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LIFE CONFERENCE 2013
WHY BMI?

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Phil Brown – Chief Underwriting Officer

12 November 2013

Agenda

- UK obesity trends
- Why BMI matters
- Is BMI a perfect measure?
- What's a normal BMI range?
- BMI in combination with other risk factors

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UK Press

Davos 2013: Obesity not a problem for the rich Jorn Madslien, **BBC News**

Obesity expert wants fatty foods tax in Wales Dr Nadim Haboubi, **BBC News**

Obesity in England costs estimated £5.1bn a year Nicola Culley, **COVER**

The fat are getting fatter: Britain's heaviest continue to put on weight despite a drop in the nation's overall obesity rate Victoria Woollaston, **MailOnline**

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UK Press

Girl aged 10 who tips scales at nearly 25 STONE is Britain's most overweight child

Statistics from the NHS also showed one in three children were overweight and up to 20% were obese Shaun Firkser, **MIRROR News**

Obesity epidemic: "No excuse to sit on our hands and do nothing" Nicola Culley, **COVER**

Life insurers to impose 'fat tax' on the obese, costing up to 50 per cent more Becky Barrow, **MailOnline**

'Obesity Killing More People Than Thought' Reported by **skyNEWS**

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Easy to be at risk, harder to reduce the risk

One extra medium latte per day = an extra 1260 calories per week.

If nothing changes you will put on 18lbs in the next year.

To maintain the same weight by burning the extra 1260 calories in a week

and assuming you are 155lbs in weight you will need to do the following:

• 2 hours extra running each week (at 6 mph), or

• 3 hours extra cycling each week (at 10 mph), or

• 5.5 hours extra walking each week (at 3 mph)

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Contributory factors

• Calories

• Lifestyle choices

• Lack of physical activity

• Genetics

• Medical reasons

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UK perspective

- Trends project 11 million more obese adults in the UK by 2030
- Overweight and obese cost NHS > £5 billion every year
- Higher risk of type 2 diabetes, heart disease and certain cancers
- 2011 survey for England showed that 62% of adults were overweight or obese (58% of women and 65% of men)
- Scotland has one of the worst obesity records in the developed world, and one of the highest rates of all OECD and European countries, in 2010, 65% of adults (16+) were overweight or obese

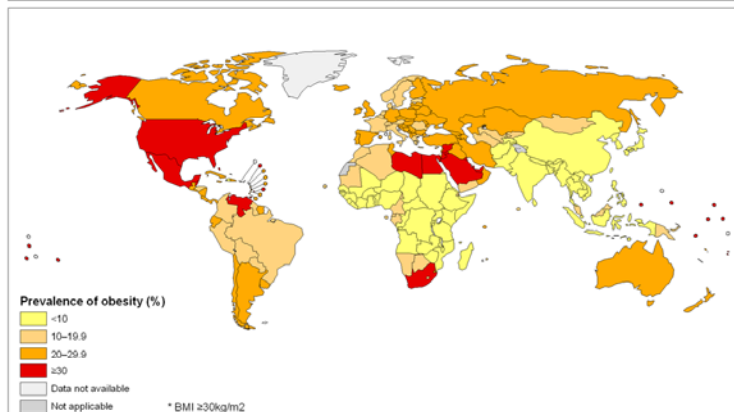Institute and Faculty of Actuaries

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Trends in adult prevalence of obesity in the UK
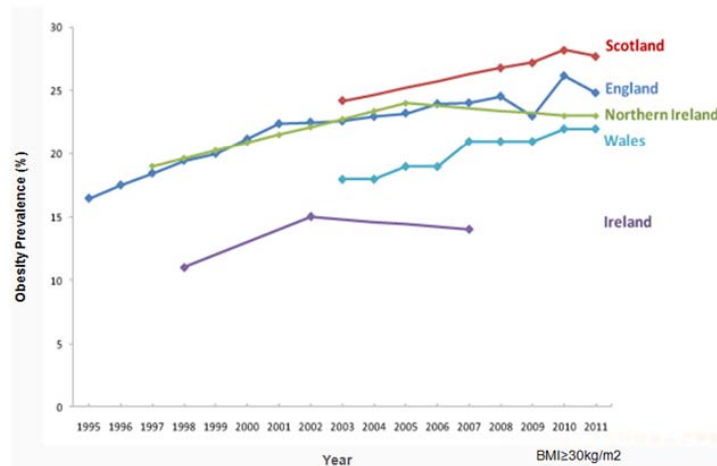
Source: Public Health England, 2013
http://www.noo.org.uk/NOO_about_obesity/adult_obesity/UK_prevalence_and_trends
Scottish Health Survey, 2010
Health Survey for England, 2010
Health and social well being survey & Health Survey for Northern Ireland, 2010 Welsh Health Survey, 2010
Survey of Lifestyles, Attitudes and Nutrition (SLAN), 2007

