TRUST RE

PERSPECTIVES

OBESITY – OVERWEIGHT
A BIOMETRIC RISK PERSPECTIVE

PRODUCED BY: LIFE & HEALTH REINSURANCE DEPARTMENT

REINSURER OF CHOICE

Introduction

The effects and consequences of human lifestyle and behaviour on mortality and life expectancy have always been significant. There are many human behaviours that could affect health and longevity. These can be of an individual nature (e.g. smoking, physical activity, nutrition, alcohol consumption, etc.) or of an institutional nature (e.g. wars, laws, access to healthcare system, etc.).

Understanding the physiology behind Obesity is important for the Life Insurance underwriter as these conditions have a negative impact on the health status of a person and are often correlated with or lead to other conditions such as hypertension and diabetes.

The purpose of this article is to review the Life Risks of Obesity and other related co morbidities that occur with obesity, and provide an insight on the key points with regard to Obesity assessment.

Background

Our physical body is composed of what we eat after Physical Exertion. Our food includes fat, fibre, protein, carbohydrate, salt, red meat, poultry, fish, fresh fruits and fresh vegetables, precooked, semi cooked and fast foods in varying quantity and frequency. Physical exercise too varies from meditative slow movements to strenuous vigorous exercise of varying timings and exertion.

Conventionally, the various steps of obesity meet the balance between energy intake and energy consumption: when the inputs exceed the needed energy consumption, our weight increases as follows:

- In a first phase, which we can call "dynamic", the weight increases because energy intake is more important than the needs,

- The second phase is represented by the "static" phase in which the weight is stabilised, reflecting a balance in the energy needs,

- Finally, the third phase, which is often desired and necessary, reveals lower energy intake needs, resulting in decreased weight.

Thus, we see that the constitution of being overweight or obesity is a matter of "energy balance" reflecting the difference between the inputs (food intake) and energy output (energy expenditure). When our body is absorbing more calories than these spent through exertion, the proportion of body fat in our body is increasing.

Per Björntorp in his article "Obesity. - Lancet 1997" noted: The concept of energy balance is easy to understand; it is the quantitative aspect which is often overlooked. A typical obese patient will see his weight increasing by 20 kg in 10 years. This means an excess of daily intake of 30-40 Cal at the beginning of the obesity proceeds to gradually increase over time to maintain a larger body. Daily excess of this magnitude initially corresponds to less than half a sandwich or the absence of, a medium or low intensity exertion such as walking or climbing stairs.

Even though there might be a slight variation in what we eat or exercise, the body regulates itself with a tendency to gain weight rather than lose it. Energy deficit causes a compensatory

response from the body in order to restore the balance: increasing food intake, decreasing energy expenditure and vice-versa. However, in this body mechanism, weight gain is more probable than loss.

The factors leading to weight gain are several and can be due to:
- Genetic Inheritance biased towards savings;
- Psychosocial and emotional factors;
- Modern Lifestyle:
  - promoting access to abundant food;
  - leading to more consumption of processed foods;
  - less physical activity.

A century ago, obesity was synonymous with wealth and prosperity, while the reverse is a reality with the wealthy taking care of their bodies. In western countries, an inverse relationship between income level and obesity is observed attributed due to the difference in eating habits (cheap but bad quality foods and food rich in lipids) and inequality of access to care. In addition, lifestyles changes also contribute to unhealthy eating.

Increasing prevalence of being overweight and obesity in industrialised countries and changing pattern of food intake in "westernising" countries has led to obesity now being recognised as a major public health hazard. Changes in Insurance buying patterns and preference for Riders have necessitated a need to review the current underwriting practice with regard to Obesity. Riders ranging from Accidental Death, Short & Long Term Disability, Critical Illness and Loss of Employment covers calls for mandatory optimal risk assessment failing which the impact shall be severe before results of corrections, if any, can compensate.

Obesity and mortality / morbidity

The increase in mortality/morbidity risk and health care costs due to obesity has been noted in several insurance and population studies. Obesity linked to the increased incidence of cardiovascular disease (CVD), the metabolic syndrome, diabetes mellitus and Glucose Intolerance, and a variety of cancers is well documented as a result of various studies.

Oster et al. (2000), using the survey data from 3,400 adults collected in 1996, estimate the health care costs attributable to obesity and the relative risk for eight conditions (see table below).

Obesity - Related diseases	BMI < 25	25 < BMI < 29	BMI > 29
	Men		
Hypertension	1.00	1.90	2.60
Hypercholesterolemia	1.00	-	1.80
Diabetes	1.00	2.60	10.40
Coronary heart diseases	1.00	1.40	2.40
Stroke	1.00	1.20	1.30
Gallbladder disease	1.00	2.00	3.50
Osteoarthritis	1.00	1.00	2.80
	Women		
Hypertension	1.00	2.30	3.80
Hypercholesterolemia	1.00	-	1.80
Diabetes	1.00	4.40	48.90
Coronary heart diseases	1.00	1.70	3.00
Stroke	1.00	1.40	1.90
Gallbladder disease	1.00	2.00	3.50
Osteoarthritis	1.00	1.70	1.60
Endometrial cancer	1.00	1.00	2.00

Relative risks of selected obesity-related disease by sex, disease and BMI. Source : Oster et Al. (2000, Table 1)

In a large longitudinal study in Taiwan, Fu et al. (2008) found that the impact of higher Body Mass Index (BMI) on costs rose for six metabolic syndrome diseases including hypertension.

