surveyed taking prescribed medication for comorbidities outlined

<table>
<thead>
<tr>
<th>Medication consumed in the previous two weeks for:</th>
<th>Under-weight</th>
<th>Normal-weight</th>
<th>Pre-Obese</th>
<th>Obese Class I</th>
<th>Obese Class II</th>
<th>Obese Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma/ COPD</td>
<td>4.9%</td>
<td>5.1%</td>
<td>8.3%</td>
<td>11.0%</td>
<td>11.1%</td>
<td>11.4%</td>
</tr>
<tr>
<td>Hypertension</td>
<td>2.4%</td>
<td>10.3%</td>
<td>20.4%</td>
<td>32.7%</td>
<td>34.4%</td>
<td>32.1%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>2.4%</td>
<td>6.9%</td>
<td>16.2%</td>
<td>21.6%</td>
<td>22.1%</td>
<td>13.9%</td>
</tr>
<tr>
<td>Pain relief</td>
<td>4.9%</td>
<td>7.5%</td>
<td>8.9%</td>
<td>12.7%</td>
<td>19.5%</td>
<td>10.1%</td>
</tr>
<tr>
<td>Heart disease</td>
<td>1.2%</td>
<td>2.9%</td>
<td>5.3%</td>
<td>7.6%</td>
<td>9.0%</td>
<td>5.1%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.4%</td>
<td>3.5%</td>
<td>7.8%</td>
<td>12.3%</td>
<td>17.4%</td>
<td>12.7%</td>
</tr>
<tr>
<td>Heartburn</td>
<td>2.4%</td>
<td>2.9%</td>
<td>4.2%</td>
<td>6.2%</td>
<td>6.3%</td>
<td>5.1%</td>
</tr>
<tr>
<td>Anxiety/ Depression</td>
<td>4.9%</td>
<td>3.4%</td>
<td>3.1%</td>
<td>6.5%</td>
<td>12.6%</td>
<td>7.6%</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>3.7%</td>
<td>2.8%</td>
<td>4.9%</td>
<td>5.8%</td>
<td>6.9%</td>
<td>6.3%</td>
</tr>
</tbody>
</table>

Individual contribution

- Total out-of-pocket spend on pharmaceuticals per person
- Total Maltese population
- Proportion of excess Government pharmaceutical spend on obese population

Formula component

- Total spend on pharmaceuticals out-of-pocket per person
  - Estimated based on data from Household Budgetary Survey (2008) [63]
- Total Maltese population
  - NSO (2016), Demographic Review 2014 [133]
- Proportion of excess Government pharmaceutical spend on obese population
  - Estimated based on excess Government spend on pharmaceuticals for the obese as a percentage of total Government spend on medicine, sourced from the 2016 Budget Financial Estimates [134]
The excess Government spend on pharmaceuticals due to obesity has been estimated as a proportion of the total Government expenditure allocated to pharmaceutical consumption within Vote 32, this comprising namely medicine, excluding surgical materials. This proportion has been applied to the total Maltese population and to the total out-of-pocket spend on pharmaceuticals per person, in order to estimate the excess individual contribution towards pharmaceuticals emanating from obesity. For the purpose of these estimates, it has been assumed that the same proportion of excess expenditure on pharmaceuticals due to obesity in terms of total expenditure on pharmaceuticals within the public sector is also applicable within the private sector.

2. Absenteeism

*Employer contribution*

<table>
<thead>
<tr>
<th>Formula component</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional hours absent from work for obese person relative to normal weight person working for pay or profit in a year</td>
<td>2015 EHIS[^18]</td>
</tr>
<tr>
<td>X</td>
<td>Labour Force Survey 2016 Q2 (NSO) [^92]</td>
</tr>
<tr>
<td>Average gross hourly wage</td>
<td>[^92]</td>
</tr>
<tr>
<td>X</td>
<td>2015 EHIS[^18]</td>
</tr>
<tr>
<td>Number of obese persons working for pay or profit</td>
<td></td>
</tr>
</tbody>
</table>

The average gross hourly wage was estimated on the basis of a 40-hour working week.
Limitations
We would like to acknowledge a number of limitations encountered in the compilation of this publication. The study has sought to focus on the costs emanating from adult obesity and therefore, has not sought to assess the financial impact of childhood obesity. The study focuses on obesity, defined by a BMI of 30.00 kg/m\(^2\) or higher, as distinct from overweight. The analysis is based on estimates of the prevalence of obesity within the three obese class categories of BMI. Reference to the overweight population is only made to the extent that it adds insight to the findings, or where analogous information on the obese population only is not available.