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Obesity map of the world

Prevalence of obesity*, ages 20+, age standardized
Both sexes, 2008

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Prevalence of obesity in adults (aged 16+)

1993-1995

Males
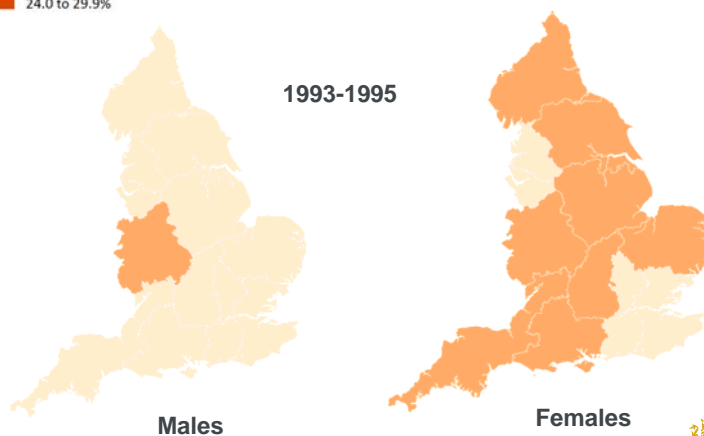
Females

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Prevalence of obesity in adults (aged 16+)

Source: Health Survey for England

- Under 16%
- 16.0 to 19.9%
- 20.0 to 23.9%
- 24.0 to 29.9%

2008-2010

Males

Females

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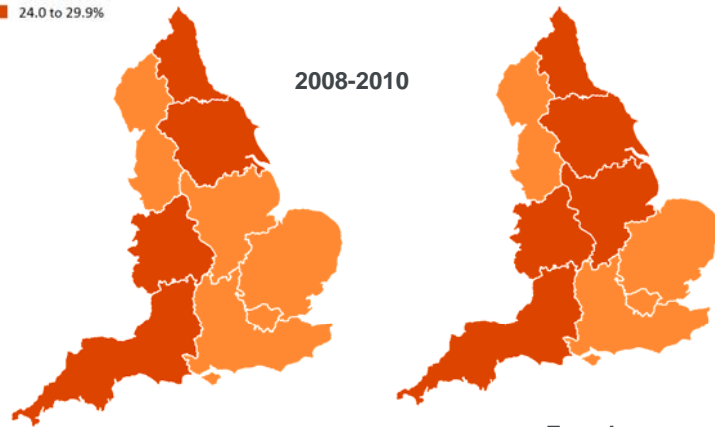
Adult obesity: BMI ≥ 30kg/m²   © Crown copyright and database rights 2012 Ordinance Survey

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How is BMI defined?

Example
- Male 174cm , 100kg

BMI = **Weight (kg) / Height(m²)**

= 100kg / 1.74m × 1.74m

= 100kg / 3.02 m²

= 33.11 kg/m² ~ 33 kg/m²

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Adult prevalence by BMI status
Health Survey for England 2009-2011

Underweight
1.6%

Obese
24.0%

Healthy weight
32.2%

Men

Overweight
42.2%

Underweight
2.2%

Obese
25.3%

Healthy weight
40.2%

Women
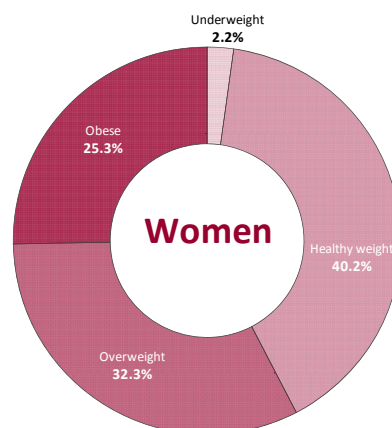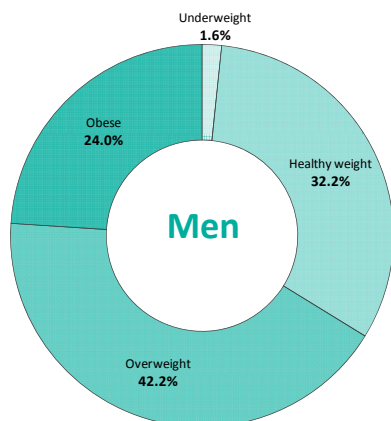
Overweight
32.3%