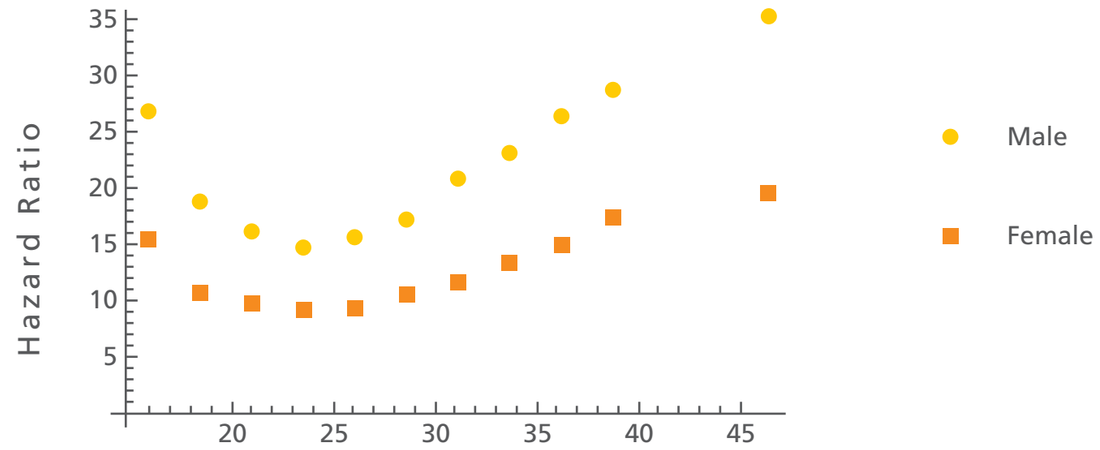
Costs associated with obesity include obesity-related work absenteeism. Cawley et al. (2007) documented job absenteeism in the U.S. and found a strong association, costs being greater for women than for men (see table below).

Occupation	Obese	Morbidly Obese	Total
	Men		
	USD	USD	USD
Overall	453.20	637.80	1,091.00
Managers	81.90	317.20	399.10
Professionals	190.50	109.70	300.20
Sales workers	73.00	39.60	112.60
Office workers	14.40	32.00	46.40
Transportations operators	58.90	96.20	155.10
	Women		
	USD	USD	USD
Overall	1,830.10	1,337.70	3,167.80
Managers	446.30	211.10	657.40
Professionals	452.10	432.80	884.90
Sales workers	186.80	130.00	316.80
Office workers	301.80	278.80	580.60
Transportations operators	178.30	132.50	310.80

Source : Cawley et al. (2007, Table 6)

Whitlock et al (2009), in analysing 57 prospective studies involving 894,576 participants, found that the lowest mortality was associated with BMI ranging from 22.5 to 25. They found that each 5-unit increase of BMI was associated on average with an increase of 30 percent in the hazard ratio for all-cause mortality.

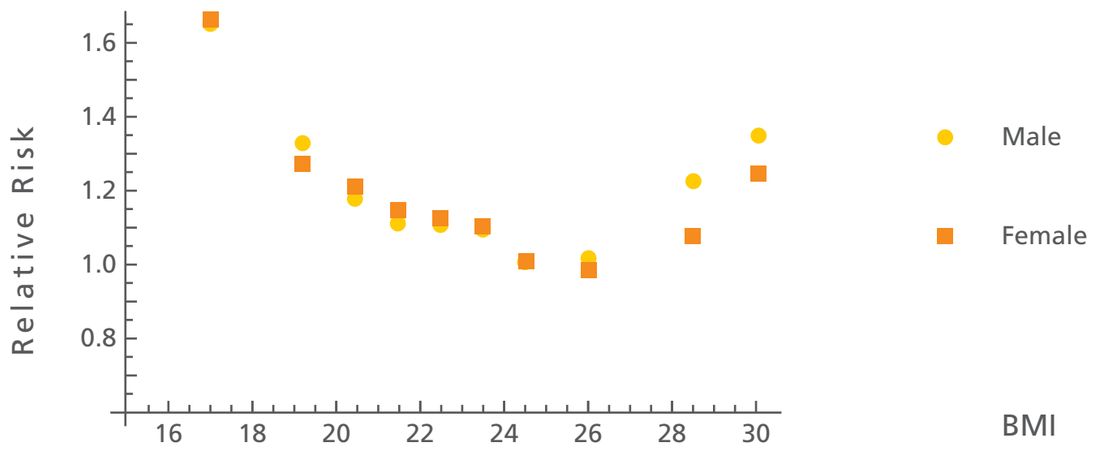
Relative Risk of Death versus BMI in USA



NOTE: Hazard ratio for all cause of mortality (annual expected death per 1,000 in the U.S) for ages 35-89 combined versus BMI for males and females in the BMI range 15-50 (excluding the first five years of follow-up). Source: Whitlock et al. (2009).

Gu et al. (2006) illustrate the relationship between BMI and relative risk of death due to all causes for men and women in China. The authors found that the U-shaped relation between BMI and mortality remains even after adjustment for factors such as age, gender, smoking habits and others.

