Population & Health Working Paper Series
PIDE-CPHSP-5

Health and Economic Consequences of Overweight and Obesity Among Adults in Pakistan

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PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS
ISLAMABAD
2015

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Designed, composed, and finished at the Publications Division, PIDE.

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ABSTRACT

Overweight and obesity is a global problem carrying immense health and economic consequences on individuals' lives. It is of utmost importance especially in the context of Pakistan, which is facing the double burden of nutrition and disease. The present study ascertains the possible consequences of overweight and obesity among adult population using Pakistan Panel Household Survey for 2010. The findings show a negative association between weight and health by yielding higher prevalence and intensity of disease among excess weight than non-excess weight adults. The cost of illness methodology is adopted in the study by considering the two major obesity co-morbidities i.e. heart disease and diabetes. The results indicate that a sizeable proportion, 22 percent, and the cost incurred by the individuals for these co-morbidities is attributed to overweight and obesity. According to the results, the share of direct cost for heart diseases and diabetes attributable to excess weight is 16 percent of the national total health expenditure in Pakistan. The annual direct cost came out to be 0.4 percent of GDP, while estimates of indirect cost are 1.9 percent of the country's GDP. This creates a huge cost burden on oversized individuals. Therefore, it is high time that strategies in the country's health plans are included concerning control and prevention of overweight and obesity. This will provide a roadmap to a sustainable health care system and increased economic wellbeing of individuals.

JEL Classification: I12, I15

Keywords: Overweight, Obesity, Cost of Illness, Productivity Loss

1. INTRODUCTION

Overweight and obesity is a global health problem. The rise in the prevalence of overweight and obesity since the 1980s has reached to an alarming situation for every nation [Ng, *et al.* (2014)]. The extent of overweight and obesity varies widely across different regions given their environment, sociocultural context, economic situation, food habits and lifestyle. Its prevalence is highly apparent in industrialised countries where more than half of the adult population is overweight and obese. Yet, the rates are also alarmingly high in developing countries. Presently the developing economies of the world are not only facing the problem of underweight population but are also at risk of excess weight; contributing to the double burden of malnutrition [Schmidhuber and Shetty (2005)].

The developed world has long since replaced nutritious diet with high caloric food. Moreover, physical inactivity is highly prevalent in these societies due to the invention of labour and time saving devices both at home and outside. All of this makes life sedentary leading to increased prevalence of obesity. [Blaylock, Smallwood, Kassel, Variyam and Aldrich (1999)]. The countries which are undergoing transition have now also started to imitate the diet pattern and sedentary life style of developed nations. Additionally, increasing urbanisation in these countries is also connected to changing behaviour related to the standard of living and food intake. All of this is contributing in the rise of overweight and obesity problem in the less developed economies also.

The overweight and obesity problem has immense social, health and economic consequences on the population [Wolf and Colditz (1998)]. The association between health and obesity has been established since long in the literature. Apart from the fact that these are risk factors for various communicable diseases, these also decrease the quality of life and increase morbidity and mortality. Evidence shows that around the world 3.4 million deaths in 2010were attributed to overweight and obesity [Lim, *et al.* (2012)]. It also involves greater expense; both in terms of medical bills and loss of productivity, due to the burden of disease on individuals and families. Excess weight is common in both children and adults, but, adults are the most vulnerable group to excess weight and the co-morbidities[1] related to it.

Acknowledgements: The study completed with the financial support from the GIZ, Health Sector Support Programme, Pakistan.

[1]Co-morbidity is defined as the occurrence of an additional disease along with a primary disease or risk factor.

According to a global disease burden research, Pakistan is ranked 9th among 188 countries in carrying obese population, in terms of absolute numbers [Ng, *et al.* (2014)]. Recent evidence from Pakistan suggests that 40 percent of Pakistani women of reproductive age are either overweight or obese [Pakistan Demographic and Health Survey (PDHS) (2012-13)]. Given the high prevalence of excess weight in Pakistan and its association with health, it is worthwhile to explore its health risks to human life especially in adult age. Moreover, the related medical care cost and productivity losses due to health risks are useful in estimating its economic burden for the country. This will aid policy makers for priority setting in the health sector given limited resource allocation to health in the country.

2. THEORETICAL FOUNDATION AND REVIEW OF LITERATURE

The relationship between health and nutrition is complex. On the one hand an individual with lower weight is liable to fall a prey to disease, while, on the other an overweight individual is also susceptible to diseases. Both of these conditions create disutility not only due to morbidity but also due to low self estimation due to physical appearance. The health production function includes inputs like nutritional status (N), medical inputs (M) and health services consumed (S), food intake (F) and leisure time (L) [Grossman (1977)].

$$H = H\,(N, M, S, F, L; \varepsilon)$$

The function emphasises the importance of nutrition as an input for individuals' health. Excess weight exerts several health consequences on human life. The co-morbidities related to excess weight are mostly chronic in nature including Diabetes, Hypertension, Dyslipidaemia, Breathlessness, Sleep apnoea, Gall bladder disease, Coronary heart disease, Osteoarthritis, Hyperuricaemia, Cancer, Low back pain, Pregnancy complications, Impaired fertility, Fetal defects etc. Among these diseases, the value of relative risk is much higher for Diabetes and Hypertension among obese population that is greater than three times[2] [Haslam, Sattar, and Lean (2006)]. Certain other complications including pulmonary, gastrointestinal and structural abnormalities are also linked with excess weight [Kinuqasa, *et al.* (1984); Stenius-Aarniala, *et al.* (2000); Daniels (2006)].

Weight loss in obese population can contribute to several long term health benefits. Evidence suggests that a 10 percent weight loss can contribute to 40-60 percent decrease in Diabetes incidence and 10mm Hg decrease in blood pressure of hypertensive patients. In addition, it can also increase life expectancy by

[2]The value of Relative Risk for a disease when greater than 1 indicates higher risk of that disease in overweight and obese individual as compared to non-overweight and non-obese individual.

decreasing mortality which is related to obesity co-morbidities, by more than 40 percent [Haslam, *et al.* (2006)]. Due to the higher number of chronic illnesses associated with obesity, it is now considered as one of the leading causes of mortality around the world [Ezzati, Martin, Skjold, Hoorn, and Murray (2006)].

