Symonds' article1 presents a table of standard weights for height for men that were derived from 1897 life insurance data from the USA and Canada. As has been the case with other life insurance height–weight tables,2–8 it is not completely clear how Symonds' table was derived and exactly what his standards represent. As noted by Rothstein,9 the goals of life insurance companies tend to be somewhat different to those of health researchers and include finding accurately and inexpensively measured factors with good predictive values rather than looking for causal factors. Characteristics such as sex, age, occupation and possibly even body weight, may be good predictors without being in themselves causes of mortality. For purposes of assessing causality in health research, life insurance...
data tend to have many limitations, including that they represent policies, not individuals (one individual may have more than one policy), that the data on weight and height are collected unsystematically, show some digit preference and may be self-reported rather than measured, and that the sample is highly selected.

As was detailed by Kemsley et al. for the UK, the construction and use of appropriate height–weight standard tables for a given population is a challenging undertaking. Numerous height–weight tables, such as the one presented by Symonds, have been developed over the past century and more. Such tables have now, however, largely fallen out of favour and been replaced by body mass index (BMI), calculated as weight in kilograms divided by height in metres squared. Although BMI, also known as Quetelet index, was developed in the 19th century, its wide use today in epidemiological and medical contexts, along with standardized cut-off values, is a relatively recent development. Investigators in the 1960s and 1970s discussed and compared a number of different functions of weight and height, including several different indices, not only Quetelet index. The units of measure were not standardized, with calculations sometimes done in kilograms and metres, sometimes in kilograms and centimetres, and sometimes even in pounds and inches. In the past, European epidemiological studies often used the Broca normal weight [normal weight (kg) = height (cm) – 100]. Functions of weight and height such as Quetelet’s BMI, Sheldon’s ponderal index (height divided by the cube root of weight) or the Broca normal weight have the advantage that they can be calculated without reference to a standard table. However, by themselves they do not solve the problem of defining cut-off values to be used to identify overweight.

Symonds defines overweight as a body weight ≥20% above his height- and age-specific weight standard, following the previous recommendation by Shepherd. The practice of using 20% above some standard weight as the definition of overweight persisted. In the USA, a common definition was 120% of the Metropolitan Life 1959 tables 'ideal weight', which was considered overweight. This equivalence was used to select BMI cut-off points of 27.8 for men and 27.3 for women to define overweight. These 1985 conference definitions were widely used in the USA for well over a decade.

On the international front, a World Health Organization (WHO) expert committee in 1995 used BMI to define three grades of overweight: grade 1 (BMI 25–29), grade 2 (BMI 30–39), grade 3 (BMI ≥40). These cut-off points were similar to those that had been previously suggested by Garrow and Bray. According to the committee, The method used to establish BMI cut-off points has been largely arbitrary. In essence it has been based upon visual inspection of the relationship between BMI and mortality: the cut-off of 30 is based on the point of flexion of the curve. This approach divorced the cut-off values for overweight from a population-specific height–weight table. A subsequent WHO consultation in 1997 used a similar approach but changed the nomenclature to define overweight as BMI ≥25, with subdivisions into preobese (BMI 25–29.99), obese grade 1 (BMI 30–34.99), obese grade 2 (BMI 35–39.99) and obese grade 3 (BMI ≥40). In the USA, a National Heart Lung and Blood Institute (NHLBI) expert committee in 1998, basing its terminology on an earlier draft of the 1997 WHO consultation, defined overweight as a BMI of 25 to <30 and obesity as a BMI of ≥30, but added the note that obese people should also be considered overweight. With these various developments, definitions of overweight and obesity used today have become relatively standard internationally and generally use BMI calculated from kilograms and metres with fixed cut-off values divisible by 5. A minor difference persists in that the NHLBI recommendations define overweight as a BMI of 25 to <30 and WHO defines overweight as a BMI of ≥25.

Symonds uses the term ‘overweight’ to describe weight over a standard and does not use the term ‘obesity’ for this purpose. More recently, the term ‘obesity’, suggesting excess body fat and not simply excess weight, has been increasingly used to describe weight over a standard. This use of the term obesity to refer to a weight standard was included in the 1997 WHO and the 1998 NHLBI recommendations; previous definitions, such as those put forth by the WHO expert committee in 1995, had some tendency to favour the term ‘overweight,’ preserving a distinction between weight-for-height (as measured by BMI or other forms of weight–height indices) on the one hand and adiposity as a measure of body fatness on the other. Even though BMI does not measure body fat directly and the degree of body fat at a given BMI level varies by age, sex and race, a given level of BMI is defined as ‘obesity’. This has led to the situation in which we have a standard definition of obesity in terms of BMI, which is not really a measure of body fat, but no standard definition of obesity in terms of
body fat, at least not according to the 1995 WHO expert committee report, which says ‘There is no agreement about cut-off points for the percentage of body fat that constitutes obesity’ (p. 420). Partly as a result, this usage has led to a number of discussions and analyses about whether BMI is a good measure of obesity. In addition, the variation in body fatness at the same BMI level has led to discussions about using different values of BMI to define overweight or obesity for different populations, thereby potentially losing some of the advantages of having standardized definitions.

