Research Brief

Cost-effectiveness of a Nutrition Education Curriculum Intervention in Elementary Schools

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ABSTRACT

Objective: To estimate the long-term cost-effectiveness of an obesity prevention nutrition education curriculum (*Food, Health, & Choices*) as delivered to all New York City fifth-grade public school students over 1 year.

Methods: This study is a standard cost-effectiveness analysis from a societal perspective, with a 3% discount rate and a no-intervention comparator, as recommended by the US Panel on Cost-effectiveness in Health and Medicine. Costs of implementation, administration, and future obesity-related medical costs were included. Effectiveness was based on a cluster-randomized, controlled trial in 20 public schools during the 2012–2013 school year and linked to published estimates of childhood-to-adulthood body mass index trajectories using a decision analytic model.

Results: The *Food, Health, & Choices* intervention was estimated to cost $8,537,900 and result in 289 fewer males and 350 fewer females becoming obese (0.8% of New York City fifth-grade public school students), saving 1,599 quality-adjusted life-years (QALYs) and $8,098,600 in direct medical costs. *Food, Health, & Choices* is predicted to be cost-effective at $275/QALY (95% confidence interval, –$2,576/QALY to $2,084/QALY) with estimates up to $6,029/QALY in sensitivity analyses.

Conclusions and Implications: This cost-effectiveness model suggests that a nutrition education curriculum in public schools is effective and cost-effective in reducing childhood obesity, consistent with the authors' hypothesis and previous literature. Future research should assess the feasibility and sustainability of scale-up.

Key Words: economic modeling, QALYs, nutrition education, cost-effectiveness, children (*J Nutr Educ Behav*. 2016;■:1-8.)

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INTRODUCTION

In the US, the prevalence of childhood obesity tripled between 1976 and 2008.[1] Currently, 17.4% of children aged 2–19 years are obese and 33.4% are overweight.[2,3] Several longitudinal studies suggested that overweight and obese children are likely to remain so into adulthood.[4,5] Obesity increases the risk for several chronic health conditions such as diabetes, heart disease, and cancer[6] and is associated with a significant economic burden, with costs projected to increase by $66 billion annually by 2030 if past trends continue.[7]

Because many weight-related behaviors are developed before adolescence[8] and weight loss is difficult once individuals become obese,[9] population-wide interventions are warranted to prevent the development of obesity in childhood. Modest decreases in caloric consumption and increases in energy expenditure across the population could result in a reduction in obesity among children,[10] potentially contributing to economic benefits in the form of averted medical costs and increased academic achievement and productivity.

Schools are frequently the setting of obesity prevention interventions because they offer the opportunity to reach many youths. Nutrition education within the school setting is 1 strategy to facilitate the adoption of behaviors that promote energy balance.[11] A recent meta-analysis of school-based obesity prevention interventions found that they are mildly effective at reducing obesity, producing an average reduction of 0.076 body mass index (BMI) units,[12] and may have differential results based

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on the duration and presence of environmental supports.

Experts have opined for substantial investments in obesity prevention.[13,14] However, because public health funding is limited, cost-effectiveness analyses are necessary to address the practical concerns of policymakers in prioritizing such investments. A cost-effectiveness analysis is an approach to assess the value of expenditures for a health intervention, presented as the cost per unit of a given outcome relative to an alternative course of action (referred to as the comparator).[15,16] Although several other factors may be considered in choosing among competing interventions (or no intervention at all), the cost-effectiveness ratio allows one to compare the value of interventions directly using a standard unit (typically, the cost per quality-adjusted life-year [QALY]). Models can be used to estimate the cost-effectiveness of interventions over the long-term, given that health benefits may not be fully realized until a later date and the trials used to assess effectiveness often have short response times.[15-17]

The objective of this study was to estimate the cost-effectiveness of a nutrition education curriculum intervention in preventing obesity among fifth-grade public school students from New York City using a decision analytic model. Based on the economic evaluations of other obesity prevention interventions for schoolchildren,[17] the authors hypothesized that a nutrition education approach as modeled for this population would be cost-effective, meaning that it would be below the commonly accepted threshold of $50,000/QALY.[15]

