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Cost Analysis of a Childcare Center-Based Intervention to Prevent Obesity in the Preschool Years

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Background: In the United States, 17% of children are considered obese, and the economic burden of obesity and related conditions are concerning. Healthy Caregivers-Healthy Children (HC2) is an early childcare center-based obesity prevention trial among ethnically diverse children and families.

Objectives: To better understand the economic impact of early childhood obesity prevention efforts, this study conducted a cost analysis of the HC2 intervention and estimated the potential lifetime cost-savings of HC2 from reducing childhood obesity.

Patients and Methods: Economic analyses estimated the direct intervention costs and the projected lifetime medical cost savings from preventing childhood obesity. Cost data were collected using detailed staffing and financial records, from the HC2 study investigators. Resources were organized into four main categories: personnel costs, contractors, supplies and equipment, and miscellaneous expenditures. Costs were estimated separately for the two phases of the intervention: Year 1 and Years 2 – 3.

Results: The total cost of HC2 intervention was 206319 $. The average cost per child in Year 1 was 113.90 $. The average cost per child for the booster sessions, in Years 2 and 3 was 29.02 $ per year. Average cost per child throughout the intervention was 172 $. If HC2 generates just a 1% reduction in obesity, lifetime savings would be of approximately 228000 $, with net savings of 21681 $, over the three years of the intervention. The average (per child) net savings across all HC2 participants range from 18 $, if 1% of participants avoid obesity, to 1728 $, if 10% avoid obesity.

Conclusions: The HC2 intervention shows potential for generating cost savings. Cost analyses of programs of this type are helpful to policymakers and program planners to allocate resources for obesity prevention programs in school and childcare settings.

Keywords: Obesity; Prevention; Early Childhood; Children; Family

1. Background

Overweight and obesity among preschool and primary school-age children is a significant public health challenge in the United States (US) (1). The Centers for Disease Control and Prevention (CDC) indicate that early childhood obesity rates have tripled since a generation ago and now affect 17% of children and adolescents in the US (2). An estimated 70% of these children will carry their obesity into adulthood (3). This is of particular concern because childhood obesity is associated with significant short- and long-term physical and mental health problems (3-7), as well as long-term economic consequences (8, 9).

In 2010, obesity-related healthcare expenses cost Americans between 147 billion $ and 210 billion $, per year (9). A recent study by Finklestein estimated the lifetime medical costs of obesity in children and found that, relative to normal weight children, obese children generate 19000 $ in excess medical spending (8). The economic burden continues to grow with the prevalence of obesity, which has generated interest among clinicians, policymakers, and other stakeholders in developing overweight and obesity prevention strategies in the US and abroad (10). Obesity prevention during childhood could generate significant social and economic benefits, lending support for continued and perhaps increased investment of taxpayer dollars in these programs.

Despite the importance of understanding the potential cost-savings associated with obesity prevention, a limited number of studies have conducted economic evaluations of childhood obesity interventions, especially in ethnically diverse subpopulations and early childcare facilities (8). Preschools and primary schools have been targeted as effective settings for overweight and obesity interventions, because children spend many hours a day in school (11). Schools can also teach, model, and reinforce healthy eating and physical activity (12).

2. Objectives

To better understand the economic implications of a school-based obesity preventive intervention, the objectives of this study were to: (a) conduct a cost analysis of the Healthy Caregivers-Healthy Children (HC2) intervention, and (b) estimate the potential lifetime cost-savings of HC2 from preventing overweight and/or obesity.

3. Patients and Methods

3.1. Description of the Healthy Caregivers-Healthy Children Intervention

The HC2 is a childcare center-based intervention, designed to test the efficacy of a parent and teacher's role modeling on children's nutrition and physical activity (13). A randomized, controlled obesity trial of HC2 in 28 low-income, ethnically diverse childcare centers was conducted in Miami-Dade County, FL, USA, from 2010 to 2013. Of the 1105 children enrolled in these centers, the majority ($\geq$ 88%) was between 2 – 5 years old (14). The racial and ethnic distributions were as follows: 60% Hispanic, 15% Haitian, 12% non-Hispanic Black, and 2% non-Hispanic White. A total of 71% of the parents/caregivers were born outside the United States.

Participating centers were randomly assigned to a treatment arm (HC2; 12 centers) or a control arm (16 centers). Therefore, randomization to the experimental (HC2) or control conditions was performed at the early childcare center level (not at the participant level). The HC2 intervention consisted of: 1) implementing daily nutrition- and physical-activity-focused curricula for teachers, parents, and, separately, for children; 2) providing technical assistance with menu modifications, such as introducing more fresh produce, low-fat milk, and less simple carbohydrate items; and 3) the creation of center policies on dietary requirements for meals and snacks, time spent engaging in physical activity, and limited television viewing. Childcare centers that were randomized to the control condition received the standard safety curriculum or one visit from the Injury Free Mobile, which provided parents with home, car, and child seat safety information (14).