Whilst both international and local literature in relation to the subject have been reviewed, the former constituted the major part of sources consulted, due to the lack of Maltese literature focusing on obesity and its related costs. Due to the unavailability of certain data within the local arena, at times, we had to resort to an application of proxies, or similar data from other publications or research material. Certain assumptions also had to be made in the absence of available information. Literature up to 19\(^{th}\) December 2016 has been consulted for the purpose of this publication. The total bill of obesity-related costs for 2016 (based on 2015 EHIS \([18]\) results) presented in this report may be underestimated to the extent that, rates of obesity are based on self-reported data (which tend to be underestimated) and certain costs, which either cannot be estimated reliably or for which insufficient data were available, were excluded. Given that recently measured BMI data were not available at the time of writing this publication, the EHIS data sets \([16-18]\) have been deemed to comprise the best available results for BMI in Malta. Furthermore, the 2015 EHIS \([18]\) contains extensive data beyond Cuschieri et al.’s (2016) \([22]\) study, such data being crucial in estimating the costs of obesity. In this context, it is advised to analyse results with caution, given that the proportion of the population being overweight and obese may be underestimated. No financial estimate for conceptual costs of health and wellbeing has been made. Thus, the costs presented in this publication may be a somewhat conservative estimate of the true costs of obesity.

The estimate of the 2016 costs of obesity based on results by Cuschieri et al. (2016) \([22]\) are not entirely comparable with costs calculated on the basis of the 2015 EHIS \([18]\) results. Certain data extracted from the 2015 EHIS also reflect the population aged 16 to 18. In view of the limited timeframe between the date of issue of the article by Cuschieri et al. (2016) \([22]\) and the date of publication of this report, results for certain data were not re-extrapolated in line with the age groups utilised by Cuschieri et al. (2016) \([22]\). Furthermore, the estimate of costs presented in the recent article by Cuschieri et al. (2016) \([49]\) are also not comparable, given that they comprise only some of the direct costs of obesity, whilst being the summation of the costs of both overweight and obesity.

The publication has merely sought to assess the costs emanating from obesity. Thus, it does not delve into any interventions that could be introduced to address the problem of obesity, together with their relative impacts.

This publication intends to show the underlying effects of the estimated costs of obesity, without delving into any interventions that can be introduced to address the problem.
Appendix B - Definitions
**Absenteeism:** The time one spends away from work due to illness.

**Adult:** A person over 15 years of age.

**Allied healthcare professionals:** A distinct group of health professionals who apply their expertise to diagnose, treat and rehabilitate people of all ages (International Chief Health Professions Officers (ICHPO) definition) \(^{135}\).

**Bariatric surgery:** A surgical procedure intended to result in weight loss by restricting the amount of food the stomach can hold, leading to a malabsorption of nutrients, or through a combination of malabsorption and gastric restriction. Bariatric surgery procedures can include the placement of an adjustable gastric band, sleeve gastrectomy, gastric bypass, gastroplasty and gastric bypass by biliopancreatic (duodenal switch) \(^{136}\).

**BMI:** An index of weight-for-height, which is used to measure population-level obesity.

**Comorbidities:** A number of diseases or disorders, which are experienced concurrently.

**DALY:** The loss of one year of healthy life, used as a measure of the burden of disease, which captures the effects of multiple comorbidities and premature mortality.

**Day patient stay:** The use of a range of hospital services by a patient who does not remain in hospital overnight, but stays for at least half a day \(^{137}\).

**Disabled (for the purpose of our report):** Those having difficulty in walking 500 metres on flat terrain without a stick or walking aid or assistance, and/or those having difficulty in walking up or down twelve steps without a stick, other walking aid or assistance.

**GDP:** Expenditure-based Gross Domestic Product, being the total final expenditure at purchasers’ prices.

**Inpatient stay:** The use of a range of hospital services by a patient who is admitted to hospital and remains overnight \(^{137}\).

**Invalidity pensions:** Contributory pensions granted to those individuals certified as being incapable for suitable full-time or regular part-time employment due to a serious disease, or bodily or mental impairment, subject to meeting certain criteria.

**National Health Expenditure:** The sum of General Government and private sector expenditure on health.

**Non-communicable diseases:** Chronic diseases which are not transferable, but which tend to be of long duration and slow progression. Non-communicable diseases generally include cardiovascular diseases, chronic respiratory diseases, diabetes and cancers \(^{138}\).

**Premature Mortality:** Focuses on deaths among the younger age groups of the population. Premature mortality is measured in terms of potential years of life lost (PYLL) before reaching the age of 70 years \(^{139}\).

**Presenteeism:** The practice of going to work despite illness, injury or anxiety, often leading to reduced productivity.

**Public Recurrent Health Expenditure:** The sum of Government expenditure on outlays for health maintenance, restoration or enhancement paid for in cash or supplied in kind by government entities, such as the Ministry for Health, other Ministries, parastatal organisations, and social security agencies. It includes transfer payments to households to offset medical care costs and extra-budgetary funds to finance health services and goods.
Appendix C - Bibliography
Weighing the Costs of Obesity in Malta


33. Vella Baldacchino, R., Sacco, M., Caruana, L., Vella Baldacchino, J. and Deguara, D., 2015. The Association Between Weight and...


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