Rose revisited: a "middle road" prevention strategy to reduce noncommunicable chronic disease risk

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In light of worldwide concern about the obesity crisis and prevention of noncommunicable chronic disease, it is timely to revisit the principles advocated by Geoffrey Rose.[1] The essential tenet of his work is that while strategies that focus on high-risk individuals (for example, weight-loss clinics for obese people) may help these people reduce their risk of chronic disease, the impact on the total burden of disease at the population level may be disappointing. This is because numerous cases of risk-factor-related health problems may arise among the many people who are in the middle of the risk distribution. In contrast, by lowering the risk across the whole population, the numbers of attributable cases of disease are significantly reduced.[1]

Although this principle is well documented for conditions like hypertension, which have a relatively direct or linear relationship with risk factors such as body mass index (BMI), it is unclear for conditions like diabetes, where incidence rises sharply among people who are in the overweight and obese categories of BMI. To explore this issue, we used data from eight years' follow-up of middle-aged women in the Australian Longitudinal Study on Women's Health[2] to estimate the reductions in incidence of hypertension and diabetes that would result if the BMI distribution were shifted to the left in various ways.

The Australian Longitudinal Study of Women's Health

Participants were randomly selected from the national Medicare health insurance database (which includes all permanent residents of Australia regardless of age, including immigrants and refugees) with intentional over-representation of women living in rural and remote areas. Further details of the recruitment methods and response rates have been described elsewhere.[2] The study collects self-reported data using mailed surveys at 2- to 3-year intervals from about 40 000 women living in all Australian states and territories. The surveys include questions about: health conditions, symptoms and diagnoses; use of health services; health-related quality of life, including measures of physical and mental health; social circumstances, including work and time use; demographic factors; and health behaviours. Informed consent was obtained from all participants in 1996, with ethical clearance by the University of Newcastle, Australia. This paper includes data from 13 716 women in who were aged 45–50 at the time of the first survey in 1996.

The women were asked to report their height and weight at each survey. BMI was calculated as reported weight (kilograms) divided by the square of reported height (metres).[2] At each survey women were asked if they had been told by a doctor that they had any of a list of conditions, including hypertension and diabetes. At survey 1 (1996) they were asked if they had ever had a diagnosis of hypertension or diabetes. At surveys 2 (1998), 3 (2001) and 4 (2004) they were asked whether they had been diagnosed with each condition in the time period that had elapsed since the previous survey.

Modelling different prevention approaches

BMI at survey one is presented as a simple frequency distribution in Fig. 1. After excluding data from women who reported having hypertension (n = 2859) or diabetes (n = 395) at survey 1, incidences of hypertension and diabetes (1996–2004) were calculated and superimposed on the 1996 BMI distribution (Fig. 1). Mean BMI was 25.8 (standard deviation, 5.13) $kg.m^{-2}$. Hypothetical reductions in the incidence of each condition were then modelled for: (1) a 1-unit reduction in BMI in the whole population (the whole-population strategy); (2) a 3-unit reduction in BMI for women in the top 20 percent of the BMI distribution (BMI > 29; the high-risk strategy); and (3) a 2-unit reduction in BMI for women in the top 50% of the BMI distribution (BMI ⩾ 24; the "middle road" strategy). These analyses were performed using SAS, version 9.1.2.

Whole-population or high-risk approach?

Our calculations showed that if the entire BMI distribution was shifted to the left by 1 unit (the whole-population strategy), then incidence of hypertension and diabetes would be reduced by 10.3% and 13.4% respectively. In contrast, if BMI were shifted to the left by 3 units in the top 20% of the distribution (BMI > 29) (the high-risk strategy), the corresponding reductions in incidence would be 7.3% for hypertension and 16.8% for diabetes. It is clear that for hypertension, the whole-population strategy of achieving a small change in everyone would result in a greater reduction in cases (10.3%) than would the high-risk strategy of larger changes among those in the top 20% of the BMI distribution (7.3%). However, for diabetes, where the risk increases much more at the high end of the BMI distribution, a greater change among those most at risk would result in a greater population risk reduction (16.8% compared with 13.4%).