Adult (aged 16+) BMI thresholds:
Underweight: <18.5kg/m^2 Overweight: 25 to <30kg/m^2
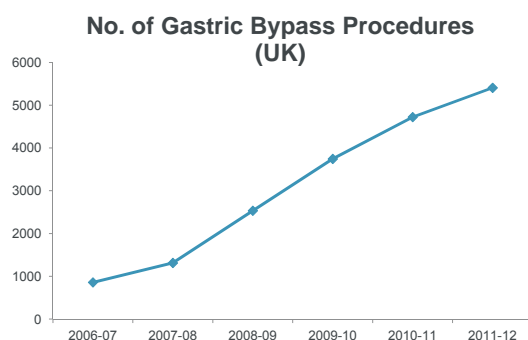Healthy weight: 18.5 to <25kg/m^2 Obese: ≥30kg/m^2

Source: Public Health England, Obesity Knowledge and Intelligence, April 2013:
http://www.noo.org.uk/slide_sets

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Trends – gastric bypass surgery

Gastric bypass surgery 'up 530% in 6 years' reportedly costing
NHS £85 million a year.

No. of Gastric Bypass Procedures (UK)

6000
5000
4000
3000
2000
1000
0

2006-07   2007-08   2008-09   2009-10   2010-11   2011-12

How much does surgery cost privately?

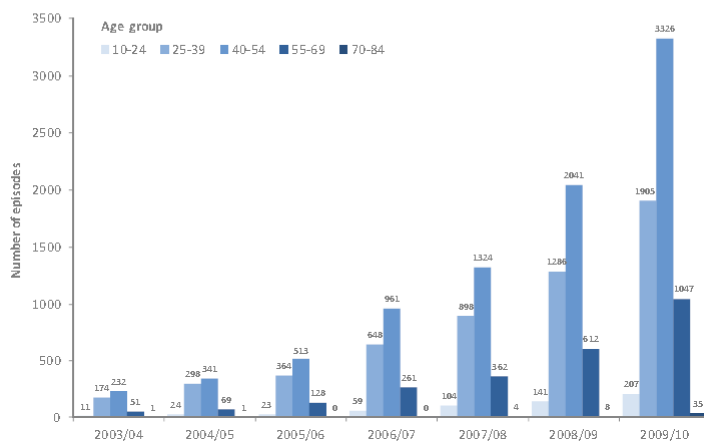• **£5,000-8,000 for gastric banding**

• **£9,500-15,000 for gastric bypass surgery**

Source: Adapted from Health and Social Care Information Centre's
publication of Hospital Episode Statistics (HES), NHS

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Number of hospital episodes for bariatric surgery in England by age group, 2003/04 to 2009/10

Source: National Obesity Observatory & NHS - Bariatric surgery for obesity , August 2010:
http://www.noo.org.uk/uploads/doc/vid_8774_NOO%20Bariatric%20Surgery%20for%20Obesity
%20FINAL%20MG%20011210.pdf

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Youngest person to have gastric bypass surgery – only two years old!

Morbidly obese two-year-old from Saudi Arabia youngest person to have gastric bypass surgery

The child had a Body Mass Index of 41 had continued to gain weight despite efforts to control his diet   Rob Williams, **The INDEPENDENT**

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Obesity and insurance

Height and weight

- Simple measure
- Objective
- Everyone understands it

Challenge?

Weight

Height

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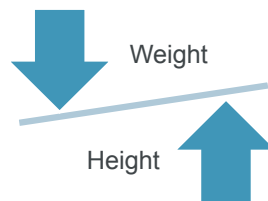
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Obesity and insurance

The couch potato
He is 1.83 meters tall (6 feet tall), never does any exercise, and weighs 92 kilograms (203 lbs).
His BMI is 27

The athlete
He is an Olympic champion 100-meter sprinter, 1.83 meters tall (6 feet tall), does an incredible amount of exercise, and weighs 96 kilograms (211 lbs)
His BMI is 28

BMI does not calculate how much fat or lean tissue (muscle) your body carries

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Obesity and insurance

- **How can the challenge be addressed?**
- Collar size
- Dress size
- Waist measurement
- Lifestyle indicators / gym attendance