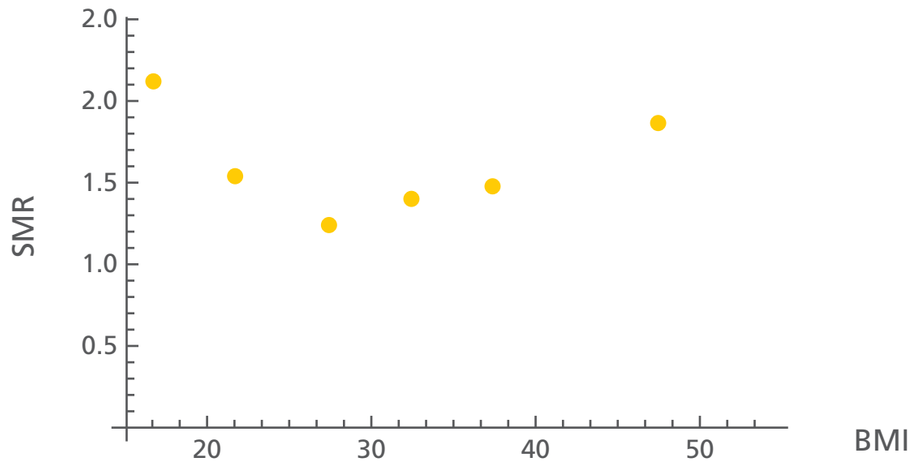
Relative Risk of Death versus BMI in China



NOTE: Relative risk of death from all causes as a function of BMI for men and women. The reference group for the relative risk calculation is the group with BMI between 22.0 and 23.9 which had the lowest all-cause mortality rate. Source: Gu et al. (2006, Table 2).

Roudebush et al. (2006) studied 241,966 life insurance policies submitted from 1989 to 2003 with 10-policy-year follow-up, comparing the actual BMI and standardised mortality based on the Valuation Basic Table (VBT). They found a U-shaped pattern with minimum attained for the group with BMI ranging from 25-29 (see figure below).

Standardised Mortality ratio according to BMI



Source : Roudebush et al. (2006, Figure 1)

The authors made the following conclusions:

1. Extra mortality for obesity amounts to 25 to 75 percent. For underweight and extreme obesity the extra mortality amounts to 75 to 150 percent;
2. There was an excess mortality for underweight and obese even for shortest policy duration.

Reuser et al. (2008) analysed the life expectancy of adults age 55 and older in a Health and Retirement prospective longitudinal study. They found severe obesity (BMI > 35) cost three years (95 percent confidence interval 2.2 – 3.8) for men and 5.2 years (95 percent confidence interval 4.4 – 6.1) for women while being underweight shortened the life expectancy of men by 2.4 years compared with men of average weight.

Zhou et al. (2008) conducted one of the largest prospective studies of the relationship between BMI and mortality from stroke, involving 212,000 relatively lean Chinese men. They observed that BMI was strongly associated with stroke mortality where the BMI was above 25.

Yan et al. (2006) studied a population of workers for assessing the relation of mid-life BMI to morbidity and mortality at older age. They found that amongst individuals with no cardiovascular risk factors, those who were obese in middle age have significantly higher risk of death from cardiovascular disease than those who had normal weight.

Obesity Defined

"The state of being grossly fat or overweight"- Oxford Dictionary.

"Overweight due to the excess of body fat" - Medical definition.

This excess is estimated by comparing the weight from an individual to a theoretical ideal weight, assuming the proportion of fat in the body does not exceed a certain percentage of the total weight for a standard individual.

The three most commonly used definitions are:

1. An Increase in percentage of Body weight that is Fat (Greater than 25% in Men and 35% in Women).
2. An Increase in Body Mass Index (BMI) which is calculated as weight in Kilograms divided by height in meters squared (kg/m²)

3. An Increase in Waist to Hip Ratio or Visceral Adiposity

Standardised / common metrics for obesity measurement

There are 3 standardised metrics commonly used for measuring or estimating the stage of obesity. These measures are:

- BMI
- Waist Measurement: Waist Circumference, Waist-to-Hip Ratio
- Body Composition analysis

BMI (Body Mass Index)

BMI is a calculation based on the ratio of height and weight (BMI = kg/m²). Decades of research have shown that BMI provides a good estimate of "fatness" and also correlates well with important health outcomes like heart disease, diabetes, cancer, and overall mortality while, in spite of the criticisms, this measure represents an easy and simple way for estimating the stage of obesity.

BMI = $Mass_{kg}$ / Height m²

Waist Measurement: Waist Circumference, Waist-to-Hip Ratio

Another measure for excess of fat is waist circumference. This can be used as an additional measure in people who are overweight to measure abdominal adiposity which correlates with insulin resistance and cancer risk. The waist circumference that increases risk of complications due to obesity varies by gender and ethnicity:

- European men > 93 cm (36.6 inch) Particularly >101 cm (39.8 inch)
- European women > 79 cm (31.1 inch) Particularly > 87 cm (34.2 inch)
- Asian/Indian men > 78 cm (30.7 inch) Particularly > 90 cm (35.4 inch)
- Asian/Indian Women > 72 cm (28.3 inch) Particularly > 80 cm (31.5 inch)

Distribution of body fat is important. Disproportionate truncal Obesity (i.e. Waist-to-hip Ratio > 0.8) is associated with Cardiovascular and cerebrovascular disorders, hypertension and diabetes mellitus more often than fat located elsewhere. The Waist-to-Hip ratio combined with Waist Circumference have been suggested to assess the presence of abdominal fat.

Yusuf et al. (2005) studied obesity and myocardial infarction based on a population of 27,000 participants in 52 countries in order to determine if obesity markers other than BMI would be a stronger indicator of myocardial infarction. The study concluded that using waist-to-hip ratio rather than BMI increases the estimate of myocardial infarction attributable to obesity.