Due to the severe health consequences of overweight and obesity, higher medical costs are associated with it. This cost places a huge burden on individuals and families in the form of high out of pocket expenses. Excess weight and the co-morbidities related to it are chronic in nature which makes the economic cost a constant burden on the family budget. The cost of obesity can occur in the form of direct cost which is incurred directly on a disease including treatment and transportation cost [Muller-Riemenschneider, Reinhold, Berghofer, and Willich (2010)]. An indirect cost can also be incurred which captures the disease related productivity loss which can result in the form of morbidity, disability and mortality. It can result in job absenteeism, early retirement, unemployment, bed days, restricted activity days and even premature mortality i.e. death before life expectancy.

A study of United States reveals that the direct cost of eight diseases i.e. Type 2 Diabetes, Coronary heart diseases, Hypertension, Gallbladder diseases, Osteoarthritis, Breast, Endometrial and Colon cancer, attributable to obesity is 5.7 percent of their national health expenditure. However, out of this direct cost attributable to obesity, 63 percent is only due to obesity related Diabetes [Wolf and Colditz (1998)]. Another study on United States attributes 9.1 percent of national medical spending to overweight and obesity [Finkelstein, Fiebelkorn, and Wang (2003)]. Most of the literature claims that indirect cost accountable to excess weight is higher even than the direct cost. Pitayatienanan, *et al.* (2014) estimate indirect cost attributable to obesity in Thailand through job absenteeism and mortality. According to the results, the share of indirect cost in the total cost is 54 percent. Furthermore, both direct and indirect cost due to obesity accounts for 1.5 percent of total health expenditure and 0.13 percent of GDP in Thailand.

Another cost component i.e., intangible cost is also associated with excess weight. This aspect of cost focuses on the decline in the patient's quality of life because of suffering from a disease. However, this aspect is not commonly captured in the studies because of its subjective nature and estimation difficulties [Rice (1967); Tarricone (2006)]. A number of studies on overweight and obesity have been conducted in Pakistan but most of these focus on the prevalence and determinants of obesity [Rehman, *et al.* (2003); Mushtaq, *et al.* (2011); Ahmed, Laghari, Naseer, and Mehraj (2013)].The economic consequences and the cost of obesity has remained an unattended area of obesity research in Pakistan.

3. DATA AND METHODOLOGY

The study uses the dataset of Pakistan Panel Household Survey [PPHS] conducted in 2010 by Pakistan Institute of Development Economics. The dataset

contains nutritional information i.e. weight and height measured for individuals. Further, a rich health module is present in the data for estimating both health consequences of excess weight and cost of illness attributable to it.

The unit of analysis of the present study is adults of age 18 years and above. The reason for using adults is that they are more susceptible to excess weight and its related co-morbidities like Diabetes, Heart diseases etc. [Haslam, *et al.* (2006); Janssen (2012)]. Prevalence of overweight and obesity is estimated using Body Mass Index [BMI] which is defined as weight in kilograms divided by the square of the height in metres. Individuals having BMI between 25-29.9are classified as overweight and BMI $\geq$ 30 as obese[3] [WHO (2000)].

For capturing the health consequences of overweight and obesity, indicators used here are: Prevalence of general or chronic illness and intensity of illness are measured through episodes and duration of illness**,** and days of hospitalisation. Both bivariate and multivariate analysis is performed**.** Binary logistic regression is performed to see whether overweight and obesity is a significant factor in developing a chronic disease. The dependent variable here is the presence of obesity co-morbidity (heart diseases and diabetes) which is in two categories, Yes or No. This dependent variable can be determined by various explanatory variables including overweight and obesity. Therefore, along with excess weight, certain other relevant independent variables are identified from the literature [Brown, *et al.* (2003); Dedkhard (2006)] including: age, gender, education, marital status, region, province, wealth status, number of chronic disease patients in the family, food consumption pattern, eating-out, working status and BMI index categories.

For the purpose of estimating the cost of an illness which is attributable to overweight and obesity, the cost of illness methodology is used [Wolf and Colditz (1998); Sander and Bergemann (2003); Moffatt, *et al.* (2011)]. This method is extensively used in health economic literature for highlighting the role of a risk factor, here overweight and obesity, in developing a disease and eventually affecting society. The prevalence-based approach is used for the present study which looks both at the prevalence of a disease and the cost incurred on it in one particular year. Hence, the time frame for the study is one year i.e. 2010, which is the data survey year.

Literature links many diseases with obesity but for the present study two co-morbidities of obesity are selected which are diabetes and heart disease. This selection of limited diseases is a conservative approach which is chosen due to non-availability of data. However, this conservative approach is justified as these two diseases are strongly associated with obesity in the literature [Janssen

[3]According to WHO expert consultation (2004), BMI cut-offs for Asian population are 23-24.9 kg/m2 for overweight and >25 kg/m2 for obesity but for the purpose of worldwide comparison and using the nationally representative survey data, study intended to use international cut-offs like certain other studies: Dennis, *et al.* (2006); NNS (2011); PDHS (2012-13).

(2012)]. Given the data limitations we are taking only the individual's perspective on cost for the present study. However, this perspective is important in the case of developing countries like Pakistan where major cost burden lies on the individuals and families i.e. 61 percent of out of pocket expenditure in the total health expenditure [Pakistan Bureau of Statistics (PBS) (2010)]. This perspective will articulate how much of the cost of a disease an individual has to bear for having excess weight.

Both the direct and indirect costs are estimated in the study. The direct cost is further divided into two: Direct medical cost including the individuals' out of pocket spending, directly on medical expense i.e. prescription cost, pharmaceutical cost and cost on laboratory tests and hospitalisation, while the indirect medical cost is on transportation. Information related to direct medical cost is given in the data in the form of self-reported health expenditure during the last year. However, the data on transportation cost is measured indirectly using information from two different sections.

In the illness section of the data, individuals have been asked about the health facility[4] they have consulted in the case of the prevailing illness. Then, another piece of information is assessed from the health access and outreach section as to which health facility a household generally visits. Now, keeping in view the facility that a household generally uses, we have assumed it to be the same facility that the person has used for the present disease. For example, if a person has consulted a government hospital for his prevailing illness, and his household generally uses a government hospital then it is assumed he has used the same hospital which he has visited for his prevailing illness. Next, information on the distance of the facility from home in kilometres along with the mode of transportation used is taken. Afterwards, to convert the distance into cost, the mileage rates[5] of the federal government are used (Appendix Table A1). Accordingly for the modes of transport, the mileage rates are multiplied with the kilometres to get the transportation cost.

Indirect cost is the cost of productivity loss due to an illness which can occur in the form of either mortality or morbidity. Given the data constrains, presently, only productivity losses that occurred due to morbidity are taken. To evaluate the productivity loss, the *Human Capital Approach* is used, which measures a human being in terms of its earnings [Copper and Rice (1976); Hodgson and Meiners (1982); Segel (2006); Tarricone (2006)]. For this, it multiplies the days lost due to illness with the wage rate to yield the productivity loss.

