Setting Population Targets for Measuring Successful Obesity Prevention

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In 2008, The Council of Australian Governments set a target to increase by 5% the proportion of Australian adults at a healthy body weight by 2017, over a 2009 baseline. Target setting is a critical component of public health policy for obesity prevention; however, there is currently no context within which to choose such targets.

We analyzed the changes in current weight gain that would be required to meet Australian targets. By using transition-based multistate life tables to project obesity prevalence, we found that meeting national healthy weight targets by 2017 will require a 75% reduction in current 5-year weight gain.

A reliable model of future body weight prevalence is critical to set, evaluate, and monitor national obesity targets. (*Am J Public Health*. 2010;100:2033–2037. doi:10.2105/AJPH.2010.200337)

MANY DEVELOPED COUNTRIES

worldwide have set future targets on the prevalence of healthy weight, overweight, and obesity in an attempt to express their political will to tackle the obesity epidemic. An analysis of recent national targets in the United States and United Kingdom demonstrates that there has been no success in achieving these targets and, more importantly, there appears to be no apparent evidence base for the choice of target (Table 1).

In 2008, The Council of Australian Governments set a target to increase by 5% the proportion of Australian adults at a healthy body weight by 2017, over a 2009 baseline. Healthy body weight refers to the normal weight category; no targets were set in reference to overweight and obese body weight categories.⁵ This is a significant target, particularly as it is backed with financial support. However, there is currently no context within which to decide whether such a target is achievable, nor whether it is the best measure of successful obesity prevention. We, and others, have demonstrated that the prevalence of healthy weight is expected to plummet in the coming decade,^{6,7} with a likely decrease among Australian adults from 35% in 2010 to 30% in 2020 if current trends persist (H. L. Walls, PhD, written communication, July 2010). In this context, even maintenance of current levels of healthy weight might be considered a marker of success. We are concerned that without realistic and practical obesity targets, the general public and the policy-makers tasked with enacting these

targets may become disillusioned and question our ability to tackle the current obesity epidemic. Insufficient public and political confidence will undermine the drive needed to address the current body weight trajectory.

We analyzed what changes in current trends in weight gain would be required to meet the national government targets. In addition, we explored other possible targets that may more realistically reflect success in obesity prevention. To do this we used a transition-based multistate life table model, developed to project the prevalence of healthy weight, overweight, and obesity in adult Australians between 2005 and 2025. With this model we estimated the impact of hypothetical scenarios decreasing the degree of weight gain in the population on the future prevalence of healthy weight, overweight, and obesity.

THE AUSTRALIAN OBESITY PROJECTION MODEL

The transition-based multistate life table model we used in this study has been described previously (H. L. Walls, PhD, written communication, July 2010). In brief, the future prevalence of healthy weight (normal weight), overweight, and obesity is dependent on the age-specific probabilities of moving from one body mass index (BMI; defined as weight in kilograms divided by height in meters squared) category to another as observed in the Australian Diabetes, Obesity, and Lifestyle (AusDiab) study between 2000 and 2005. The crude transition probabilities between each

of the adjacent alive states (healthy weight, overweight, obese) and between each of the alive states and mortality were estimated for each 5-year age category between age 25 years and age 85 years or older, and were smoothed with a Lowess smoother. The age-specific mortality probabilities were recalibrated to reflect the age-specific Australian mortality probabilities between 2000 and 2005.⁸

We constructed abridged 5-year multistate life tables with 3 alive states (healthy weight, overweight, and obese), based on the transition probabilities outlined previously. In essence, the life table simulates the progression per 5-year period of a cohort of adults aged 25 to 29 years in the year 2000 exposed to the incidence and mortality observed between 2000 and 2005 throughout their future lifetime, and followed until death. We used a series of linked life tables to simulate the progress of the entire adult population between the years 2000 and 2025. In these life tables, the distribution of people between the different states at a given age and time depends on the distribution at the previous age and time and on the transition probabilities between each of the states in the model. The baseline multistate life-table population, representing the age structure in Australia in the year 2000, was created by combining the age-specific population numbers for the year 2000 with the age-specific prevalence of healthy weight, overweight, and obesity observed in AusDiab for each 5-year age group. Every 5 years a new cohort of adults aged 25 to 29 years entered the model, based