All children received measurements of their height, weight, and waist circumference, during the first two intervention years. Body mass index (BMI) was converted to an age- and sex-adjusted percentile and z-score (15, 16). Additional data were collected at baseline from children and their caregivers, including: infant feeding history, parent perception of child weight status, acculturation level, and level of food insecurity in the household. Parents and other caregivers were also assessed on a number of nutrition and physical activity measures.

This study was approved by the University of Miami Institutional Review Board, University of Miami, Miami, FL, USA, and also, the approved protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki. Informed consent was obtained from all parents of children included in the study.

3.2. Cost Analysis

Cost data were collected using detailed staffing and financial records from the HC2 study investigators. Resources were organized into four standard categories: personnel costs, contractors, supplies and equipment, and miscellaneous expenditures. The majority of intervention activities occurred during the first year of the HC2 program. Year 1 costs included personnel costs associated with Curriculum Specialists who delivered the intervention, consulting fees paid to a physician who assisted in designing and managing the intervention, program supplies, and staff travel. In Years 2 and 3, intervention costs consisted entirely of personnel costs incurred to deliver quarterly booster sessions, aimed at maximizing the sustainability potential of the intervention.

3.3. Cost-Savings Projections

Lifetime savings and net savings are calculated using recently published estimates of the incremental lifetime medical care spending among obese children (benchmark age is 10 years old) compared to normal weight children (8). Obese children spend approximately 19000 $ more on medical care over a lifetime than normal weight children (8). This estimate is slightly above the range reported for adult populations, in which the lifetime spending on obesity-related medical care ranges between 9000 – 17000 $ (17). The estimate of average lifetime medical costs of childhood obesity was multiplied by three different rates of avoided obesity, among the HC2 participants (1, 5, and 10%) to project the potential cost-savings from the intervention. This analysis is meant to illustrate how cost data can be combined with clinical findings on reducing obesity, to estimate net economic savings.

4. Results

Table 1 presents the results of the cost analysis of HC2, with all estimates expressed dollars, at their 2013 value. The total cost over the duration of the HC2 intervention was 206319 $. The Control centers did not receive any specialized services, this should read: therefore, no costs were attributable to that group. Within the 12 childcare centers participating in the HC2 intervention, approximately 100 children per center actively participated in the program. The average cost per child in Year 1 was therefore 113.90 $. The average cost per child in Years 2 and 3 was 29.02 $ per year, for the booster sessions. Over the duration of the intervention, the average cost per child was 172 $.

As described above, these cost data were combined with lifetime estimates of preventable medical expenditures from childhood obesity to project the potential savings from HC2. Results are presented in Table 2. If the

Table 1. Cost Analysis of Healthy Caregivers–Healthy Children, a Childcare Center-Based Obesity Prevention Intervention Trial [a]

Resource Category	HC2	Control
Year 1 [b]		
Personnel (Curriculum Specialists)	100654 $	N/A
Contractors	5000 $	
Supplies and equipment	23024 $	
Other/Miscellaneous	8000 $	
Year 1 total costs	136679 $	
Year 2 [b]		
Personnel costs (booster session)	34820 $	
Year 3 [b]		
Personnel costs (booster session)	34820 $	
Summary Cost Estimates		
Total economic cost over the duration of the intervention	206319 $	
Average Costs		
Average cost per child - Year 1	113.90 $	
Average cost per child - Years 2 and 3	29.02 $	

[a] Cost estimates presented in US dollars, at their 2013 value. The control condition did not receive any specialized services, and there were no additional costs associated with this group; of the 28 schools enrolled in the HC2 trial, 12 received intervention services; on average, 100 children per school actively participated in the intervention (i.e. were exposed to the intervention). To estimate the average cost per child, we divided the total annual costs by 1200.
[b] Data are presented for a 9 months period.

Table 2. Projected Lifetime Savings From Reduced Childhood Obesity Among Healthy Caregivers – Healthy Children Participants [a]

	No.	Savings	Net Savings (Savings – Intervention Costs)
1200 participants over 3 years			
10% avoid obesity	120	2280000 $[b]	2,073,681 $[c]
5% avoid obesity	60	1140000 $[b]	933,681 $[c]
1% avoid obesity	12	228000 $[b]	21,681 $[c]

[a] Excess (i.e. preventable) medical expenditures from childhood obesity (amount above what a normal-weight individual spends) is 19000 $, on average (8); net savings factors in total intervention costs over 3 years of 206319 $.
[b] Data are presented as total lifetime savings.
[c] Data are presented as net savings, which is equal to lifetime savings minus intervention costs.

program generates a 10% reduction in obesity, which corresponds to 120 HC2 participants avoiding the onset of obesity and carrying obesity into adulthood, lifetime savings would be of approximately 2.3 million dollars. Net savings (total lifetime savings minus intervention costs) would be 2.1 million $. A 5% reduction in obesity would generate 1.1 million $ in lifetime savings (933681 $ net savings), and a 1% reduction in obesity would generate lifetime savings of 228000 $ (21681 $, in net savings). The average (per child) net savings across all HC2 participants ranged from 18 $, if 1% of participants avoid obesity to 1728 $, if 10% avoid obesity.