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[4]Facilities include: Lady Health Worker, Rural Health Centre/Basic Health Unit, government hospital, government dispensary, government doctor in private capacity, private doctor, private clinic, chemist, hakim, faith healers and others.

[5]These rates may not be very accurate because while setting them on government benchmarks also allows for automobiles wear and tear cost, but, given data unavailability these rates can be considered as fairly good proxies.

i.e.,

Indirect cost due to morbidity = time lost due to illness × wage rate

Firstly, for calculating the days lost due to illness various methods can be used including job absenteeism, unproductive work time lost etc. [Mattke, Balakrishnan, Bergamo, Newberry, (2007); Lensberg, Drummond, Danchenko, Despiegel and Francois (2013)]. Among these a method used here is *perceived impairment* which directly asks the individuals how much of their normal day routine is being hindered due to illness [Mattke, *et al.* (2007)]. In the present data, individuals were asked the same question and the response was reported in the form of number of days with disturbed the routine due to illness. Therefore, this information is used here as a proxy for time lost due to illness.

Individuals in the data have different working status including employed, unemployed, housewives, students, the elderly and those neither working nor looking for work. For the employed individuals we can take their actual wages but for others not working we have to approximate a wage rate [Rice (1967); Cooper and Rice (1976); Tarricone (2006)]. For the unemployed persons there are two possibilities: If unemployment is due to a disease, it is assumed that had the person been working, he would have got the same wage as the person with similar characteristics working in the labour market [Rice (1967)]. Therefore, wages of the employed persons in the data with similar age, sex and education as that of unemployed persons are picked and applied here after adjusting for the national unemployment rate (1 minus the unemployment rate) in the country. However, if the unemployed is due to any reason other than illness then the zero wage rate is applied.

For the housewives, two methods have been used in the literature i.e. *replacement cost*[6] and *opportunity cost* [Cooper and Rice (1976)]. The opportunity cost, preferred for the present study, assumes that if a woman takes up household work instead of employment, she would be getting the same wage as the person of similar characteristics in the labour market. Hence age, sex and education specific wages are applied here. For evaluating students we will have to capture their future lost income due to current illness [Cooper and Rice (1976)]. So, for them gender specific mean wages for the educated population are taken as a proxy. Lastly, for the elderly and persons neither working nor willing to work, we can assume that they might have been provided informal care [Tarricone (2006)]. So, the market replacement cost of providing informal care can be applied for them. Given data availability, the mean wage rate for the industry is used to evaluate this group.

The evaluation of productivity loss through the human capital approach provides us with indirect cost estimates. However, literature shows these

[6]Replacement cost offers a women wage rate equal to a domestic servant.

estimates can be overestimated because it is not the actual loss but the potential productivity loss [Tarricone (2006)]. Thus the self-reported nature of the disease and days lost due to illness, assumptions made to calculate the transportation cost, the conservative approach to select diseases and using only the single study perspective, can be considered to be the limitations of the study.

The steps involved in the prevalence based cost of illness approach to measure cost of illness attributable to overweight and obesity are described below [Wolf and Colditz (1998); Brimingham, *et al.* (1999); Sander and Bergemann (2003); Konnopka, Bodemann, and Konig (2011); Moffatt, *et al.* (2011); Janssen (2012)]:

(1) Estimating prevalence of overweight and obesity (It is measured from the data through BMI. Prevalence of overweight and obesity is 21 and 9 percent respectively).
(2) Estimating the *Relative Risk*[7] [RR] for selected co-morbidities: It is calculated by dividing the prevalence of a particular illness in the overweight and obese versus the non-overweight and non-obese. The relative risk, when greater than one, will indicate high risk of heart disease and diabetes in overweight and obese population as compared to normal or underweight individuals. The procedure is also described in Appendix Table A2. The Confidence Interval [CI] around Relative risk is also calculated.[8]
(3) Calculating *Population Attributable Fractions* [PAFs] using formula: $\frac{P(RR-1)}{[P(RR-1)+1]}$; where P is the proportion of the overweight and obese population and RR is the relative risk of a disease in the overweight and obese population. PAF tells us how much of the proportion of illness is attributable to overweight and obesity. Both the relative risk and PAFs are calculated separately for the overweight and obese population for selected diseases. Results can then be added to see the combined effect of excess weight.
(4) Estimating the direct and indirect cost for selected illnesses as described above in detail.

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[7]Relative risk is the comparison of the risk of a disease in exposed group i.e. having the risk factor (which is being overweight and obese for the present analysis) to that of unexposed group [Indrayan (2012)].

[8]For calculating the confidence interval, firstly log natural (ln) for the relative risks (RR) are estimates. Secondly, standard error (S.E) for the ln(RR) is computed using formula: $\sqrt{\frac{1}{A}-\frac{1}{A+B}+\frac{1}{C}-\frac{1}{C+D}}$. Thirdly, formula for 95 percent confidence interval is used: $\ln(RR)\pm 1.96\times S.E[\ln(RR)]$. Lastly, taking anti-logarithm for two values computed using confidence interval formula will give upper and lower limits of confidence interval for relative risk [Birmingham, Muller, Palepu, Spinelli, and Anis (1999)].

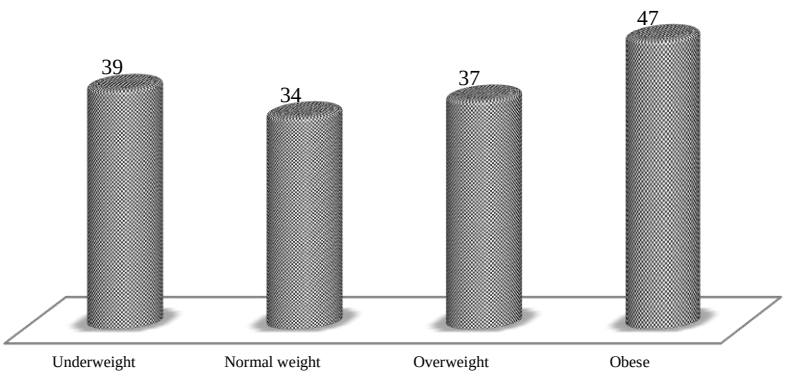
(5) Finally, multiplying PAFs with the cost of illness will yield the cost of illness attributable to overweight and obesity.