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Obesity and insurance

Mortality risks - Association between BMI and risk of death
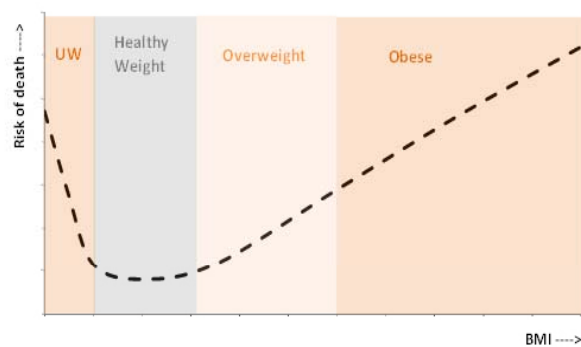
Source: Public Health England, 2013 : http://www.noo.org.uk/NOO_about_obesity/mortality
Pischon T, Boeing H, Hoffmann K, Bergmann M, Schulze MB, Overvad K, et al. General and abdominal adiposity and risk of
death in Europe. New England Journal of Medicine 2008;359: 2105-20
Berrington de Gonzalez A, Hartge P, Cerhan JR et al. Body-Mass Index and Mortality among 1.46 Million White Adults. New
England Journal of Medicine 2010;363:2211-9

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Obesity and insurance

- Adverse affect on employment (increased sickness absence)
- Loss of productivity (both through increased sickness absence and as a result of premature death)
- Can affect mental wellbeing

A Scottish government publication estimates that approximately 4% of incapacity benefit claims result directly from the consequences of Obesity[1]

[1]Source: Preventing Overweight and Obesity in Scotland – A Route Map Towards healthy Weight: Published by The Scottish Government in 2010

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Classification of BMI

Classification	BMI(kg/m^2)	
	Principal cut-off points	**Additional cut-off points**
Underweight	<18.50	<18.50
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	18.50 - 24.99	18.50 - 22.99
		23.00 - 24.99
Overweight	≥25.00	≥25.00
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	≥30.00	≥30.00
Obese class I	30.00 - 34.99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

Source: Adapted from WHO, 1995, WHO, 2000 and WHO 2004.

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The obesity paradox
Hazard Ratios (HRs) of All-Cause Mortality for Overweight and Obesity Relative to Normal Weight

BMI determined by measured height and weight

	No. of HRs	Summary HR (95% CI)	I^2, %
BMI of 25-<30			
All ages	89	0.93 (0.89-0.95)[a]	75.8
Mixed ages	67	0.93 (0.89-0.96)[a]	79.6
Age ≥65 y only	22	0.90 (0.84-0.95)	31.2
BMI of ≥30			
All ages	56	1.13 (1.06-1.19)[a]	73.4
Mixed ages	41	1.16 (1.10-1.24)[a]	74.6
Age ≥65 y only	15	0.98 (0.86-1.12)[a]	61.1
BMI of 30-<35			
All ages	30	0.94 (0.86-1.03)[a]	80.5
Mixed ages	24	0.95 (0.86-1.06)[a]	83.2
Age ≥65 y only	6	0.89 (0.71-1.11)	56.2
BMI of ≥35			
All ages	30	1.25 (1.13-1.39)[a]	65.4
Mixed ages	24	1.28 (1.14-1.44)[a]	68.9
Age ≥65 only	6	1.10 (0.89-1.34)	25.1

Conclusion:

Grade 1 obesity overall <u>was not associated</u> with higher mortality, and overweight was associated with significantly lower all-cause mortality

From: Flegal K et al: Association of All-Cause Mortality With Overweight and Obesity Using Standard Body Mass Index Categories, JAMA, January 2, 2013—Vol 309, No. 1

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The obesity paradox
Can the results be transferred to the insurance setting?

Flegal K et al: Association of All-Cause Mortality With Overweight and Obesity Using Standard Body Mass Index Categories, JAMA, January 2, 2013—Vol 309, No. 1

1. Study does not analyse by cause of death

2. Provides results only based on all age groups, confounding the mortality of younger age groups

3. Normal build range of 18.5 – 25 includes increased mortality rates for the low BMIs

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Association of BMI with mortality
Studies better reflecting the insurance setting