TABLE 1—Past Obesity Targets in the United States and United Kingdom

Country	National Target	Date Target Initiated	Date to Achieve Target	Strategy	Achieved?
United States	Healthy People 2000 aims to reduce prevalence of overweight to no more than 20% of adults, from 24% in 1976-1980. ¹	1990	2000	Decrease prevalence	No
United States	Healthy People 2010 aims to increase percentage of healthy weight adults from 42% to 60% and decrease the prevalence of obese adults from 23% to 15%. ²	2000	2010	Decrease prevalence	No ^a
United Kingdom	Reduce percentage of obese men from 7% in 1986-1987 to 6% in 2005, and of obese women from 12% in 1986-1987 to 8% in 2005. ³	1992	2005	Decrease prevalence	No
United Kingdom	Halt the year-on-year rise in obesity among children aged younger than 11 years to broadly tackle obesity in the population as a whole. ⁴	2004	2010	Decrease prevalence	No ^b

^aProjections suggest these will not be met.

^bAbandoned in 2007.

on population projections between 2010 and 2025 from the Australian Bureau of Statistics,⁹ and assuming the prevalence of healthy weight, overweight, and obesity at age 25 to 29 years changed to the same extent as that of those aged 30 to 34 years. From these projection models, age-specific and total prevalence of healthy weight, overweight, and obesity were derived for each 5-year period between 2000 and 2025.

DATA SOURCE FOR THE OBESITY PROJECTION MODEL

AusDiab is a national, population-based survey of 11 247 Australian adults aged 25 years or older at baseline (1999 to 2000). The response rate to the baseline biomedical testing among those who completed the household survey was 55%.¹⁰ In

2004 to 2005, all participants (n = 11 247) were invited to a follow-up examination. Those who refused further contact (n = 128); were deceased (n = 341); had moved overseas, had moved into a high-care nursing facility, or had a terminal illness (n = 21) were considered ineligible.⁹ Of the 10 757 participants eligible for follow-up, 6400 (59%) presented for the biomedical examination or blood tests.⁹ For the current analysis, participants missing values for height or weight were excluded, leaving 11 067 participants at baseline and 6350 at follow-up. At both examinations, measured height and weight were collected. Mortality was determined by linkage to the National Death Index to June 1, 2005. BMI was categorized as healthy weight (≥ 18.5 kg/m² to 24.99 kg/m²), overweight (25.0 kg/m² to 29.99 kg/m²) and obese (≥ 30.0 kg/m²).¹¹

SCENARIO ANALYSES

To analyze the effect on future prevalence of healthy weight, overweight, and obesity of potential changes in weight gain we generated a series of scenarios in which the degree of weight gain in the AusDiab cohort was artificially decreased and a “new” BMI at follow-up was created. This new follow-up BMI became the input data for the estimation of the transition probabilities required to generate the projection life tables. We analyzed decreases in weight gain in 2 ways. First, we analyzed the effect of reducing the degree of weight gain over time for the whole population. This was done by incrementally reducing the observed increase in BMI in individuals within the AusDiab cohort over the 5-year follow-up by a given percentage. Second, we analyzed the effect of changes

restricted to those with healthy weight, by decreasing their rate of progression to overweight by a given percentage. Changes in incidence of overweight were analyzed by making incremental changes to the probability of becoming overweight from healthy weight, as observed in the AusDiab cohort.

In addition to analyzing incremental series of changes in weight gain we also wanted to analyze the potential effect of current best practice prevention. This was reflected through either a 0.06 or a 0.5 BMI-unit lesser weight gain than was observed over the 5-year period, achieved by decreasing any increases in BMI between baseline and follow-up in AusDiab by 0.06 or 0.5 BMI units. In individuals whose gain in BMI was less than either 0.06 or 0.5 BMI units over the 5-year follow-up, the “new” BMI was held at the baseline BMI value. Individuals who lost weight between baseline and follow-up measurements retained their original BMI values for both time points. Though very optimistic, a 0.5 BMI-unit reduction in weight gain was chosen to represent the most effective single adult obesity prevention intervention detailed in a recent systematic review.¹³ The 0.06 BMI-unit reduction represents the mean change in BMI from the same review.