Measurement Protocols

- Measure the waist circumference at the end of several consecutive natural breaths, at a level parallel to the floor, midpoint between the top of the iliac crest and the lower margin of the last palpable rib in the mid axillary line.
- Measure the hip circumference at a level parallel to the floor, at the largest circumference of the buttocks.
- Make both measurements with a stretch-resistant tape that is wrapped snugly around the subject, but not to the point that the tape is constricting. Keep the tape level and parallel to the floor at the point of measurement.
- Ensure that the subject is standing upright during the measurement, with arms relaxed at the side, feet evenly spread apart and body weight evenly distributed.

Body Composition Analysis

Body composition (the percentage of body fat and muscles) is also considered when Obesity is diagnosed. Although probably unnecessary in clinical routine practice, it can be helpful if clinicians question whether elevated BMI is due to muscle or excessive fat. The percentage of body fat can be estimated by measuring skin fold thickness (usually over the triceps) or determining mid upper arm area.

Bioelectrical impedance analysis (BIA) can estimate the percentage of body fat non-invasively. BIA estimates the percentage of total body water directly; the percentage of body fat is derived indirectly. BIA is most reliable in healthy people and in people with only a few chronic disorders that do not change the percentage of total body water (e.g. moderate obesity, diabetes mellitus).

Obesity and Nutrition

In many countries, excess food is available and the most common nutritional problem is Obesity. Diet and Disease are interrelated in many ways:

- Excess energy intake contributes to a number of diseases, including ischemic heart disease and diabetes, particularly when high in animal (saturated) fat content.
- Food intake and Cancer: An excess of energy rich-foods (i.e. containing fat and sugar), often with physical inactivity, plays a role in the development of certain cancers. Numerous carcinogens, intentional additions (e.g. nitrates for preserving foods) or accidental contaminants (e.g. moulds producing aflatoxin and fungi) may also be involved in the development of cancer.
- Proportion of Processed foods eaten: Some processed convenience foods have a high sugar and fat content and are therefore a predisposition to obesity.

Obesity and All-cause Mortality

Insurance Studies:

The Build Study 1979 :

All-cause Mortality increases with increasing weight to height (increasing BMI) In an Age Distribution of 15 to 69, Age Group 15 to 39 showed a higher excess mortality with obesity in the younger age group and a higher mortality rate with underweight in the older age group.

Men	
Approximate BMI (Average 25)	Extra Percentage Mortality Risk
17.5	17%
20 - 27.5	NIL
30	17%
32.5	30%
35	39%
37.5	68%
40	86%

Women	
Approximate BMI (Average 22.7)	Extra Percentage Mortality Risk
16	28%
18.1	11%
20.4 TO 31.8	NIL
34	31%
36.3	40%

American Cancer Study:

Male Non Smokers had the strongest graded relationship between Mortality and changes in BMI.

	BMI RANGE	ALL AGES	18 - 39	40 - 59	≥60
Overall	< 19	1.18	1.08	1.16	1.56
	< 22	1.07	1.05	1.02	1.27
	22 - 24	1.0	1.0	1.0	1.0
	28 - 30	1.17	1.23	1.1	1.28
	32 - 33	1.5	1.49	1.21	1.15
	≥34	1.29			
Non Smokers	< 22	1.37	1.06	1.69	0.94
	22 - 24	1.0	1.0	1.0	1.0
	25 - 27	1.18	0.91	1.37	1.08
	28 - 30	1.23	1.17	1.45	1.02
	31 - 33	1.68	1.67	1.84	2.23
	≥34	1.84			

Brackenridge Table on Mortality Ratios and BMI

The original data was derived from three different sources each with more than 750,000 persons

1. American Cancer Society.
2. Life Insurance Actuarial tables.
3. Norwegian Population studies.

The Data represents a wide cross section of people from various geographical areas and reveals that Mortality ratios are higher for Men at Lower BMI than for women, reflecting a difference in visceral adiposity.

All-Cause Mortality Ratio	BMI = (kg/m²)	
	Men	Women
1.0	21 - 24	21 - 26
1.5	32	34
2.0	36	38
2.5	38	40

Medical conditions with a statistically significant relationship to obesity and being overweight

- Numerous Cardiovascular risk factors such as hypertension and elevated lipids
- Cerebrovascular disease; stroke and ischemic Attack
- Diabetes mellitus (Type 2) and impaired Glucose tolerance
- Cancer
- Fatty liver and Non Alcoholic steatohepatitis
- Mood Disorders
- Varicose veins
- Gall stones
- Osteoarthritis (particularly the spine, hips and knees) and reduced mobility
- Urinary Incontinence
- Sleep Apnea
- Digestive Disorders including Constipation and gastro- esophageal reflux
- Gout
- Psychological problems, such as low self-esteem or depression

Cardiovascular risk factors- Hypertension and Elevated Lipids

Hypertension: Hypertension is a well-established risk factor for adverse cardiovascular outcomes, including Coronary Heart Disease (CHD) mortality and strokes. In the worldwide INTER HEART study (2004) of patients from 52 countries, hypertension accounted for 18% of the population's attributable risk for first Myocardial Infarction. Epidemiologic studies have found that both Systolic and Diastolic Hypertension have a Strong, Positive, Continuous and Graded relationship to CHD.
Visceral adipocyte contributes to the release of excess free fatty acids into portal circulation, which in turn affects liver clearance of VLDL and LDL, and leads to lower levels of HDL 2.