METHODS

Overview

This cost-effectiveness analysis used standard methods recommended by the Panel on Cost-effectiveness in Health and Medicine,[15] including: a 3% discount rate for costs and benefits, a no-intervention (or standard-of-care) comparator, and quantification of benefits using the standard QALY unit. This study was conducted from a societal perspective in which all of the costs and benefits of an intervention are considered regardless of who experiences them.[15,16] This study is summarized in the following steps: (1) determine intervention effectiveness (using a previously conducted cluster-randomized, controlled trial); (2) create a decision analytic model[17,18] to estimate the reduction in adult obesity contingent on participating in the in-tervention at 10 years; (3) quantify the QALYs saved and direct medical costs averted; (4) conduct a retrospective cost analysis of the intervention and estimate the costs for citywide implementation; and (5) calculate the cost-effectiveness ratio.

The *Food, Health, & Choices* Intervention

Food, Health, & Choices (FHC) was a 24-lesson nutrition education curriculum delivered over the course of 1 school year. The curriculum focused on 6 behaviors likely to influence energy balance: reducing consumption of sugar-sweetened beverages; reducing consumption of fast food; reducing consumption of processed, packaged snacks; reducing screen time; increasing physical activity; and increasing consumption of fruits and vegetables.[6]

The effectiveness of the intervention was evaluated in a cluster-randomized, controlled trial conducted during the 2012–2013 school year.[19] Twenty schools were selected from 6 New York City school districts with high rates of obesity and chronic disease; all fifth-grade students within the school were eligible to participate.[20] Students' height (in centimeters) was measured with a portable stadiometer (Model 213; Seca, Chino, CA) and their weight (in kilograms) was measured with a Tanita body composition analyzer (Model SC-331s, Arlington Heights, IL) at the start and end of the school year. Measurements were repeated twice or until 2 measures for height fell within 1.0 cm of each other, and for weight within 0.1 kg of each other, and were averaged. Body mass index was calculated as kilograms per square meter. The Teachers College Columbia University and New York City Department of Education (NYCDOE) Institutional Review Boards approved the effectiveness trial; this cost-effectiveness study represents a secondary analysis of these data.

Of the 769 students for whom both baseline and postintervention data were collected, 4% fewer boys and 2.4% fewer girls in the curriculum condition were considered overweight or obese (BMI over the 85th percentile according to the Centers for Disease Control and Prevention guidelines), compared with 1.3% more boys and 1.3% fewer girls in the control condition. The adjusted odds ratio in the curriculum condition was 0.17 for boys ($P = .04$) and 0.25 for girls ($P = .10$), controlling for relevant individual- and school-level covariates; this indicated that the intervention effect of the curriculum on body weight was statistically significant only among boys. These estimates were used as parameters for the effectiveness of the intervention and were consistent with a recent systematic review[12] and previous cost-effectiveness analyses.[21,22]

Modeling the Long-term Effectiveness of the Intervention

The FHC intervention was modeled under a hypothetical citywide implementation scenario, informed by an ongoing classroom wellness program administered by the NYCDOE, in which it was delivered by trained teachers during the reference year (2012–2013). A longitudinal decision analytic model[17,18] was used to estimate the reductions in adult obesity contingent on participating in the intervention at age 10 years. The model population was a hypothetical cohort of fifth-grade students with a distribution of observable demographic characteristics and weight status based on publicly available data (Table 1). The primary outcome of the model was the reduction in adult obesity and the associated medical costs averted and QALYs saved. Given the uncertain health and economic effects of adult overweight,[23] the model accounted only for costs associated with obesity.

Current Practice

In New York City, there is no specific requirement for nutrition (or health) education within public elementary schools. Thus, the comparator used in the current study was a no-nutrition education alternative, which assumed that children receive no structured nutrition education and incurred no cost.

Cases of Adult Obesity Averted

The researchers estimated the number of cases of adult obesity averted as a result of the intervention using an obesity progression model (Figure).