The altered transition probabilities from each of these scenarios were applied to our model from the year 2010, and flow-on effects on future prevalence of healthy weight, overweight, and obesity were then estimated to 2025.

MEASURES REQUIRED TO MEET NATIONAL TARGETS

In the first instance, we analyzed what changes would be required to achieve the Australian

Note. HW = healthy weight; OW = overweight.

^aApproximate national target for healthy weight prevalence.

FIGURE 1—Projected prevalence of healthy weight for Australian adults, by comparison of projected trends assuming a continuation of current rates of body mass index progression with scenarios that achieve the national targets for healthy weight by 2020: 2000–2025.

national target. A 75% reduction in 5-year BMI gain was found to be necessary to meet the national targets for healthy weight prevalence by 2020, decreasing the mean increase in adult BMI over 5 years from 1.66 kg/m² to 0.42 kg/m². Similarly, an 80% decrease in the probability of becoming overweight from healthy weight would be required to meet the target, changing the overall probability of incident overweight

over 5 years from around 15% to 4% (Figure 1).

MEASURES TO HALT DECLINING HEALTHY WEIGHT PREVALENCE

Because of the improbability of reaching the target prevalence for healthy weight, we next analyzed which scenarios would halt the continuing decrease in the prevalence of healthy weight, simply

Note. HW = healthy weight; OW = overweight.

^aApproximate national target for healthy weight prevalence.

FIGURE 2—Projected prevalence of healthy weight for Australian adults, by comparison of projected trends assuming a continuation of current rates of body mass index progression with scenarios that stabilize the trends for healthy weight between 2010 and 2020: 2000–2025.

holding it steady at around 35% from 2010.

Stabilizing the prevalence of healthy weight from 2010 to 2020 would require the entire population to reduce the average 5-year BMI gain by 45%, changing the mean increase in BMI over 5 years from 1.66 kg/m² to 0.91 kg/m². Alternatively, this result could be achieved with a 45% reduction in the 5-year probability of becoming overweight from healthy weight, shifting the probability of incident overweight from 15% to 8% (Figure 2).

LIKELY IMPACT ON FUTURE HEALTHY WEIGHT PREVALENCE

Finally, we modeled the effects of the most effective single adult obesity prevention intervention detailed in a recent systematic review, a reduction in weight gain of 0.5 BMI units.¹² This scenario slowed the current decreasing trends in the prevalence of healthy weight, and resulted in a decline of healthy weight prevalence from 35% in 2010 to 32% in 2020 (compared with 30% with current trends; Table 2). In addition to having a positive effect on the prevalence of healthy weight, this scenario also resulted in a lesser increase in the prevalence of adult obesity, with the prevalence increasing only 1% between 2010 and 2020 rather than 5% with current trends. The lesser increase in obesity was offset by an increase over current projections in the prevalence of overweight from 38% in 2010 to 40% in 2020.

We additionally modeled the effect of reducing weight gain by 0.06 BMI units to represent the mean effect size of adult obesity prevention strategies reported in the same systematic review.¹² This scenario did not alter the projected

prevalence of healthy weight, overweight, or obesity between 2010 and 2020, and, by 2025, healthy weight prevalence had improved by only 1% compared with current projected trends.

STRENGTHS AND LIMITATIONS

The key strength of the current study is the use of an obesity projection model that is based on recent estimates of individual weight change. Recent evidence suggests that the rate of increase in BMI may be slowing,^{13–16} presenting a serious limitation to projection models that are based on past prevalence.⁶ The prevalence of obesity is a result of decades of varying environmental influences and behavioral patterns, and projection models based on past prevalence are likely to capture trends that are no longer applicable. Our incidence-based model incorporates the most recent probabilities of transitioning between BMI groups, thereby producing a robust future projection of BMI groups assuming no change in current patterns of weight gain. A similar population-level incidence-based model has recently been validated against the observed trends in the United States.¹⁷ Nevertheless, all models have limitations and any attempt to predict the future remains a prediction. In our model, the forecasted prevalence is conditional on current transition rates between BMI categories, and does not take into account future changes in other factors, other than policy measures, that may affect these rates. Moreover, our model is subject to the potential selection bias of the AusDiab study with a 55% response rate at baseline of whom 59% returned at follow-up; however, this would