Elevated Lipids: Lipoprotein disorders are now described by the absolute Plasma level of Lipids (Cholesterol and Triglycerides) and Lipoprotein level (LDL and HDL). The prevalence of dyslipidemia is highest in the individual with premature CHD. It is as high as 80 to 88% compared to 40 – 48% in age matched control without CHD. In the worldwide INTERHEART study, dyslipidemia accounted for 49% of the population's attributable risk. Elevated Cholesterol is a necessary albeit insufficient condition for the development of atherosclerosis and acts with other risk factors in a multiplicative fashion.

Stroke and Ischemic Heart Disease: The clinical end product of cerebrovascular disease is a transient ischemic attack (TIA), a completed stroke or strokes, or various combination of these.

The study by Marquardsen (1981) of 769 patients carefully observed in three phases as:

1. Immediate Prognosis – 3 weeks: Mortality was at 50.5% for Men and 44.8% for Women.
2. Functional Recovery: 50% became fully independent, 20% were able to walk unaided, 18% had severe disability, and the remaining 12% were completely incapacitated.
3. Long term survival: Mortality in first year was 19% (5 times more than expected), and after 3 years 46%, compared with an expected mortality of 12%. The Median survival time was 3.5 years for the patients with strokes, versus more than 10 years in the corresponding general population.

Apart from neurological evidence of severe cerebral damage, other poor prognostic factors were lack of improvement in motor function, persistent confusion and apathy, incontinence and extra-cerebral complications. Atherosclerotic lesions tend to develop in parallel in different arterial systems whereas coronary lesions usually show ten years before cerebral ones.

Further strokes occurred in 37% of the immediate survivors and the contributing factors being more than one previous stroke, a history of heart failure, a primary stroke with more than slight residual disability, atrial fibrillation, Electrocardiogram (ECG) abnormalities and arterial hypertension.

Diabetes Mellitus and Impaired Glucose Tolerance

Insulin resistance, impaired glucose tolerance and type 2 diabetes mellitus are all strongly associated with increasing BMI and abdominal obesity. Studies including the Nurses' Health study and the Health Professional study, show that the attributable risk of obesity for type 2 diabetes mellitus is as high as 80%. Insulin resistance is very unlikely to occur in the absence of increased intra-abdominal fat and/or being overweight/obesity, as measured by using the BMI or waist circumference. Insulin resistance, Metabolic Syndrome, Impaired Glucose tolerance and type 2 diabetes mellitus are major cardiovascular risk factors and account for some of the increase in CVD observed with Obesity.

The relative risk of type 2 diabetes increases progressively with weight gain, for example in the USA, in women aged 30-35 the risk with increasing BMI is as follows:

A 10Kg loss in weight by an obese person reduces the Overall Mortality by 20% and Diabetes Related mortality by 30%.

BMI	Relative Risk
< 22	1%
30 - 35	25%
Excess of 35	90%

Metabolic Syndrome

Metabolic syndrome is a collection of five of the following medical conditions:
abdominal (central) obesity, elevated blood pressure, elevated fasting plasma glucose, high serum triglycerides, and low high-density lipoprotein (HDL) levels.
Aggressive treatment is important because metabolic syndrome is associated with an increased risk of type 2 diabetes, cardiovascular disease (CVD), and premature mortality.
The probability of having metabolic abnormalities, including metabolic syndrome, increases with the level of obesity. It is also known that the risk is higher in those with lower levels of cardiorespiratory fitness (CRF) and that overweight and obese individuals have lower levels of CRF than normal weight individuals.

Cancer

Obesity is associated with increased risks of the following cancer types, and possibly others as well:

- Esophagus
- Pancreas
- Colon and Rectum
- Breast (after menopause)
- Endometrium (lining of the uterus)
- Kidney
- Thyroid
- Gall Bladder

A study using NCI surveillance, Epidemiology and End Results (SEER) data estimated that in 2007 in the United states about 34,000 new cases of cancer in men (4 percent) and 50,500 in women (7 percent) were due to obesity. The percentage of cases varied widely for cancer types and was as high as 40 percent for some cancers particularly endometrium cancer and esophageal adenocarcinoma.

The Cancer Prevention study to investigate the relationship between BMI and Cancer including over 900,000 participants with an average age of 57 years revealed the following:

BMI	Comparative BMI	Gender	Cancer Mortality Rate	95% Confidence Limits
More than 40	18.5 - 24.9	Male	1.52	1.13 - 2.05
		Female	1.62	1.40 - 1.83
Non Smoker				
35 - 39.9	18.5 - 24.9	Male	1.31	1.01 - 1.70
= 40		Female	1.88	1.56 - 2.27
Per Unitary Increase in BMI	18.5 - 24.9	Male	1.1	
		Female	1.05	

Source: N Engl J Med 2003; 348:1625-1638 April 24, 2003

The study revealed that the proportion of all deaths from cancer that could be attributed to being overweight and obesity in non-smoking adults 50 years of age or older, was about 15% for men and 20% for women.

By excluding smokers from the analysis, the protective effect of Increased BMI disappeared in Lung Cancer and a clear relationship could be established for death caused by cancer, especially esophageal and pancreatic cancer.

The studies of the risks of increasing waist circumference on Colon Cancer and Post-Menopausal Breast Cancer revealed increased risk estimates for larger waist circumference and Waist to Hip Ratio, although the Breast Cancer risk was substantially attenuated by including BMI in the model.

