The skinny on BMI and mortality

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Clinical question

How are body mass index (BMI) and mortality associated?

Bottom line

Normal (20-25 kg/m²) to overweight (25-30 kg/m²) BMI carries the lowest risk of mortality (lowest around 25 kg/m² [27.5 kg/m² in the elderly]). Mortality increases below 20 and above 30 kg/m² (more at the extremes).

Evidence

Various systematic reviews of observational studies in the general population evaluate all-cause mortality and BMI.[1-10]

- The review with the most studies[1] (97 studies, 2.88 million participants) found the following relative risks (RRs) compared with normal BMI (18.5-24.9 kg/m²):
  -overweight (25.0-29.9 kg/m²), RR=0.94;
  -obese, grade I (30.0-35.0 kg/m²), RR=0.95; and
  -obese, grade II or higher (BMI >35 kg/m²), RR=1.29.
- The review with the most participants[2] (8 studies, 5.8 million participants) found these hazard ratios (HRs) for men compared with high-normal BMI (22.5-24.9 kg/m²):
  -low BMI (<18.5 kg/m²), HR=1.88;
  -low-normal BMI (18.5-19.9 kg/m²), HR=1.39;
  -mid-normal BMI (20.0-22.4 kg/m²), HR=1.15;
  -low overweight (25.0-27.4 kg/m²), HR=0.97;
  -high overweight (27.5-29.9 kg/m²), HR=1.04; and
  -obese, grade I (30.0-35.0 kg/m²), HR=1.18.
- The third largest study[3] (19 studies, 1.46 million participants) found the following HRs for women compared with high-normal BMI (22.5-24.9 kg/m²):
  -BMI below 18.5 kg/m², HR=1.25;
  -BMI 20.0 to 27.4 kg/m², very similar risk throughout range (HR=1.03-1.05); and
  -above 27.5 kg/m², mortality increases with BMI (27.5-30.0 kg/m², HR=1.14; 40.0-50.0 kg/m², HR=2.13).
- Other studies had similar findings.[4-6] Meta-analyses had similar findings for those with diabetes. For the elderly (≥65 years),[1,8] being overweight lowered risk (best at 27.5 kg/m²).[8] For those with pre-existing cardiovascular disease,[9,10] chronic obstructive pulmonary disease,[11] or hemodialysis,[12] overweight and grade I obesity conferred similar risk[9] or reduced risk[10-12] relative to normal BMI.

Context

- Confidence intervals not presented above: trends of risk are more informative. Highest risk occurs at extremes of BMI, with lowest risk around 25 kg/m² (27.5 kg/m² in the elderly). Minimal differences in HRs and RRs around 1 (eg, 0.9-1.1) are likely of little clinical importance.
- Observational studies cannot prove causation.
- The BMI indicates weight for height: weight (in kg) divided by height (in m²); BMI does not indicate fitness level.[13]
- Guidelines recommend BMI to assess obesity and need for intervention in those who are overweight or obese.[14,15]

Implementation

While BMI can be useful in population studies, application to individuals might not be ideal.[16] The Edmonton Obesity Staging System,[16] adopted by the World Obesity Federation, has been validated in large cohorts and predicts mortality better than BMI.[17] It offers a useful approach to identifying those who might benefit from more clinical attention.[18] New resources to help clinicians are available from the Canadian Obesity Network (**www.obesitynetwork.ca**).

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