**Estimated Hazard Ratios for Death from Any Cause According to Body-Mass Index for All Study Participants and for Healthy Subjects Who Never Smoked**
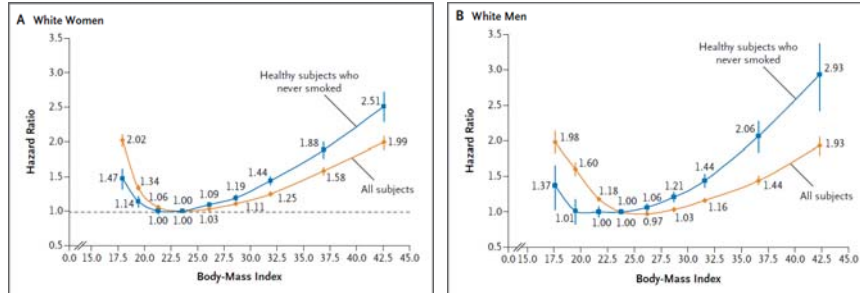
From: Gonzalez et al: Body-Mass Index and Mortality among 1.46 Million White Adults, N Engl J Med 2010;363:2211-9

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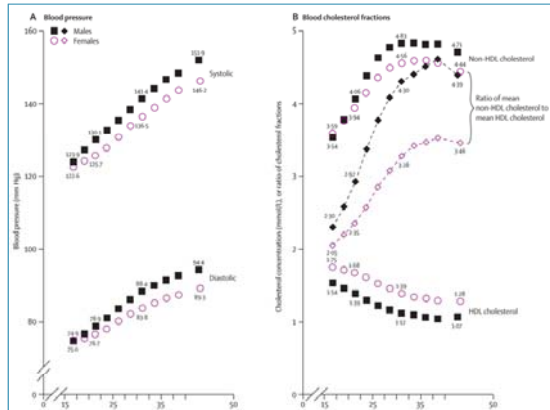and Faculty
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Metabolic Risk Factors
Obesity is the starting point

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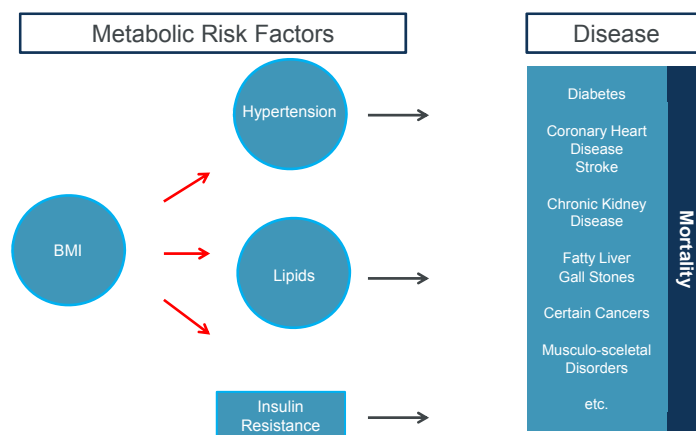
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Relationship between BMI and Cholesterol and Lipids

Increasing BMI correlates with
- increasing blood pressure
- increasing dyslipidaemia

From: Body-mass index and cause-specific mortality in 900 000 adults: collaborative analyses of 57 prospective studies, Lancet. 2009; 373(9669): 1083–1096

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Risk Overlap – the problem of multivariance

Loadings

450%

350%

200%

200%
Hypertension

150%
BMI

100%
Cholesterol

100%

150%

Extra mortality = 0

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Metabolic Risk Factors
Obesity is the starting point

Metabolic Risk Factors

Disease

Hypertension

BMI

Lipids

Diabetes
Coronary Heart Disease Stroke
Chronic Kidney Disease
Fatty Liver Gall Stones
Certain Cancers
Musculo-sceletal Disorders
etc.

Mortality

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Metabolic Risk Factors
Obesity is the starting point

Metabolic Risk Factors

Disease

Hypertension
BMI
Lipids

Diabetes
Coronary Heart Disease Stroke
Chronic Kidney Disease
Fatty Liver Gall Stones
Certain Cancers
Musculo-sceletal Disorders
etc.