After calculating the cost of illness attributable to overweight and obesity, the results are scaled-up for the whole population. One way deterministic sensitivity analysis is performed on the results which cover-up the possible biases in cost estimation caused due to the assumptions made. For this purpose only one core parameter i.e. the relative risks for the selected diseases, is both increased and decreased by different percentages arbitrarily, say by 5, 10, 15 and 20 percent and then the change in cost is observed.

4. HEALTH CONSEQUENCES OF OVERWEIGHT AND OBESITY

Using the data it is first investigated whether obese and overweight persons are more likely to get sick. Next, it is further probed which type of disease is mostly prevalent in those individuals. Results show that the majority i.e. 37 percent of overweight and 47 percent of obese adults suffered from any disease during the last year, while, this percentage is 34 for normal weight individuals (Figure 1). This shows a high prevalence of illness among over weight individuals.

Fig. 1. Percentage of Adults Suffered from a Disease by Nutritional Status



Source: Authors' Computation from PPHS dataset, 2010.

While looking at the type of diseases mostly suffered by over weight individuals, results came in consistent with the literature [Haslam, et *al.* (2006); Konnopka, *et al.* (2011)]. The diseases which are highly prevalent in overweight and obese adults came out to be cardiovascular diseases and diabetes (Table 1). The prevalence of heart disease is 19 and 24 percent for overweight and obese

adults respectively, while it is merely 12 percent for normal weight individuals. Similarly, the prevalence of diabetes is 6 and 9 percent for overweight and obese individuals and only 4 percent for normal weight adults. This indicates a huge difference in the occurrence of both diseases among normal and over weight individuals.

Table 1

Percentage of Adults having Specific Illnesses by BMI Categories

	BMI Categories				
Illness Type	Underweight	Normal Weight	Overweight	Obese	Total
Heart Diseases	10.4	12.0	18.7	24.2	14.6
Diabetes	2.1	3.6	6.3	8.5	4.5
Reproductive Problems	6.4	6.0	8.5	6.3	6.6
Respiratory Problems/TB	12.0	5.4	3.6	4.9	5.9
Hepatitis/Jaundice	6.2	4.9	6.2	4.7	5.3
Intestinal/Renal/Kidney problems	8.1	6.8	6.4	6.5	6.8
Others[1]	54.7	61.4	50.2	45.0	56.2
Total	100	100	100	100	100

Chi-square Value: 0.00.

[1]Others category of illness includes fever, measles, injury, mental illness, sight problems and other disabilities.

Authors' Computation from PPHS dataset (2010).

Table 2 provides the differences of mean episodes of illness, mean duration of illness, and mean hospitalised days between normal and excess weight individuals. This information is first taken for all the diseases and then for only those individuals who have the two obesity co-morbidities i.e. heart diseases and diabetes. According to the results, on average the duration of illnesses 346 days for normal weight whereas it is 414 and 527 days for the overweight and obese. These differences further become prominent when only obesity co-morbidities are selected (Table 2).

The results for the mean hospitalised days do not show any prominent difference when all the diseases are covered but the results for chronic patients show a particular trend. It can be seen from the table that the chronic patients who are obese stay hospitalised for 17 days on average. Conversely, the chronic patients who have normal weight spend only 8 days on average in hospital, showing a huge difference in the length of stay between obese and non-obese patients (Table 2). Only the results of episodes of illness are in favour of obese individuals as they report fewer episodes of illness compared to normal weight individuals.

Table 2

Mean Days Estimates of Disease Intensity by Nutritional Status

BMI Category	Episodes of Illness in Last Year	Duration of Illness	Days Hospitalised
For all Type of Diseases			
Underweight	1.8	374.3	7.7
Normal Weight	1.8	345.8	11.9
Overweight	1.8	414.0	10.2
Obese	1.6	526.8	10.7
Total	1.8	384.6	10.7
For Selected Obesity Co-morbidities[1] only			
Underweight	2.0	646.1	5.0
Normal Weight	1.8	645.2	7.5
Overweight	1.7	696.6	7.3
Obese	1.4	742.5	17.7
Total	1.7	678.1	8.2

[1] Obesity co-morbidities includes heart diseases and diabetes.
Authors' Computation from PPHS dataset (2010).

Due to the chronic nature of the disease for overweight adults, medical cost for them is very high when compared with normal weight individuals [Popkin,Kim, Rusev, Du, and Zizza (2006)]. The results show that the average health care expenditure on all the diseases for normal persons is 8854 rupees, while it is 11610 and 12069 rupees for overweight and obese individuals respectively (Appendix Table A3). Moreover, when only chronic diseases are selected, the medical cost is still high for overweight individuals signifying higher severity of disease among overweight individuals.

A multivariate binary logistic model is selected to find out the significance of overweight and obese in the development of chronicity, keeping other important determinants for the chronic disease constant (Table 3). The dependent variable here is the presence of only two obesity co-morbidities, heart disease and diabetes, which is dichotomous i.e. having No (0) and Yes (1) categories. Independent variables are selected from literature such as: Overweight and obesity, age, gender, province, region, wealth status, marital status, education, work status, familial chronic disease and food consumption [Brown, *et al*. (2003); Dedkhard (2006)].

Table 3

Result of Binary Logistic Regression for Determinants of Obesity Co-morbidities

Explanatory Variables	B Coefficient	Significance Value	Odd Ratio
Overweight (BMI 25-29.9) Adults[1]	0.381*	0.00	1.464
Obese (BMI=> 30) Adults	0.593*	0.00	1.810
Age (in single years)	0.036*	0.00	1.036
Female Adults[2]	0.154	0.33	1.167
Province – Sindh[3]	0.222*	0.05	1.249
Province – KPK	0.761*	0.00	2.141
Province – Balochistan	–0.590*	0.00	0.554
Rural Residents[4]	–0.539*	0.00	0.583
Poor Wealth Status[5]	–0.337*	0.02	0.714
Currently Married[6]	0.530*	0.03	1.699
Separated/Divorced/Widowed	0.527	0.06	1.694
Education (in Single Years)	0.024	0.12	1.024
Work Status – Students[7]	–0.508	0.38	0.601
Work Status –Other not in Labour Force	–0.380	0.08	0.684
Work Status – Unemployed	–0.351	0.33	0.704
Work Status –Non-manual Workers	–0.030	0.92	0.970
Work Status –Manual Workers	–0.263	0.08	0.769
Consumption of Grains (in kg)	–0.007	0.39	0.993
Consumption of Pulses (in kg)	–0.534	0.07	0.586
Consumption of Oil (in Litres)	0.061	0.80	1.063
Consumption of Dairy Products (in Litres)	–0.007	0.70	0.993
Consumption of Meat (in kg)	0.208	0.20	1.231
Consumption of Eggs (in Numbers)	0.023	0.58	1.023
Consumption of Soft Drinks (in Numbers)	0.099	0.25	1.104
Consumption of Sugar (in kg)	–0.047	0.72	0.954
Consumption of Vegetables and Fruits (in kg)	–0.047	0.47	0.954
Number of Family Members with Co-morbidity	0.475*	0.00	1.607
Constant	–3.485*	0.00	0.031
Model Chi-square		495.280	
Model Significance		0.00	
Log likelihood		3237.208	
Cox and Snell R^2		0.121	
Nagelkerke R^2		0.195	
Predicted Percentage		82.1	

Reference Categories: [1]Adults with BMI<25, [2]Male adults, [3]Adults in Punjab province, [4]Urban residents, [5]Adults of non- poor wealth status, [6]Adults who are never married, [7]Housewives.
*Indicates significance of a variable; Variables in Continuous form are in *Italics.*
Authors' Computation from PPHS dataset, 2010.