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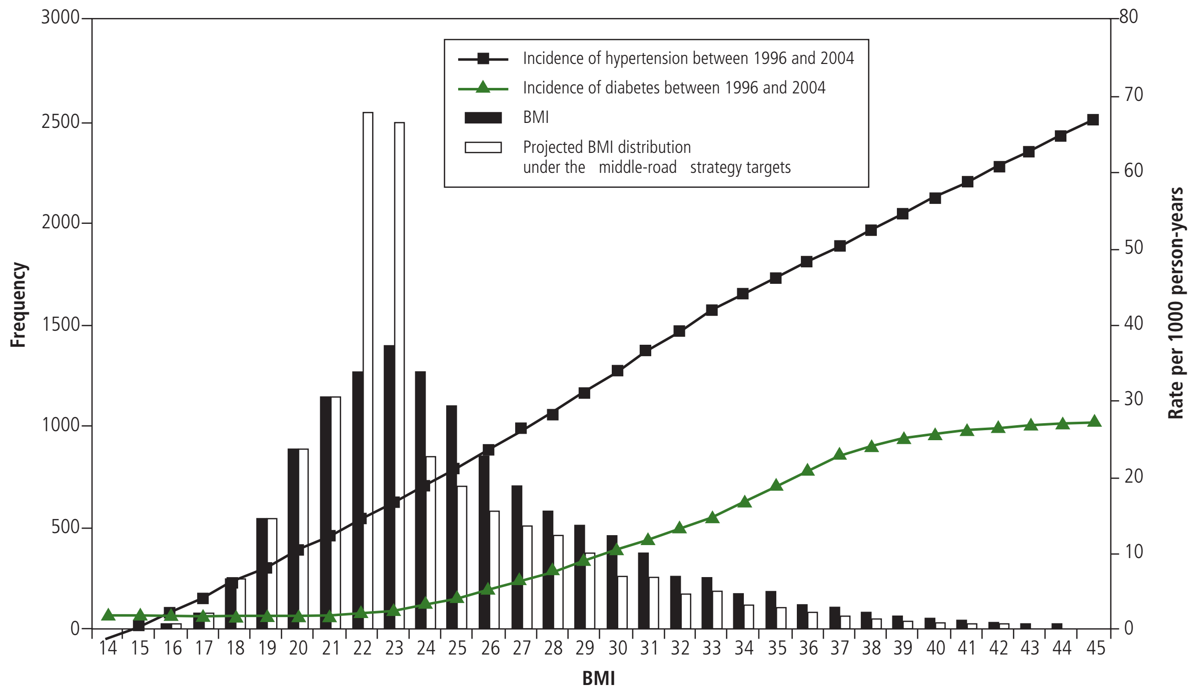
Fig. 1. **Distribution of BMI in 13 716 Australian women aged 45–50 years in 1996**



BMI, body mass index.

The "middle road" approach

However, when we modelled a shift in the BMI distribution of 2 units in the top 50% of the BMI distribution (BMI $\geqslant$ 24) – the middle road strategy – there was a reduction in incidence of 12.3% for hypertension and 23% for diabetes. Hence for both hypertension and diabetes, the middle road strategy would result in the greatest reduction in both these conditions in this population of middle-aged women. The white bars in the Fig. 1 indicate the new population distribution of BMI, if this could be achieved.

Like many others, we were under the impression that Rose's hypotheses related only to the high-risk and population approaches. On revisiting his text, we found Rose had noted that while the range of variation in many health risks is quite stable (that is, when the population average shifts, the dispersion remains fairly constant), this was less true for body weight. He pointed out that when the population average weight rises, there is a disproportionate increase in "exceptional" obesity. He suggested therefore that weight reduction in the entire upper half of the distribution, without any slimming among those on the "thin side of average", would be particularly welcome, because of the "J-shaped" relationship between body weight and total mortality.[1]

Lessons learned

Rose's advice on the benefits of weight reduction for the upper half of the BMI distribution is borne out by our prospective data. Although our estimates are based on self-reported data and require replication with more objective measures, they confirm that a middle road strategy may be optimal for combating the growing rates of chronic illness associated with increasing BMI.

Using our data, we estimate that if all women with BMI $\geqslant$ 24 reduced BMI by 2 points (approximately 5.5 kg), the incidence of hypertension would be reduced by 12% and the incidence of diabetes would be reduced by 23%. Assuming that each kilogram of stored fat is equivalent to 7000 kcals (29 400 kJ), and that this energy is converted with an efficiency of 50%, then closing the "energy gap" by 200 kcals per day through an additional 20 minutes or 2000 steps of brisk walking and reducing energy intake by 100 kcal (the equivalent of one chocolate biscuit) every day for one year would substantially contribute to achieving this goal.[3,4]

As suggested in the WHO Global Strategy on Diet, Physical Activity and Health (DPAS) (resolution WHA57.17, May 2004), these data suggest that small changes in two of the main risk factors could result in significant reductions in risk of chronic noncommunicable diseases across populations. The level of change suggested here is likely to require considerable social, cultural and environmental support to encourage more active living among today's time-pressured women. ■

Competing interests: None declared.

References

1. Rose G. *The strategy of preventive medicine*. Oxford: Oxford University Press; 1992.
2. Lee C, Dobson AJ, Brown WJ, Bryson L, Byles J, Warner-Smith P, et al. Cohort profile: the Australian longitudinal study on women's health. *Internat J Epidemiol* 2005;34:987-99.
3. Hill JO, Wyatt HR, Reed GW, Peters JC. Obesity and the environment: where do we go from here? *Science* 2003;299:853-855
4. Hill JO. Preventing excessive weight gain. *Obesity Res* 2005;13:1302.