Mortality

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01/11/2013

Is there anything else than BMI?
"Metabolic health" delivers important information

	Cases/n	Age- and sex-adjusted HR (95% CI)	Fully adjusted HR (95% CI)[a]
Whole sample			
Metabolically healthy nonobese	777/12716	1.00 (referent)	1.00
Metabolically unhealthy nonobese	656/4201	1.56 (1.40–1.73)	1.59 (1.42–1.77)
Metabolically healthy obese	38/1160	0.60 (0.43–0.83)	0.91 (0.64–1.29)
Metabolically unhealthy obese	397/4128	1.25 (1.11–1.41)	1.79 (1.47–2.17)
P trend		<0.001	<0.001
Men			
Metabolically healthy nonobese	417/5771	1.00 (referent)	1.00
Metabolically unhealthy nonobese	334/1983	1.46 (1.26–1.69)	1.46 (1.25–1.69)
Metabolically healthy obese	23/610	0.69 (0.45–1.05)	1.09 (0.68–1.75)
Metabolically unhealthy obese	203/1669	1.41 (1.20–1.67)	2.09 (1.60–2.73)
P trend		<0.001	<0.001
Women			
Metabolically healthy nonobese	360/6945	1.00 (referent)	1.00
Metabolically unhealthy nonobese	322/2218	1.69 (1.45–1.97)	1.71 (1.45–2.01)
Metabolically healthy obese	15/550	0.51 (0.30–0.86)	0.73 (0.42–1.27)
Metabolically unhealthy obese	194/2459	1.12 (0.94–1.33)	1.56 (1.17–2.08)
P trend		<0.001	<0.001

Sample contains participants without a history of CVD at baseline (n = 22,203).

[a] Contains adjustment for age, sex, smoking, physical activity, socioeconomic group, and BMI.

Department of Epidemiology and Public Health, University College London, United Kingdom

From: Hamer and Stamatakis: Metabolically Healthy Obesity and Risk of All-Cause and Cardiovascular Disease Mortality
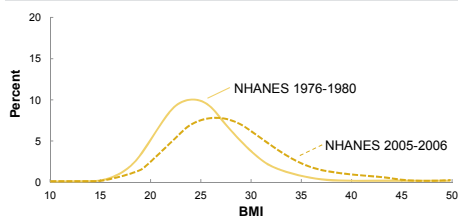J Clin Endocrinol Metab, July 2012, 97(7):2482–2488
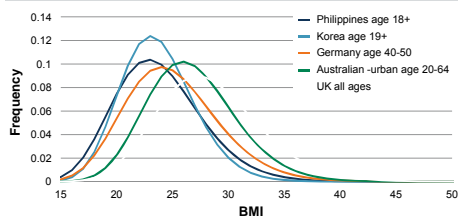
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How has the obesity epidemic manifested in your country?

BMI distribution over time

NHANES 1976-1980

NHANES 2005-2006

BMI distribution by country

Philippines age 18+
Korea age 19+
Germany age 40-50
Australian -urban age 20-64
UK all ages

- Shape of distribution curve
  - Symmetrical?
  - Log-normal?
- Changes over time
- Average BMI ↑ → increased spread in the population *Fahad Razak et al. PLoS Med 10(1):e1001367*
- Average BMI ↑ → increasing degree of skewing *Penman AD et al. Prev Chronic Dis Vol. 3; Juliy 2006*

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How to solve the problem of multivariance and different BMI distributions?

▶ Analysis of data from insured lives, big enough to deliver significant results of risk factor interaction

▶ The underwriters should talk to actuaries regarding BMI distribution

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Analysis of pooled insurance data
Advantage: Huge numbers including extreme values

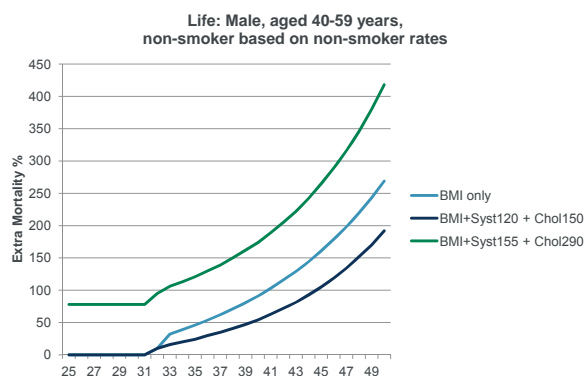| N (number of insured people)	5,325,006
Follow-up	10 years
Number of deaths	61.386
Men : Women	57.2 : 42.8
Examples of extreme values	
Age > 60	612,437 (11%)
BMI over 40 kg/m^2	38,085 (2%)
Chol. over 300 mg/dl	61,022 (1%)
RR (sys) over 180 mmHg	3,332 (0%)