The results for the overweight indicate that as compared to normal adults, overweight adults are 1.5 times and obese adults 1.8 times more likely to get heart disease or diabetes (Table 3). Additionally, these results are highly significant keeping all other factors constant. This clearly indicates that overweight and obesity is a dominant contributing factor for heart disease and diabetes. Apart from excess weight, other significant factors for the development of co-morbidities are age, province, region, poverty, marital status and familial history of the disease while, factors like gender, education, work status and food consumption are insignificant.

The findings of other significant factors show that co-morbidities increase with age, and with the increase in the number of other similar patients in the family i.e. BMI increases by 0.04 and 0.48 points with the increase of one unit of these factors. Moreover, the probability of these co-morbidities is higher in province KPK i.e. the odd ratio for KPK is 2.1 times higher than Punjab. For Sindh this probability is 1.2 times higher and for Balochistan it is 0.6 times lower than Punjab. This indicates higher prevalence of co-morbidities in KPK and lower in Balochistan. Rural residents have 0.6 times lower likelihood of developing co-morbidity than urban residents. Similarly, poor adults have 0.7 times lower likelihood of developing co-morbidity than non-poor adults. The result for the last significant variable i.e. marital status shows that both currently married and once married individuals have 1.7 times higher probability of co-morbidity as compared to unmarried individuals.

5. ECONOMIC CONSEQUENCES OF OVERWEIGHT AND OBESITY

Economic consequence involves the cost of being overweight and obese. For calculating the cost of obesity, first the information on relative risk of the two diseases is required. According to the results the RR for overweight persons having any of the two diseases is 1.67 and for obese persons it is 2.18.[9] Similar prominent difference between the overweight and the obese's relative risk can be seen from the results of both diseases separately (Table 4). These findings indicate that both heart disease and diabetes are more prevalent in overweight and more prominent among obese adults as compared to normal weight adults The results also indicate that the relative risk for diabetes is higher for both the overweight (1.93) and obese (2.61) adults than of heart disease i.e. 1.60 and 2.06 correspondingly. Gender and age wise results indicate that the relative risk for both overweight and obese individuals is higher among females and adults with age exceeding 30 (Appendix Table A4).

[9]According to the 95 percent Confidence Interval, Relative risk for overweight persons having any of the both disease can range from 1.44 to 1.93; similarly for obese persons it can range from 1.86 to 2.56.

Table 4

Relative Risks with 95 percent Confidence Intervals (CI) and PAFs of Selected Obesity Co-morbidities for Overweight and Obese Adults

	Relative Risks		PAFs		
Diseases	Overweight	Obesity	Overweight	Obesity	Total
Heart Disease	1.60 (1.34 - 1.90)[2]	2.06 (1.70 - 2.50)	11.2	8.5	19.6
Diabetes	1.93 (1.39 - 2.69)	2.61 (1.81 - 3.76)	16.5	12.3	28.7
Any disease	1.67 (1.44 - 1.93)	2.18 (1.86 - 2.56)	12.4	9.3	21.7

[1]Any disease refers to any of the heart disease or diabetes.

[2]CI are shown in brackets.

PAFs are converted into percentages by multiplying with 100.

Authors' Computation from PPHS dataset (2010).

Through estimated relative risks, Population Attributable Fractions are calculated using the formula mentioned in the methodology chapter.[10] PAFs are estimated to see what proportion of the disease is caused by overweight and obesity. The results show that 11 percent of overall heart disease in the adult population is caused by overweight, while 9 percent is due to obesity, summing up to 20 percent of heart disease attributable to overweight and obesity. Similarly for diabetes, 17 percent of the disease is caused by overweight and 12 percent is due to obesity, totalling 29 percent due to diabetes (Table 4).

The findings show that relative risk is higher for obesity than for overweight; here, PAF percentages are higher in overweight than in obese. This higher proportion of the diseases attributable to overweight than obesity is due to high prevalence of overweight in population. The findings also indicate that excess weight is a more dominant risk factor for diabetes than for heart disease. These results are consistent with that of the literature [Birmingham, *et al.* (1999)]. Overall, for both the diseases, 22 percent of the disease is attributable to excess weight which is a very high proportion (Table 4). PAF percentages, when seen for both genders separately, show that disease burden due to excess weight is higher for females than for males for both the diseases (Appendix Table A5).

Results for disease cost show that the average out of pocket medical expense for diabetes is 19364 rupees, while, the average indirect medical cost i.e. transportation cost, is 117 rupees; a total of 19481 rupees of direct cost. Similar cost for heart diseases is Rs 13685 and 125 respectively, a total of Rs 13810 (Table 5). This shows a higher average direct cost for diabetes; however, the total cost is higher for heart diseases. The reason for this higher total cost is higher prevalence for heart diseases than diabetes in the population. Yet, the results of average cost show that diabetes is a more costly disease than heart diseases. Similar results can be seen in international literature [Wolf and Colditz (1998); Pitayatienanan, *et al.* (2014)].

[10]Formula for PAF $=\frac{P(RR-1)}{[P(RR-1)+1]}$; which is later converted to percentages by multiplying with 100.

The findings also suggest that all the cost categories are higher for diabetes as compared to heart diseases. A similar trend can be seen for average productivity cost which is also higher for diabetes (Table 5). Moreover, results for total (both direct and indirect) average cost are 144255 rupees for diabetes and 68155 rupees for heart diseases; making the average total cost of 86478 rupees for both diseases per annum.

