Nemours Health & Prevention Services

The Need to Measure Effectiveness of Childhood Obesity Prevention Efforts: The Healthy Eating and Physical Activity Index

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Planting the seeds for better health

SUMMARY

1 More than a third of U.S. children are overweight or obese.[1] The number and type of initiatives focused on preventing childhood obesity have increased in the last decade as childhood obesity has become recognized as a major public health threat.

2 To reverse the epidemic of childhood obesity effective prevention strategies must be distinguished from those that are ineffective. It is difficult to measure the impact of obesity prevention initiatives focused on child behavior change. The ultimate goal is a reduction in obesity, measured by a reduction in Body Mass Index (BMI) in the child population. A necessary intermediate goal is a positive change in behaviors such as eating and physical activity. Any measure of factors influencing behavior change should account for the complex interplay of risk and protective factors among individual children, their families, community entities such as schools, and societal factors, such as access to sources of healthy food.

3 The Healthy Eating and Physical Activity Index (HEPA), recently developed by Nemours Health and Prevention Services (NHPS), uses statistical methods to aggregate a range of physical activity and healthy eating behaviors and the environmental supports for them (such as the walkability of a community or access to fresh fruits and vegetables).[2] The index is scored from 8 (most healthy) to 0 (least healthy). A score of eight indicates a high level of participation in the specified healthy behaviors. There is an association between a child's HEPA Index score and overweight and obesity in children aged 6 to 17. This initial finding points to the possibility of developing a similar index that would measure the impact of multi-sector interventions directed at the children in the younger age ranges, a project NHPS is currently pursuing.

4 The HEPA Index continues to be expanded and refined. It represents an initial and promising attempt to quantify the impact of prevention activities and to conduct rigorous evaluation in an arena in which it is scarce. The HEPA Index and similar evaluation efforts will be useful to groups whose programmatic work is based on the social ecological model, as described in this paper.

About Nemours Health and Prevention Services

Nemours Health and Prevention Services (NHPS) is a division of Nemours, one of the nation's largest pediatric health systems, operating the Alfred I. duPont Hospital for Children and outpatient facilities throughout the Delaware Valley and northern and central Florida.

The goal of NHPS is to drive long-term improvements in policies and practices that promote child health, and to leverage community strengths and resources to help children grow up healthy. One of our initial areas of emphasis is the prevention of childhood obesity through promotion of healthy lifestyles, the centerpiece of which is the *5-2-1-Almost None* prescription for a healthy lifestyle (visit **www.GrowUpHealthy.org** for details). NHPS is also launching a campaign to promote children's social and emotional health.

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Our Formula for a Healthy Lifestyle: 5–2–1–Almost None

Nemours is taking a leading role to help people understand the causes and health implications of obesity and the best ways to promote healthier lifestyles among children and families.

5-2-1-Almost None is our formula for a healthy lifestyle.

- Eat five or more servings of fruits and vegetables per day.
- Spend no more than two hours per day in front of a screen (TV, video games, recreational computer time).
- Get at least one hour of physical activity per day.
- Drink almost no sugary beverages like soda and sports drinks.

For more information about our work to make Delaware's Children the Healthiest in the Nation, visit: **www.growuphealthy.org**

By Vonna Drayton, Pat Redmond and Likun Hou

Background

More than a third of U.S. children are overweight or obese.[3] The human and economic impact in years to come for adults with obesity-related disease could be unprecedented if the epidemic is not halted. A tremendous amount still needs to be learned about the causes of obesity and about interventions that will be effective in combating the epidemic.

Among the critical tools needed to monitor and prevent obesity are reliable measures of obesity itself, and of factors that are predictive of obesity on a population level. Body Mass Index (BMI), calculated from weight in kilograms divided by height in meters squared, is considered the best available clinical tool to screen for childhood obesity and monitor progress with treatment.[4] BMI is also increasingly used in community settings, such as schools, to identify overweight or obese children and evaluate the effectiveness of healthy lifestyle initiatives.

Although percentiles of BMI for age and gender correlate with concurrent risk factors for chronic diseases (and future morbidity and mortality) and are useful in tracking prevalence, even population-level BMI data do not provide much of the critical information needed to test and evaluate prevention initiatives. This is because reduction in the prevalence of an unhealthy BMI among children is an *outcome* for which prevention initiatives are striving. There is a need to develop a measure to track the effectiveness of *interventions* designed to achieve this outcome.

NHPS has recognized the need for a tool to assess the organization's impact on targeted communities and monitor its work to change child behavior. Development of a measure to track the effectiveness of population-level obesity prevention initiatives is essential for the design of future initiatives, and will also allow for course corrections in current activities.

NHPS has short- and medium-term goals of increasing the number of families and children actively practicing healthy behaviors. Its long-term goal is to halt the childhood obesity epidemic in Delaware, as measured by a leveling off and eventual reduction in BMI among children age two through 17 years. The challenge facing NHPS is to understand the relationship between these goals. The HEPA Index was constructed to measure this relationship.