5. Discussion

Healthy Caregivers-Healthy Children has already shown to be effective in a number of areas aiming to improving overweight and obesity, like increasing consumption of fruits and vegetables and reducing sedentary behavior among children and parents. The HC2 intervention was designed with sustainability in mind, by targeting the "nutritional gatekeepers" in addition to the children themselves. Specifically, the HC2 program is consistent with the US Department of Agriculture's concept of the nutritional gatekeeper and the Project MOM campaign, which suggests that empowering the nutritional gatekeepers in both the home and the child care center will produce a lasting and effective impact on the health and nutrition of future adults. This is the first formal economic analysis of the HC2 intervention, which contributes to a sparse economic literature on obesity prevention initiatives, in early life stages. Cost results are presented for two distinct phases of the intervention (Year 1 and Years

2 – 3), as well as the total cost over the duration of the intervention and the annual cost per participant. The HC2 intervention costs 206319 $ over 3 years to impact 1200 preschoolers. Investing in the HC2 intervention would be cost saving, if the intervention leads to ≥ 1% of children (i.e. 12 out of 1200) avoiding obesity.

The projected cost savings from the HC2 intervention represent reductions in lifetime medical expenditures, when obesity is avoided. Preventing the onset of obesity impacts a number of other areas, however, that may very well translate into savings. The HC2 not only teaches the child about healthy eating and physical activity, it also teaches the parent or caregiver. Therefore, this behavior change has the potential to affect the entire family and produce long-term benefits on a broad scale. For instance, avoiding obesity can result in reduced absenteeism in the workplace which is perhaps, a consequence of taking time out of the workday to access medical care or taking time off due to extended periods of illness (10). An increase in worker productivity and a greater quality of life have the potential to lead to economic gains and savings as well (10).

Several limitations are noted. First, the cost estimates are based on aggregate annual costs, and it is not possible to provide confidence intervals or other measures of dispersion around the average cost per participant. Second, the potential savings are based on hypothetical projections of a percentage of participants avoiding obesity. For this reason, we used three conservative thresholds (1, 5, and 10%), which allowed us to examine under what circumstances the intervention would generate net savings. The estimate of lifetime medical costs associated with obesity is specifically linked to childhood obesity, which is the most appropriate estimate for this population. There are a number of other published estimates of both annual medical costs and lifetime costs of obesity; however, these are all based on adult populations aged 20 and older (9, 10, 18-20). Third, the intervention was conducted in schools with a higher proportion of minorities from low-income neighborhoods and may not be generalizable to families from different backgrounds. However, minorities and low-income individuals are the most vulnerable to preventable, chronic diseases, many of which are directly linked to obesity (21). Therefore, interventions like HC2 targeting ethnically diverse and low-income preschool-aged children are an important focus for additional effectiveness and cost effectiveness studies to build the evidence base on the impact and economic feasibility of implementing HC2 and similar interventions, on a broader scale.

Furthermore, studies show that those who are least able to afford care are disproportionately affected by obesity (22). Children who receive Medicaid benefits are six times more likely to be diagnosed with obesity than children with private insurance (22). Children who are obese and are insured by Medicaid are three times more expensive than the average insured child (22). This disparity has many economic consequences for the US government and presents multiple policy implications. Medicaid and Medicare incur 41% of cost attributed by obesity (23). Therefore, the government must identify obesity prevention programs that improve health outcomes at low cost (23).

Healthy Caregivers-Healthy Children is an early childhood obesity prevention initiative with moderate costs that can potentially reduce future medical care costs and loss of productivity costs, as a result of overweight and obesity. Overall, the HC2 intervention was found to impact a change in BMI percentile, over time, in this minority population. It also impacted the eating habits of children who are already obese and targeting this high-risk group is vital to curbing the obesity epidemic. With the incidence of obesity and overweight among toddlers and young children on the rise, programs targeting obesity prevention like HC2 that can be adopted in preschools and primary schools, as part of the standard curricula, show promise. The HC2 has shown to be effective in modifying and reinforcing healthy eating and activity habits in the home, at moderate costs. Given the limited and shrinking budgets at all levels of government for education and other services, it is imperative for programs to show they are economically viable over the long-term.

Authors' Contributions

Kathryn E. McCollister collected cost data, conducted analyses, and wrote the manuscript. Davina V. Tolbert assisted with background research, organized results of the cost analyses, and contributed to writing the manuscript. Subodh Mishra assisted with cost analysis and writing of the manuscript. Ruby Natale and Susan Uhlhorn assisted with cost data collection, reviewed cost analysis results for accuracy, and contributed to the writing of the manuscript. Sarah E. Messiah contributed to the writing of the manuscript and reviewed cost analysis findings to confirm accuracy.

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