Table 5

Annual Cost (Total and Average) Attributable to Overweight and Obesity for year 2010, in Rupees

	Total Disease Cost		Cost Attributable to Overweight		Cost Attributable to Obesity		Sum of Overweight and Obesity Cost	
Disease by Cost	Total	Average	Total	Average	Total	Average	Total	Average
Heart Disease								
Direct Medical Cost	11,263,051	13685	1,258,083	1529	952,854	1158	2,210,937	2686
Indirect Medical Cost[1]	102,639	125	11,465	14	8,683	11	20,148	24
Direct Cost	11,365,690	13810	1,269,548	1543	961,537	1168	2,231,085	2711
Indirect Cost	44,726,048	54345	4,995,900	6070	3,783,824	4598	8,779,723	10668
Total Cost	56,091,738	68155	6,265,447	7613	4,745,361	5766	11,010,808	13379
Diabetes								
Direct Medical Cost	5,053,922	19364	831,876	3187	619,611	2374	1,451,486	5561
Indirect Medical Cost	30,542	117	5,027	19	3,744	14	8,772	34
Direct Cost	5,084,464	19481	836,903	3207	623,355	2388	1,460,258	5595
Indirect Cost	32,566,172	124775	5,360,392	20538	3,992,613	15297	9,353,005	35835
Total Cost	37,650,636	144255	6,197,295	23744	4,615,968	17686	10,813,263	41430
Any Disease								
Direct Medical Cost	16,316,973	15053	2,089,958	4716	1,572,465	3532	3,662,423	8248
Indirect Medical Cost	133,181	123	16,492	33	12,428	25	28,920	58
Direct Cost	16,450,154	15175	2,106,450	4749	1,584,893	3557	3,691,343	8306
Indirect Cost	77,292,220	71303	10,356,291	26608	7,776,436	19895	18,132,728	46503
Total Cost	93,742,374	86478	12,462,742	31357	9,361,329	23452	21,824,071	54809

[1]Indirect medical cost includes transportation cost only.
Authors' Computation from PPHS dataset, 2010.

Among these total and average costs, the proportion of cost attributable to overweight and obesity is calculated by multiplying total cost with PAFs. The results show that for heart diseases on average Rs 1543 is attributable to overweight and Rs 1168 to obesity. The total, Rs 2711 as part of Rs 13810 of average direct cost is attributable to excess weight. Similarly in total average direct cost of Rs 19481for diabetes, 5595 rupees is attributable to excess weight. Similar results can be seen for indirect cost in Table 5.6. Overall, amongst Rs 86478 of total average cost for both diseases, rupees 54809 are attributable to excess weight.

It is also interesting to see the share of the average costs in the mean income of an individual. According to PPHS data, the yearly mean income of an individual in Pakistan is 1,36,359 rupees [PPHS Dataset (2010)]. Conforming to it, the share of direct cost of both co-morbidities comes to 11 percent[11] of the income. Likewise, the direct cost of both co-morbidities attributable to overweight and obesity is 6 percent[12] of the income of an individual. The breakdown of average direct and indirect cost for both diseases attributable to overweight and obesity is derived according to the wealth status. The results show greatly reduced cost, both direct and indirect, in poor as compared to non-poor categories (Appendix Table A6).

The above cited costs attributable to overweight and obesity are calculated from the sampled population of a nationally representative data on which the average costs are scaled up so that the total cost due to excess weight for both diseases can be estimated for the whole population. For undertaking this exercise, certain information like total population, national health expenditure, private health expenditure and Gross Domestic Product of Pakistan, is retrieved from external sources (Table 6). Average costs attributable to obesity and prevalence of diseases are extracted from the survey data.

The results show that among the total population of Pakistan of age 15 years and above[13] i.e. 112 millions, 16 million are suffering from heart diseases and 5 million from diabetes. This sick population is then multiplied by the average direct, indirect and total cost of heart diseases and diabetes which is attributable to overweight and obesity. The results demonstrate that in Pakistan the direct out of pocket cost which is attributable to excess weight incurred by the patients of heart disease is 44 million rupees, while, for diabetes it is 28 million rupees. A total of 72 million rupees' direct cost on both diseases is due to excess weight (Table 6). Results of sensitivity analysis show that this direct cost can be as low as 43 billion rupees and as high as 99 billion (Appendix Table A7). However, the productivity losses due to both of these diseases are estimated up to 356 million rupees as a result of excess weight. Sensitivity analysis shows that it can decrease up to 217 billion and increase up to 482 billion, with the variation in relative risks by different percentages.[14] Therefore, the total direct and indirect cost of both illnesses attributable to excess weight is 429 million rupees.

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[11]Share is calculated as: (15175/136359)*100.

[12]Share is calculated as: (8306/136359)*100.

[13]Adult population 15+ of Pakistan is taken and children are excluded because the present study is on adults of age 18+. Data of total population was not available for age 18+ that is why age 15+ is taken.

[14]Detailed results for sensitivity analysis i.e. variations in relative risk values, population attributable fractions percentages, average and total costs, can be seen in Table A7 in Appendix.

Table 6

Scaling-up of Annual Cost Attributable to Overweight and Obesity to the Whole Population (in Rupees)

	Average Cost[1]		Percent/ Number
Direct cost of heart disease due to overweight	1543	Prevalence of heart Disease[2]	14.6%
Direct cost of heart disease due to obesity	1168	Prevalence of diabetes[2]	4.5%
Indirect cost of heart disease due to overweight	6070	Population (age 15+) of Pakistan[3]	112,547,050
Indirect cost of heart disease due to obesity	4598	Population with heart disease[4]	16,431,869
Direct cost of diabetes due to overweight	3207	Population with diabetes[4]	5,064,617
Direct cost of diabetes due to obesity	2388	National health expenditure[5]	448,403,000,000
Indirect cost of diabetes due to overweight	20538	Private Out of pocket expenditure[5]	271,757,000,000
Indirect cost of diabetes due to obesity	15297	Gross Domestic Product [GDP][3]	18,276,440,000,000
	Scaled-up Total Cost[6]		Percent[7]
Direct cost of heart disease due to excess weight	44,545,438,925	Share of direct cost in total cost	16.9%
Indirect cost of heart disease due to excess weight	175,294,366,558	Share of indirect cost in total cost	83.0%
Direct cost of diabetes due to excess weight	28,335,813,985	Share of direct cost of both diseases due to excess weight in national health expenditure	16.2%
Indirect cost of diabetes due to excess weight	181,491,911,049	Share of direct cost of both diseases due to excess weight in private out of pocket expenditure	26.8%
Direct cost for both diseases due to excess weight	72,881,252,911	Share of direct cost of both diseases due to excess weight in GDP	0.40%
Indirect cost for both diseases due to excess weight	356,786,277,607	Share of indirect cost of both diseases due to excess weight in GDP	1.95%
Total cost for both diseases due to excess weight	429,667,530,518	Share of total cost of both diseases due to excess weight in GDP	2.35%

[1] Average cost is extracted from data, taken from Table 5.