The table shown in Symonds’ article can be converted to BMI units. Assuming that the weights in Symonds’ table should be reduced by 10 pounds to adjust for clothing weights and the heights should be reduced by 1 inch to adjust for shoe heights, it can be seen that the standard weights-for-height presented by Symonds range from a BMI slightly above 23 to a BMI slightly above 25. These century-old standards derived from affluent healthy white men in safe occupations are close to the dividing line of a BMI of 25 used today to differentiate overweight from normal weight. Symonds’ definition of overweight as 120% of the standard implies a definition of overweight after age 40 as a BMI ranging from 28 to slightly above 30 and thus usually slightly below the dividing line of a BMI of 30 used to differentiate obesity from overweight.

Symonds’ definition of overweight, translated into BMI units after adjustment for clothing and shoes, is shown in Figure 1 by height (in inches) and age. A fixed BMI standard that does not vary with height imposes some constraints on the weight–height relation. Symonds’ table allows for more variability in the weight standards by height than a fixed standard BMI value would allow. As can be seen, the definition in BMI units for a given age is not constant across height, with a variation in the weight standards that is not captured by a fixed BMI value. In Symonds’ table the definition of overweight is a slightly higher BMI value at both short and tall heights than at intermediate heights. As can also be seen, the definition in BMI units for a given height increases fairly steadily with age. For a height of 5 feet and 10 inches or ~178 cm, Symonds’ definition of overweight ranges from a BMI just above 25, for ages 15–24 years, up to a BMI of 29.1 for ages ≥60 years.

Estimates of the prevalence of overweight in the USA for adult men ages 20 through 69 years based on the NHANES data from 1999 to 2008 are shown in Figure 2. One limitation of Symonds’ table is that it only applies to the height range from 59 to 74 inches (~150–188 cm) after adjustment for shoe heights. Of the 9289 men in the age range 20–69 years with measured heights and weights, >3% (n = 307) were too tall to have a standard weight in Symonds’ table, while only two were too short. The use of BMI rather than a height–weight table allows for calculation of BMI values for men of any height. In order to make the estimates comparable across all definitions, men beyond the height range of Symonds’ table were excluded from all analyses.

These estimates use various past and present definitions of overweight: that of Symonds as 120% of the standard age- and height-specific weights in the table (after appropriate adjustments for clothing and shoes); the definition as 120% of Broca normal weight [height (cm) – 100]; the definition for men recommended by the 1985 NIH consensus conference as a BMI of ≥27.8; and the current WHO definition of overweight as a BMI of ≥25. The figure also includes the prevalence for the current WHO definition of obesity as a BMI of ≥30. For estimates using Symonds’ definition, the NHANES values were converted to inches and pounds and rounded to the

![Figure 1 BMI cut-off values for overweight based on Symonds, by age group and height in inches (1 inch = 2.54 cm)](https://academic.oup.com/ije/article-abstract/39/4/963/796932/0)
nearest inch and nearest pound. For other calculations, the measured values in kilograms and centi-metres were used. BMI was rounded to one decimal place.

Symonds’ definition of overweight (20% over standard weight), unlike the other definitions, produces prevalence estimates that are almost constant over age groups. Other definitions show increasing prevalence at older ages. Symonds’ 20% definition is slightly higher than the European definition based on 120% of Broca normal weight at younger ages but converges to almost the same prevalence by ages 60–69 years. Relative to the 1985 NIH consensus committee’s definition of a BMI of 27.8, Symonds’ 20% definition is very similar in the youngest age group (20–39 years) but lower at older ages. The currently used WHO definition of overweight, as a BMI of ≥25, gives prevalence estimates that are 20 to almost 40 percentage points higher than Symonds’ definition and at older ages are almost twice as high as those using Symonds’ definition. The difference between a BMI cut-point of 27.8, as recommended by the 1985 NIH conference, and a BMI cut-point of 25, used by WHO and NHLBI, is ~8 kg at a height of 170 cm. Because a high proportion of the male population falls into the BMI range between 25 and 27.8, this weight difference translates into a difference in age-adjusted prevalence of over 20 percentage points. Symonds’ 20% overweight definition gives higher prevalences than the WHO definition of obesity, with the difference diminishing over age groups.

Symonds’ article with data from over a century ago touches on many themes still of interest today—the mortality (‘vitality’) risks associated with different weight categories, variation in weight standards by age and national origin, possibilities of selection bias and the exclusion of unhealthy participants. A prominent feature of Symonds’ table is that it allows for increases in weight with age. This has been the subject of some controversy. In the USA, the 1990 Dietary Guidelines allowed for an increase in BMI standards by age 35, but the 1995 and subsequent Dietary Guidelines used fixed values by age. The topic of whether the NHLBI standards are appropriate for older persons has been raised by several investigators. These and other issues regarding appropriate weight standards may well continue to be debated in the century to come.

Disclaimer: The findings and conclusions in this report are those of the author and not necessarily those of the agency.

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References