The association of increased risk of certain cancer with obesity is explained as:

- Fat tissue produces excess amount of estrogen, high levels of which have been associated with the risk of breast, endometrial and some other cancers.
- Obese people often have increased levels of insulin and insulin-like growth factor-1 (IGF -1) in their blood, which promote development of certain tumours.
- Fat cells produce hormones, called adipokines, that may stimulate or inhibit cell growth, for example Leptin, which is more abundant in obese people – promotes cell proliferation, whereas Adiponectin which is less abundant in obese people, may have an anti-proliferative effect.
- Fat cells may also have a direct and indirect effects on other tumour growth regulators, including mammalian target of rapamycin (mTOR) and AMP –activated protein kinase.
- Obese people often have chronic low-level or "subacute" inflammation which has been associated with increased cancer risk.

Breast Cancer

Studies have shown that being overweight and obesity are associated with a modest increase in the risk of postmenopausal breast cancer and in contrast a reduced risk in premenopausal breast cancer.
The relationship between obesity and breast cancer may be affected by the stage of life in which a woman gains weight and becomes obese. Weight gain during adult life, most often from about age 18 to between the ages of 50 and 60, has been consistently associated with the risk of breast cancer after menopause.

The increased risk of postmenopausal breast cancer is due to increased level of estrogen in obese women. Fat tissues become the most important source of estrogen after menopause and as obese women have more fat tissue, their estrogen levels tends to be higher, potentially leading to more rapid growth of estrogen responsive breast tumours.

Endometrial Cancer

Being obese and overweight are consistently associated with endometrial cancer, which is cancer of the lining of the uterus. The relative risk of developing the disease is two to four times more for a woman of normal weight, regardless of menopausal status. Evidence points to a role for diabetes, possibly in combination with low levels of physical activity to increase the risk.

Colorectal Cancer

The distribution of body fat appears to be an important factor, with abdominal obesity showing the strongest association with colon cancer risk. In addition, high levels of insulin or insulin related growth factors in obese people account for association of obesity with colon cancer risk.

Kidney Cancer

Kidney cancer or renal-cell cancer (RCC) have one of the strongest correlations with obesity compared to cancer at any other site. Epidemiologic investigation has demonstrated an association that tends to affect women more than men though both genders are impacted. Men and women at the most extreme ends of obesity tend to have the highest risk. Pathologies commonly found in obese people such as higher estrogen levels, elevated insulin levels, a greater concentration of growth factors in adipose tissue, hypertension, cholesterol metabolism abnormalities, and immune malfunction are just some of the potential mechanisms that may increase kidney cancer risk. Obese individuals may also have lower serum levels of vitamin D and engage in less physical activity.

Esophageal Cancer

Obesity increases the risk of esophageal adenocarcinoma independently of other factors. From a clinical perspective, data suggest that patients with obesity and frequent symptoms of gastro-esophageal reflux are at especially increased risk of adenocarcinoma.
Overweight and Obese people are twice as likely as people of healthy weight to develop cancer.

- Highest risks were seen for BMI 40 kg/m².
- Higher among men than women and among those aged < 50 than those ≥ 50 years.
- Obese people with frequent symptoms of Gastro-oesophageal risk had higher risk than those with no reflux and also those with reflux but who are not obese.

Pancreatic Cancer

Studies have reported an increase in risk of pancreatic cancer among overweight and obese individuals. Waist circumference is an important factor in association of being overweight and obesity with pancreatic cancer.

Thyroid Cancer

Increasing weight has been found to be associated with an increase in the risk of thyroid cancer.

Gall Bladder Cancer

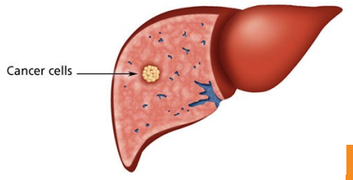
The increase in risk is attributed due to the higher frequency of gall stones, a strong risk factor for gall bladder cancer in obese individuals.

Prostate Cancer

Prostate cancer is the most commonly diagnosed cancer among men and the second leading cause of death from cancer in men in the USA, with approximately 230,000 new diagnoses and 30,000 deaths in 2004 as revealed by the study of American cancer society. Obesity and being overweight were found to have a correlation with prostate cancer.

Liver Cancer

Compared with persons of normal weight, the relative risks of liver cancer were 1.17 for those who were overweight and 1.89 for those who were obese.



Non Alcoholic fatty liver diseases (NAFLD)

Nonalcoholic fatty liver disease (NAFLD) refers to a wide spectrum of liver disease ranging from:

- Fatty liver (accumulation of fat in the Liver, also known as Steatosis),
- Nonalcoholic steatohepatitis (NASH- fat in the liver causing liver inflammation)
- Cirrhosis (irreversible scarring of the liver as a result of chronic inflammation of the liver)

All of the stages of nonalcoholic fatty liver disease are believed to be due to insulin resistance, a condition closely associated with obesity.
BMI correlates with degree of liver damage, i.e. the greater the BMI, the greater is the Liver damage.

Nonalcoholic fatty liver disease is currently the most common liver disease in the US and worldwide, affecting an estimated 10-24% of the world's population. In the US, the centre for disease control reports that currently, approximately one half of the US adult population is overweight (BMI>25) and one quarter of the US adult population is obese (BMI >30).

That means upwards of:

- 29 million Americans have nonalcoholic fatty liver disease
- 6.4 million of these people have nonalcoholic steatohepatitis
- Even more alarming, nonalcoholic fatty liver disease is occurring among children in the US.

Public Health officials and doctors project that obesity related liver diseases (Cryptogenic cirrhosis and Liver cancer) will become the leading cause of liver failure and liver transplantation in the not too distant future.