[2] Prevalence of heart diseases and diabetes are extracted from the data, taken from Table 1.

[3]Taken from Economic Survey of Pakistan (2014), and value is for year 2010 at market prices.

[4] Population of Pakistan multiplied with the prevalence of diseases.

[5] Expenditures are taken from National Health Accounts of Pakistan, for year 2010.

[6] Required average costs are multiplied with the required population of patients; direct and indirect costs are added in the end to get total cost.

[7] Share of direct/indirect costs are calculated by divided with total cost and multiplied with 100; shares in national expenditures and GDP are calculated by multiplying it with costs.

Authors' Computation from PPHS dataset, 2010.

Productivity losses are a massive burden as cost of illness when compared with the direct cost i.e. the share of direct cost is 17 percent and that of indirect cost is 83 percent. These huge differences between direct and indirect cost are also consistent with the present literature [Popkin, *et al.* (2006)]. However, some literature also shows contradictory results by estimating lesser indirect than direct cost [Sander and Bergemann (2003); Moffat, *et al.* (2011); Pitayatienanan, *et al.* (2014)]. This huge amount of indirect cost might be overestimated due to two reasons. First, due to the self-reported nature of days lost due to illness which is measured in terms of perceived impairment reported by the patient. Individuals suffering from illness may claim much higher impaired days for their illness. Secondly, using the human capital approach to measure indirect cost yields potential productivity loss, not the actual loss, because it also estimates non-paid, informal or household work.

To assess the disease burden due to excess weight, its share has been measured in both the national and private health expenditure of Pakistan. The share of only direct cost is seen here, because in the national figures indirect cost is not captured. The results reveal that the share of direct cost for heart diseases and diabetes due to excess weight in national total health expenditure is 16 percent. Similarly, among the national private out of pocket expenses, 27 percent is the share of direct cost on heart diseases and diabetes.. The share in GDP for direct cost is 0.4 percent and 1.9 percent for indirect cost; that is 2.3 percent of the total cost for the two diseases due to excess weight (Table 6).

6. CONCLUSION

Body weight is strongly co-related with health. According to evidence available from the literature, there is a negative association between weight and health. Results show that excess weight increases disease prevalence and its intensity when duration of illness increases as well as hospitalised days. Overweight and obesity is a major risk factor for certain chronic diseases. The prevalence of heart diseases and diabetes is higher in overweight and obese individuals as compared to normal weight individuals. It is estimated that 22 percent portion of these two diseases can be attributed to overweight and obesity.

Results also show that a sizeable proportion of illness cost incurred by the individuals for these co-morbidities is attributed to overweight and obesity. The total direct cost for both diseases is estimated at 72 billion rupees per annum due to excess weight, while the indirect cost estimate is 356 billion rupees in Pakistan. The share of direct cost for both diseases due to excess weight is extracted from the National Health Expenditures which is 16percent. This share is 26 percent for private out of pocket expenditure and 0.4 percent of the GDP for Pakistan. These results indicate a huge disease burden attributed to overweight and obesity. By preventing overweight and obesity we can both lower the disease and cost burden on overweight individuals.

The study provides a comprehensive understanding of the health risks of overweight and obesity to adults in Pakistan. It also gives evidence of a huge economic burden due to this health problem. Certain behavioural changes are needed to avoid the health problems related to overweight and obesity. Health professionals should stress on lifestyle changes in their patients suffering from weight problems or with other co-morbidities related to it. Moreover, insurance schemes should be launched to lighten the burden of treatment cost on the patients through involvement of the health sector in prevention of obesity and overweight problem.

APPENDIX

Table A1

Mileage Allowances for Government Employees

(i)	Personal Car/Taxi	Rs. 10/- per k.m.
(ii)	Motor Cycle/Scooter	Rs. 4/- per k.m.
(iii)	Bicycle/Animal Back	Rs. 2/- per k.m.
(iv)	Public Transport	Rs. 2.5/- per k.m.

Federal Government of Pakistan, 2010.

Table A2

Formula, Calculation Process and Interpretation for Relative Risk

	Disease yes	Disease no	Total
Exposure yes	A	B	A + B
Exposure no	C	D	C + D
	A + C	B + D	A + B + C + D

$$RR = \frac{A / A+B}{C / C+D}$$

1 No difference
< 1 less risk in the exposed group
> 1 more risk in the exposed group

Table A3

Mean Health Care Expenditure (in Rupees) on Illness by Nutritional Status

BMI Category	Expenditure on consultation	Expenditure on medicines	Expenditure on hospitalisation/ lab tests	Total expenditure
For all type of diseases				
Underweight	1133	6547	1125	8804
Normal weight	1186	6702	967	8854
Overweight	1438	8780	1392	11610
Obese	2189	8226	1655	12069
Total	1345	7298	1157	9800
For selected obesity co-morbidities only				
Underweight	3048	10608	1834	15490
Normal weight	1950	8070	1253	11273
Overweight	2081	13319	2206	17605
Obese	4014	10695	2645	17354
Total	2484	10293	1843	14619

Table A4

Relative Risks for Selected Obesity Co-morbidities for Overweight and Obese Adults by Age and Gender and the Confidence Intervals for Relative Risks

Diseases/Age/Gender	Overweight	Obesity
	Males	
Heart Disease		
18-29	1.92 (0.66 - 5.63)	–
30-49	1.64 (0.85 - 3.16)	2.30 (0.95 - 5.59)
50+	1.18 (0.80 - 1.76)	1.54 (0.93 - 2.57)
Total	1.46 (1.05 - 2.02)	1.81 (1.15 - 2.84)
Diabetes		
18-29	–	–
30-49	2.46 (0.87 - 6.92)	–
50+	1.47 (0.74 - 2.91)	2.17 (0.93 - 5.04)
Total	1.92 (1.09 - 3.39)	2.01 (0.86 - 4.67)
Any Disease		
18-29	1.78 (0.61 - 5.18)	–
30-49	1.84 (1.08 - 3.14)	1.72 (0.73 - 4.10)
50+	1.25 (0.91 - 1.73)	1.70 (1.15 - 2.51)
Total	1.56 (1.19 - 2.05)	1.86 (1.27 - 2.70)
	Females	
Heart Disease		
18-29	0.50 (0.18 - 1.37)	1.24 (0.47 - 3.30)
30-49	1.24 (0.84 - 1.84)	2.61 (1.88 - 3.61)
50+	1.76 (1.37 - 2.27)	1.35 (0.97 - 1.88)
Total	1.64 (1.33 - 2.01)	2.06 (1.65 - 2.57)
Diabetes		
18-29	–	3.26 (0.37 - 28.51)
30-49	1.38 (0.65 - 2.95)	2.68 (1.36 - 5.27)
50+	1.77 (1.09 - 2.87)	1.89 (1.09 - 3.28)
Total	1.94 (1.29 - 2.91)	2.74 (1.80 - 4.18)
Any Disease		
18-29	0.46 (0.17 - 1.24)	1.42 (0.59 - 3.38)
30-49	1.27 (0.91 - 1.78)	2.62 (1.98 - 3.46)
50+	1.77 (1.44 - 2.16)	1.48 (1.15 - 1.92)
Total	1.70 (1.43 - 2.02)	2.21 (1.84 - 2.64)

