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The modelled cost-effectiveness of a prevention program targeting both eating disorders and high BMI

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1. OBJECTIVE

Prevention programs for eating disorders (EDs) and high body mass index (BMI) have the potential to reduce the onset of these interconnected public health concerns. However, it remains unclear whether routine implementation of such programs would be cost-effective. This study aims to determine the cost-effectiveness of an intervention that aims to prevent both ED and high BMI.

2. METHOD

A Markov model was developed to evaluate the incremental cost-effectiveness of a targeted school-based program, Healthy Weight, that aims to prevent both EDs and high BMI among Australian adolescents with body image concerns (aged 15-18 years), versus a 'no intervention' comparator (the ACE-HiBED model). The model was developed in Microsoft Excel 2010 to estimate the cost-effectiveness of the Healthy Weight intervention over the lifetime of the target population (up to 100 years). The model determines the number of health-adjusted life years (HALYs) gained due to the intervention's effect on the BMI and ED status of the targeted population. It does this by calculating the difference in the epidemiology of nine high BMI related diseases and EDs between the intervention population and an identical population without the intervention. The reductions in BMI and ED symptoms lead to a decrease in the incidence of the diseases, which in turn results in decreased prevalence, mortality, and disability related to these diseases. This, therefore, leads to improved long-term health outcomes (HALYs) and healthcare cost-savings. The DisMod-II model was utilized to assess the epidemiological impact of the decrease in BMI and ED symptoms on each of the diseases. Each disease was comprised of four health states, namely "healthy", "diseased", "dead due to the disease", and "dead due to other causes". The age- and sex-specific probabilities of transitioning between health states were calculated using the DisMod II software. Epidemiology-related model inputs such as total population prevalent years lived with disability, incidence, prevalence, and mortality of the diseases were taken from the GBD 2019 study. The impact of the diseases on health was measured using the years lived with disability multiplied by the disease-specific disability weights. For each of the diseases related to high BMI, potential impact fractions (PIFs) and relative risk of disease related to BMI were utilized to determine the proportional change in the incidence of the diseases resulting from changes in the population's BMI

This analysis was conducted from a 'healthcare and education' sector perspective with costs (measured in 2019 Australian dollars) and health impacts modelled over the lifetime of the target population. An incremental cost-effectiveness ratio (ICER), expressed as cost per health-adjusted life year (HALY) gained, was calculated. Sensitivity analyses including decay of intervention effect, remove effect on Anorexia Nervosa, including males, decreased participation rates, reduction on obesity prevalence rather than BMI, and using utility weights rather than disability weights were done to test model assumptions.

3. RESULTS

When implemented across 1416 secondary schools in Australia, the cost of intervention implementation was AUD$2.13 million (95% CI, AUD$1.83–2.43 million), which translated to approximately AUD$132 per student. The intervention led to a reduction of 43, 134, and 153 incidence cases of AN, BN, and BED, respectively. The mean of total HALYs gained was 146 (95% CI, 90–209) while healthcare cost-savings were estimated to be AUD$3.97million (95% CI, AUD$2.57–5.46 million) compared to no intervention. As a result, a cost-saving of AUD$1.83 million (95% CI, AUD$0.51–3.21 million) was achieved. This cost-saving was wholly attributable to reduction in the incidence, prevalence, and mortality of EDs because of the Healthy Weight intervention. The cost-effectiveness plane shows that most of the runs of the model (99.6%) fell in the south- east quadrant which means that the intervention was more effective and less costly than no intervention. Without cost-offsets, the mean ICER for this intervention was AUD$14,778 per HALY gained (95% CI, $11,625– $20,162) and none of the iterations fell above the willingness-to-pay (WTP) threshold of AUD$50,000 per HALY. Primary findings were robust to extensive sensitivity analyses.

4. DISCUSSION

In this study, a population-based Markov model (ACE-HiBED) was developed to estimate the cost-effectiveness of the Healthy Weight intervention for the prevention of ED and high BMI. To our knowledge, this is the first study to assess the cost-effectiveness of an evidence-based preventive intervention of both ED and high BMI at the population level. This study demonstrated that, using several commonly accepted value-for-money thresholds, Healthy Weight is likely to be cost-saving (i.e., more effective and less costly) than no intervention, and was cost-effective even when healthcare cost-savings were excluded. The sensitivity analysis demonstrated that variations in some of the modelling parameters did not change the conclusion of this study. To ensure the successful implementation of this program at the population level, further research on its feasibility and acceptability among schools and the wider community is required.

Keywords: *Economic evaluation, modelling, obesity, eating disorders*