Losing excess weight is the cornerstone of treatment of nonalcoholic fatty liver disease and a retrospective study finds that among obese individuals with elevated transaminases, weight gain led to a further increase in the level of liver enzymes in contrast a 10% loss of weight led to a significant decrease in the levels of the enzymes, and the enzymes may even become normal.

- Decrease in Enzymes occurred at 8% per 1% loss of body weight.
- Patients undergoing stomach (gastric) reduction operation for morbid obesity, substantial weight loss is accompanied by a marked reduction in transaminases.

Mood and Anxiety Disorders

A study based on data compiled from the National Comorbidity Survey (2006) replication, a nationally representative, face to face household survey revealed that Obesity which is on the rise in the United States , is associated with increasing rates of major depression, bipolar disorders, panic disorder and other disorders.

Results of an NMIH study show that nearly one out of four cases of obesity is associated with mood or anxiety disorder, though the causal relationship and complex integrity between the two is still unclear.

Varicose Veins

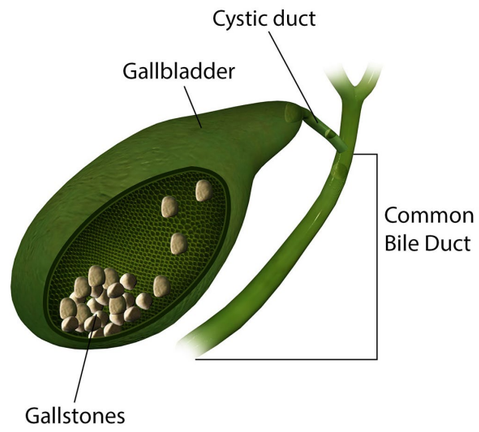
Varicose veins are enlarged, swollen, and tortuous (twisting) veins, frequently linked to faulty valves in the vein. Among the various risk factors, overweight/obese people have a significantly

higher risk of developing the disease with females much more likely to have the disease than men.

Gall Stones

Gall stones are hard particles that develop in the gall bladder. The gallbladder is a small pear-shaped organ located in the upper right abdomen- the area between the chest and hips – below the liver.

- Women are more likely to develop gallstones than men, Extra estrogen can increase cholesterol levels in bile and decrease gallbladder contractions, which cause gall stones to form.
- People over age 40 are more likely to develop gallstones.



Other factors that affect a person's risk of gallstones include:

- Obesity: People who are obese, especially women, have an increased risk of developing gallstones. Obesity increases the amount of cholesterol in bile, which can cause stone formation.
- Rapid Weight loss: As the body breaks down fat during prolonged fasting and rapid weight loss the liver secretes extra cholesterol into bile. Rapid weight loss also prevents the gallbladder from emptying properly. A low calorie diet and bariatric surgery that leads to weight loss can increase the risk of gallstones.
- Diet: Research suggests diets high in calories and refined carbohydrates and low in fibre increase the risk of gallstones which share the same risk factors as that of obesity.
- Metabolic Syndrome, Diabetes and Insulin resistance: These conditions increase the risk of gallstones and metabolic syndrome, increasing the risk of gallstone complications.

Osteoarthritis

Obesity is one of the risk factors for hip or knee osteoarthritis (OA), since mechanical overload on weight bearing joints activates chondrocytes and accelerates cartilage degeneration. Surprisingly, obesity and being overweight also contribute to upper limb osteoarthritis due to a systemic effect involving the pro inflammatory and degenerative role of some adipocytes, secreted by adipose tissue as well as some joint cells.

Urinary incontinence

Various epidemiological studies showed that obesity is a strong independent risk factor for prevalent and incident urinary incontinence. A clear dose-response effect of weight on urinary incontinence with each 5-unit increase in body mass index associated with about a 20-70% increase in the urinary continence risk was observed. The odds of incident urinary incontinence during 5 to 10 years increased by approximately 30- 60% for each 5 unit increase in body mass index. Weight loss studies indicated that surgical and non-surgical weight loss led to significant improvements in urinary incontinence symptoms.

Sleep Disorders

Decreased sleep duration and quality is associated with an increase in body weight and adiposity. Insomnia, obstructive sleep apnea and restless legs syndrome are three of the most prevalent types of sleep disorder that lead to an increased risk for numerous health conditions. Various studies have examined the impact of these sleep disorders on obesity, and are an important link in understanding the relationship between sleep disorders and chronic disease. Physical activity and exercise are important prognostic tools in obesity and chronic disease and numerous studies have explained the relationship between sleep disorders, obesity and exercise.

Treatment

Many physicians now approach obesity as an illness and not a problem of willpower and self-control as done for alcoholism or addictive behaviour. In addition, many view obesity as a chronic illness, like hypertension and diabetes which require lifelong intervention and therapy.

The approach to treatment is multilevel including diet, behaviour modification, exercise, stress reduction and pharmacological therapies to surgery.

- Drugs: sibutramine hydrochloride monohydrate, gastrointestinal lipase inhibitors (orlistat), Type 1 cannabinoid receptor inhibitors (rimonabant)
- Bariatric surgery:
  - Gastric band
  - Digestive diversion: diversion of the digestive tract to compromise absorption

Conclusion

Having reviewed the various obesity related pathologies, this article concludes to take into consideration the abdominal adiposity as a risk factor in addition to BMI-based rating. The article calls attention to the related risk associated with obesity by briefly mentioning the disease and probability of occurrence.