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Overlap
Calculation of BMI mortality and mortality of BMI with normal and abnormal blood pressure and cholesterol
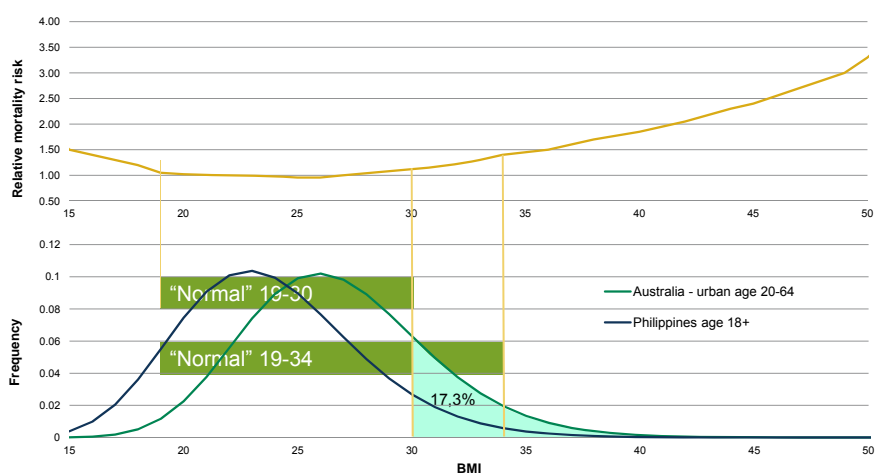
The Munich Re metabolic risk calculator

Life: Male, aged 40-59 years, non-smoker based on non-smoker rates

- BMI only
- BMI+Syst120 + Chol150
- BMI+Syst155 + Chol290

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BMI – Mortality Risk
Impact of normal range

BMI mortality - age 40-59

"Normal" 19-30

"Normal" 19-34

17.3%

- Australia - urban age 20-64
- Philippines age 18+

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BMI – Mortality Risk
Impact of normal range