Table A5

Population Attributable Fractions (in Percentages) for Diseases for Overweight and Obese Adults by Gender

Diseases/Gender	Overweight	Obesity	Total
	Total		
Heart Disease	11.2 (6.7 - 15.9)	8.5 (5.7 - 11.6)	19.6 (12.4 - 27.5)
Diabetes	16.5 (7.6 - 26.3)	12.3 (6.5 - 19.4)	28.7 (14.2 - 45.7)
Any Disease	12.4 (8.5 - 16.5)	9.3 (6.9 - 12.0)	21.7 (15.5 - 28.4)
	Male		
Heart Disease	8.8 (1.1 - 17.7)	6.6 (1.3 - 13.8)	15.4 (2.4 - 31.5)
Diabetes	16.2 (1.8 - 33.5)	8.1 (0 - 24.2)	24.3 (1.8 - 57.8)
Any Disease	10.6 (3.9 - 18.1)	6.9 (2.3 - 12.9)	17.5 (6.2 - 31.0)
	Female		
Heart Disease	11.8 (6.5 - 17.6)	8.5 (5.4 - 12.0)	20.3 (11.9 - 29.6)
Diabetes	16.5 (5.8 - 28.7)	13.2 (6.5 - 21.7)	29.7 (12.3 - 50.4)
Any disease	12.9 (8.2 - 17.8)	9.5 (6.8 - 12.5)	22.3 (15.0 - 30.3)

Note: Lower and higher limited of PAFs according to the CI of relative risks are given in brackets.

Table A6

Annual Average cost (in Rupees) Attributable to Overweight and Obesity by Wealth Status

	Average Cost		
	Total	Non-poor	Poor
Direct cost of heart disease due to overweight	1543	1627	898
Direct cost of heart disease due to obesity	1168	1232	680
Indirect cost of heart disease due to overweight	6070	6523	2306
Indirect cost of heart disease due to obesity	4598	4941	1747
Direct cost of diabetes due to overweight	3207	3308	2287
Direct cost of diabetes due to obesity	2388	2464	1704
Indirect cost of diabetes due to overweight	20538	19169	5500
Indirect cost of diabetes due to obesity	15297	14278	4097

Table A7

Results of Sensitivity Analysis

Parameters by Disease	20% decrease	15% decrease	10% decrease	5% decrease	Original	5% increase	10% increase	15% increase	20% increase
Heart Disease									
RR overweight	1.28	1.36	1.44	1.52	**1.60**	1.68	1.76	1.84	1.92
RR obesity	1.65	1.75	1.86	1.96	**2.06**	2.17	2.27	2.37	2.48
PAF overweight	5.5%	8.4%	8.4%	9.8%	**11.2%**	12.5%	13.7%	15.0%	16.2%
PAF obesity	5.4%	6.9%	6.9%	7.7%	**8.5%**	9.2%	9.9%	10.7%	11.4%
Average direct cost overweight	762	966	1164	1356	**1543**	1723	1899	2069	2235
Average indirect cost overweight	2998	3802	4581	5337	**6070**	6782	7472	8141	8795
Average direct cost obesity	739	850	958	1064	**1168**	1272	1373	1472	1571
Average indirect cost obesity	2910	3343	3769	4188	**4598**	5005	5404	5793	6182
Diabetes									
RR overweight	1.55	1.64	1.74	1.84	**1.93**	2.03	2.13	2.22	2.32
RR obesity	2.09	2.22	2.35	2.48	**2.61**	2.74	2.87	3.00	3.13
PAF overweight	10.4%	13.5%	13.5%	15.0%	**16.5%**	17.9%	19.2%	20.5%	21.8%
PAF obesity	8.6%	10.5%	10.5%	11.4%	**12.3%**	13.1%	14.0%	14.8%	15.6%
Average direct cost overweight	2017	2330	2633	2925	**3207**	3479	3744	3997	4246
Average indirect cost overweight	12917	14926	16865	18736	**20538**	22285	23980	25604	27196
Average direct cost obesity	1680	1863	2042	2217	**2388**	2558	2722	2883	3043
Average indirect cost obesity	10763	11932	13077	14200	**15297**	16383	17435	18467	19489
Any Disease									
RR overweight	1.34	1.42	1.50	1.59	**1.67**	1.75	1.84	1.92	2.00
RR obesity	1.75	1.85	1.96	2.07	**2.18**	2.29	2.40	2.51	2.62
PAF overweight	6.6%	9.6%	9.6%	11.0%	**12.4%**	13.7%	15.0%	16.3%	17.5%
PAF obesity	6.1%	7.7%	7.7%	8.5%	**9.3%**	10.1%	10.9%	11.6%	12.3%
Average direct cost overweight	2779	3297	3797	4281	**4749**	5203	5643	6066	6481
Average indirect cost overweight	15915	18728	21446	24073	**26608**	29067	31451	33745	35991
Average direct cost obesity	2420	2712	3000	3281	**3557**	3830	4095	4355	4614
Average indirect cost obesity	13673	15275	16846	18388	**19895**	21388	22839	24260	25671
Direct Scaled-up Cost	43,393,456,829	51,072,748,136	58,543,467,134	65,814,562,639	**72,881,252,911**	79,795,548,679	86,511,907,732	93,031,176,344	99,454,043,487
Indirect Scaled-up Cost	217,007,452,743	253,434,202,161	288,855,335,877	323,314,671,238	**356,786,277,607**	389,526,855,337	421,321,861,085	452,162,859,269	482,544,892,490
Share of Direct Cost in Health Expenditure	9.7%	11.4%	13.1%	14.7%	**16.3%**	17.8%	19.3%	20.7%	22.2%

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