Taking into account the change in buying pattern, demand for Products with Additional riders, Temporary Total Disability, Long Term Care and Loss of Employment, lifestyle changes with regard to diet and exercise and the increased prevalence of Diabetes, Cardiovascular disease and cancer, it is hereby recommended to introduce Abdominal Obesity as a rating criteria in addition to the BMI-based risk assessment.

Classification of Risk & Underwriting requirements

According to the above, we are suggesting the following approach underwriting wise.

BMI:

Classification	BMI (kg/m²) Europe, Middle East, Australia, NZ and Indian Sub-continent	BMI (kg/m²) China, Japan & Far East	Requirements
Normal range	18.50 - 24.99	18.5 - 22.99	
Overweight	25.00 - 29.99	23.0 - 27.50	
Pre-Obese -1	25.00 - 27.49	23.0 - 25.49	A
Overweight	27.50 - 29.99	25.0 - 27.50	A+B
Obese	≥ 30.00	≥ 27.50	
Obese class I	30.00 - 34.99	27.6 - 32.90	A+B+C
Obese class II	35.00 - 39.99	33.0 - 37.49	A+B+C+D
Obese class III	≥ 40.00	≥ 37.50	A+B+C+D+E

Waist to Hip Ratio:

Male	Female	Health Risk	Requirements
0.95 or below	0.80 or below	Low Risk	
0.96 to 1.0	0.81 to 0.85	Moderate Risk	A+B+C
More than 1.0	More than 0.85	High Risk	A+B+C+D

A- Height, Weight, Waist and Hip Circumference Plus Weight questionnaire
B - Blood Pressure Reading
C- Fasting Blood Glucose and Hba1c + Lipid Profile
D- ECG
E- Treadmill Testing (TMT)

Risk Assessment

1. BMI shall be the basis of Risk Classification and Acceptance.
2. In addition to BMI, Waist to Hip Ratio shall form the basis to call for Additional Requirements.
3. Family history of Type 2 diabetes or premature cardiovascular diseases to be assessed more accurately using waist circumference and serum triglyceride details to mitigate metabolic and cardiovascular complications due to obesity.
4. Medical conditions correlated with obesity to be interpolated to assess the risk. Disease specific related requirements need to be called for, e.g.
   a. Overweight + Hypertensive + /or Raised Fasting Blood Sugar (FBS) or Borderline HbA1c – Diabetes Questionnaire.
   b. Obesity in women- Post Menopausal with Breast nodules/hyperplasia – Breast Cancer.
   c. Abdominal adiposity – with Fatty Liver – Liver Function test & Hepatic questionnaire.
5. BMI, waist to hip ratio, blood pressure readings, blood glucose levels, lipid profile, if available should be considered together to determine the correlations for related conditions.
6. Obese applicant who has recently lost weight, needs to be approached cautiously, especially in the elderly where unexplained weight loss is associated with increased mortality risk.

Rating

Postpone if less than 6 months since last episode of surgical intervention.
Decline if:

- BMI > 40 and Waist Hip Ratio Men > 1.00 & Women > 0.90;
- Waist Hip Ratio Men > 1.25 & Women > 1.10 (whatever the BMI ratio).

	Waist / Hip Normal	Waist / Hip Moderate	Waist / Hip High risk
Death by any Cause			
Overweight/ Pre obese -1	Standard	50%	75%
Obese - class 1	25%	75%	100%
Obese - class 2	50%	100%	125%
Obese - class 3	100%	I.C.	Decline
• Controlled High Blood Pressure (HBP) – Add 30% • Smoker (more than 10 cigarettes/day) – Add 30% • Controlled Dyslipidemia – Add 30% • Hyper Cholesterolaemia + Hypertriglyceridemia – Add 50%			
Disability			
Overweight/ Pre obese -1	Standard	75%	75%
Obese - class 1	25%	100%	100%
Obese - class 2	50%	125%	150%
Obese - class 3	100%	I.C.	Decline
Accidental			
If BMI<35	Standard		
If BMI> 35	50%		
Critical Illness			
Overweight/ Pre obese-1	25%	100%	150%
Obese - class 1	75%	150%	175%
Obese - class 2	150%	200%	Decline
Obese - class 3	Decline	Decline	Decline

I.C. = Individual Consideration

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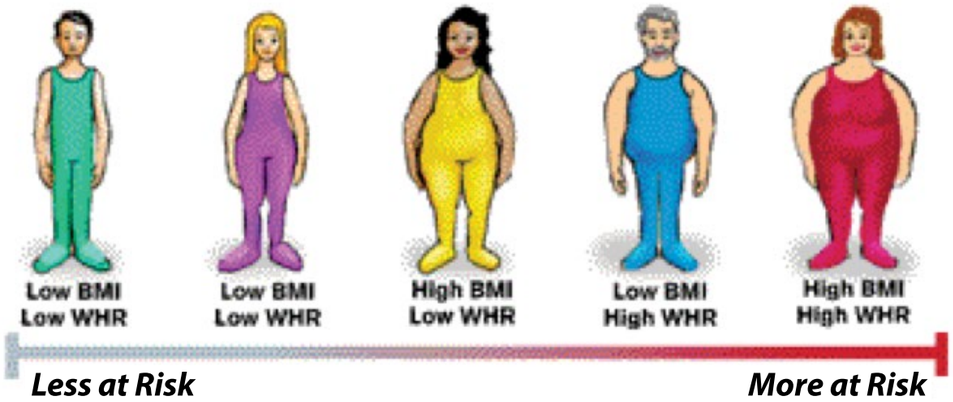

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