BMI mortality - age 40-59

Price
100.0%
"Normal" 19-30

100.8%
"Normal" 19-34

Australia - urban age 20-64
Philippines age 18+

1.5%
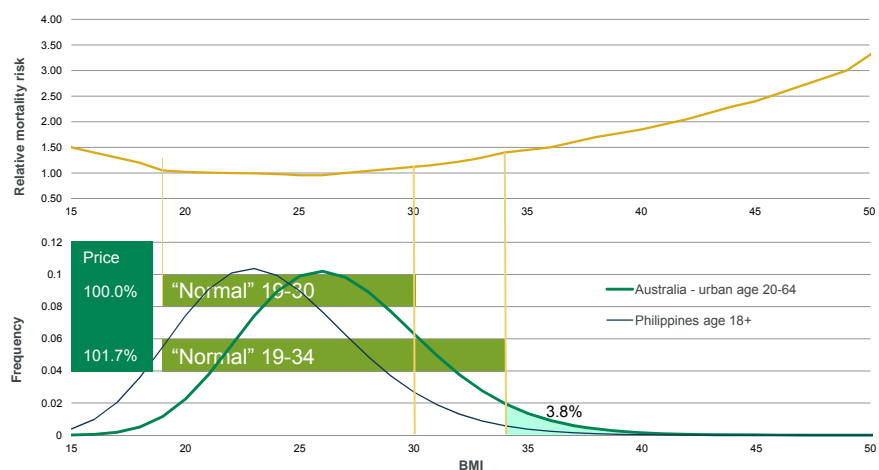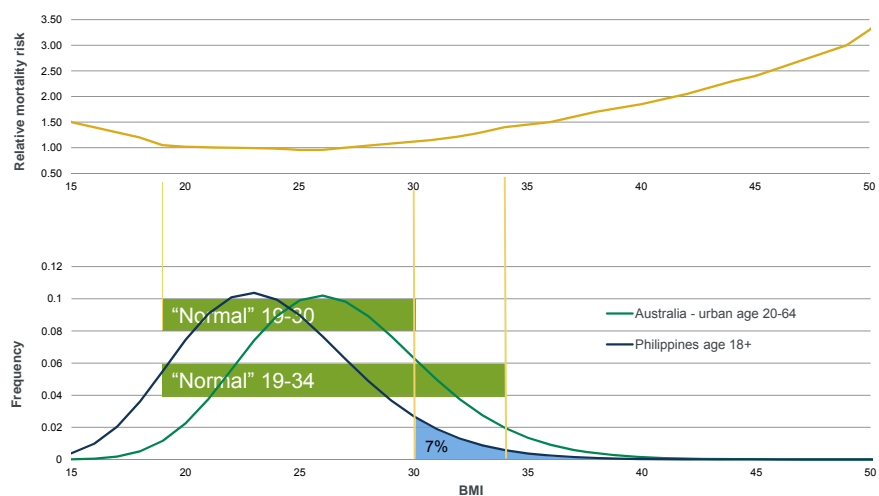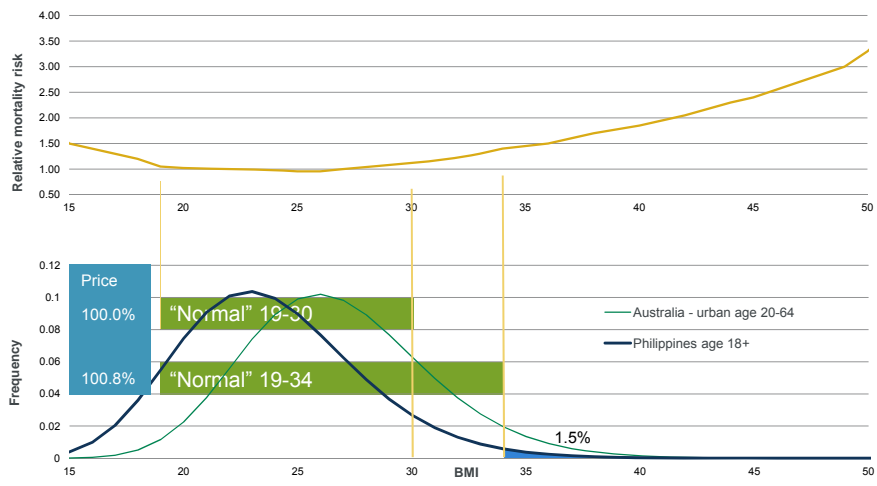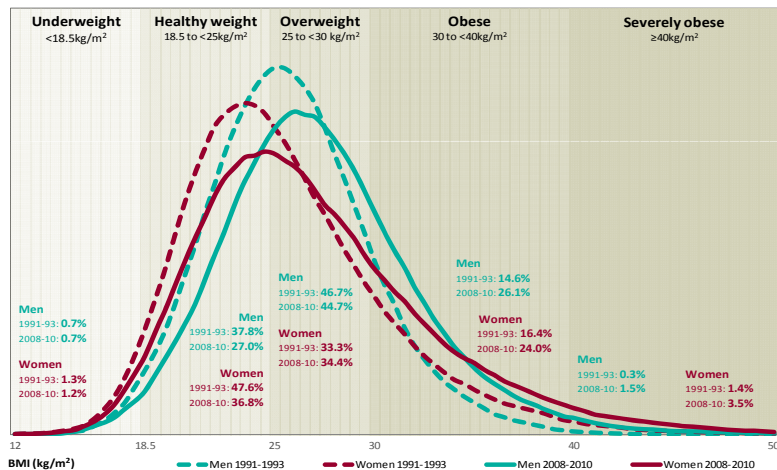
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Change in the adult BMI distribution
Health Survey for England 1991-1993 and 2008-2010

| Underweight <18.5kg/m² | Healthy weight 18.5 to <25kg/m² | Overweight 25 to <30 kg/m² | Obese 30 to <40kg/m² | Severely obese ≥40kg/m² |

Men
1991-93: **0.7%**
2008-10: **0.7%**

Women
1991-93: **1.3%**
2008-10: **1.2%**

Men
1991-93: **37.8%**
2008-10: **27.0%**

Women
1991-93: **47.6%**
2008-10: **36.8%**

Men
1991-93: **46.7%**
2008-10: **44.7%**

Women
1991-93: **33.3%**
2008-10: **34.4%**

Men
1991-93: **14.6%**
2008-10: **26.1%**

Women
1991-93: **16.4%**
2008-10: **24.0%**

Men
1991-93: **0.3%**
2008-10: **1.5%**

Women
1991-93: **1.4%**
2008-10: **3.5%**

BMI (kg/m²)

Men 1991-1993   Women 1991-1993   Men 2008-2010   Women 2008-2010

Adults aged 18+ years (population weighted)

Source: Public Health England, Obesity Knowledge and Intelligence, April 2013:
http://www.noo.org.uk/slide_sets

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Summary

1	BMI trends increase the need for an individualized risk assessment approach (market dependent)
2	There is no ideal BMI cut-off, as it depends on the distribution in your population to be insured
3	Determining normal range requires integrated approach (Medical-Actuarial)
4	MRC offers you local opportunities to adapt your distribution and standard ranges to market needs

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