TABLE 2—Comparing Projected Trends in Prevalence of Healthy Weight, Overweight, and Obesity Among Australian Adults: 2000–2025

Year	Healthy Weight		Overweight		Obesity	
	Current Trends, %	0.5 BMI-Unit Reduction, %	Current Trends, %	0.5 BMI-Unit Reduction, %	Current Trends, %	0.5 BMI-Unit Reduction, %
2000	41	41	39	39	20	20
2005	38	38	38	38	24	24
2010	35	35	38	38	27	27
2015	32	33	38	39	29	27
2020	30	32	38	40	32	28
2025	28	31	38	41	34	28

Note. BMI = body mass index. Current trends assume a continuation of recent rates of BMI progression and are compared with a hypothetical reduction in 5-year BMI progression by 0.5 BMI units. BMI was measured as weight in kilograms divided by height in meters squared.

likely lead to an underestimation of obesity prevalence.¹⁰ In light of these limitations, we advocate the funding of cohort studies with 5-year follow-ups and encourage detailed analysis of population changes in weight gain. When setting obesity targets, policymakers should make the best use of the most contemporary cohort studies available, as we have in our analysis.

IMPLICATIONS AND RECOMMENDATIONS

We have demonstrated that to meet current national targets for healthy weight, the rate of 5-year weight gain in Australia would need to be 75% less than it was between 2000 and 2005. Even to stabilize current levels of healthy weight, current rates of 5-year BMI progression must be reduced by almost half. Given the modest success of obesity prevention interventions in adults to date (a recent systematic review reported a mean BMI change of 0.06,¹² which, as we demonstrate, results in very little change to future prevalence of healthy weight, overweight, and obesity), a stabilization, let alone a reversal of current adult healthy weight

prevalence by 2020, is a highly unlikely consequence of newly introduced policy initiatives. As our theoretical modeling of a best-practice obesity prevention intervention illustrates, a slowing of the current projected decline in adult healthy weight trends may indeed be the best marker of successful obesity prevention.

Our analysis further indicates that, although a reduction in 5-year weight gain by 0.5 BMI units is not sufficient to halt or reverse the projected rise in obesity prevalence, it would markedly slow the escalating levels of obesity. This significant slowing of the prevalence of obesity should be considered a marker of success if one considers the burden of obesity on the health care system. Nevertheless, the same simulated reduction in BMI gain still resulted in a decline of healthy weight prevalence from 35% in 2010 to 32% in 2020, far from the proposed national target. We advocate that national targets additionally focus on a slowing of the current projected increase in obesity prevalence.

In the current analysis, we assessed obesity targets for the total population as this is the focus of the current national targets

within Australia. However, when one is projecting the effect of obesity prevention interventions in a population as a whole, important differences between subgroups that are at higher risk of obesity may be masked. Therefore, to obtain a more comprehensive understanding of how obesity prevention interventions may be influencing the distribution of the prevalence of obesity, subgroups of the population should be identified and analyzed. In doing so, policymakers can make informed decisions as to where preventive efforts should be focused.

Obesity is a multifaceted condition with few successful intervention options. Thus, curbing current body weight trends to meet national targets will be challenging. Governments should set realistic milestones that focus, at least initially, on slowing current projected trends. Targets should indeed offer an inspirational role demonstrating political commitment and providing the impetus for change; however, they also need to be realistic and focused around the achievement of tangible results. The formulation and evaluation of such targets requires the use of a reliable

incidence-based projection model. Use of such a model is critical to provide a meaningful context for the setting of targets, the choice of strategies by policymakers, and the evaluation of the long-term impact of the chosen obesity prevention strategies. ■

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Contributors

All authors were involved in the study conception, design, and analysis; interpretation of data; and in drafting the article and revising it critically for important intellectual content. K. Backholer executed the analyses and drafted the article. All authors gave final approval of the version to be published.

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Human Participant Protection

This research was approved by the Monash University standing committee on ethics in research involving humans (CF08/0136-2008000007).

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