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Measuring the Impact of a Social Ecological Model of Intervention on Obesity

NHPS uses a four-level social-ecological model to develop and implement childhood obesity prevention strategies in local communities throughout the state of Delaware. NHPS is also conducting a social marketing campaign and advocates for public policy changes that support healthy eating and active lifestyles for children. The social-ecological model considers the complex interplay between individual children, their parents and/or caregivers, community entities such as schools and child care programs, and societal factors, such as the built environment and access to sources of healthy food. The social ecological approach explicitly acknowledges that the causes of obesity are multi-factorial.

By focusing on improving eating and physical activity practices in a wide variety of community settings, advocating for policy change and spreading motivating messages through social marketing, NHPS increases the chances that a given family will be exposed to the prevention initiative. Obesity prevention strategies include a continuum of activities that address multiple levels of the model as well as the focus on policy change. This approach is considered more likely to sustain prevention efforts over time than any single intervention.

The current version of the HEPA Index was constructed from the 2006 administration of the Delaware Survey of Children's Health (DSCH), an instrument developed by NHPS to track the obesity epidemic in Delaware and the impact of obesity-focused interventions. The Delaware Survey of Children's Health consists of a random-digit dialing survey of Delaware households with at least one child less than 18 years of age. Administered in 2006, the survey provides baseline surveillance data for monitoring the impact of NHPS interventions on family and child behavior as well as the prevalence of overweight and obesity. The survey includes questions on parents' and/or legal guardians' perceptions regarding health issues surrounding healthy eating and physical activity and the characteristics of their neighborhoods. For instance, questions include the following: "During the past week, on how many days did [selected child] exercise or participate in physical activity for at least 20 minutes that made [him/her] sweat or breathe hard?" "Overall, how would you rate your neighborhood as a place to walk?" "On an average [school day/weekday] how many hours does [selected child's] usually watch TV, watch videos, or play video games?"[5]

To measure the relationship between NHPS activities, behavior changes, and BMI, NHPS researchers narrowed the broad scope of the DSCH to focus on those factors most likely to predict BMI. The hypothesis underlying NHPS's surveillance and prevention efforts as well as the construction of the HEPA Index is that healthy eating, physical activity and community characteristics (such as safe places for walking) are more important *as a gestalt* than as individual factors.

A second hypothesis is that obesity prevention efforts will be enhanced if the impact of the gestalt can be broken down into its strongest components and communicated to policy makers. Ultimately, the index and the prevention efforts it is measuring are attempts to discover which combination of interventions are most effective at fighting childhood obesity in a community setting.

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A detailed technical paper describing the statistical methods used in the development of the HEPA Index and the variability of the index by age range is available from NHPS. Contact **vdrayton@nemours.org**

The Healthy Eating and Physical Activity Index

The index represents the number of factors most likely to have an impact on overweight and therefore suggests the complexity of the interventions that are needed.

INDEX	SCORE	REFERENCE
HEPA	0	Least healthy
	1	
	2	
	3	
	4	
	5	
	6	
	7	
	8	Most healthy

The HEPA Index Calculation

NHPS scientists selected questions from the DSCH that were measures of *5-2-1-Almost None* behaviors within each level of the social ecological model and, using factor analysis techniques, condensed the large number of questions into a smaller group of factors that were used as meaningful measures for additional analyses, and to construct the index.[6] Because the DSCH samples for county by age did not provide an adequate sample size for the age group of two to five for each county, detailed analyses were conducted at the county level on the six through seventeen age group only.

A total of fourteen factors were first identified from the factor analyses and then narrowed to eight. The original fourteen included:

1. fruit and vegetable consumption
2. screen time—TV
3. screen time—computer
4. child physical activity
5. sugar sweetened beverage consumption
6. parent support of physical activity
7. school lunch
8. school physical activity
9. school vending machine
10. promotion of healthy eating and physical activity in the primary care setting
11. access to fruits and vegetables within the community
12. community support for healthy lifestyle behaviors
13. access to physical activity within the community
14. walkability of the community.

These fourteen factors were then analyzed using logistic regression models to determine which were most likely to be predictive of whether a child is overweight and/or obese (BMI ≥85th percentile). Eight factors—which would constitute the factors in the HEPA Index—were identified from these analyses: access to fruits and vegetables within the community; screen time—TV; parent support of physical activity; school physical activity; community support; access to physical activity in the community; walkability of the community; and primary care promotion of healthy eating and physical activity.

These factors cut across the levels of the social ecological model and cover the *5-2-1-Almost None* behaviors except for sugar-sweetened beverage consumption. Notably, this does not mean that sugar-sweetened beverage consumption does not exert a critical effect on body weight, but only two questions were available to construct the factor, which may have weakened the strength of the factor in the analysis. The eight factors were significantly associated with the likelihood of a child's overweight and, therefore, added to derive the HEPA Index.

The HEPA Index has a range of 0 to 8. A score of 0 would mean the sum of all the factors was 0, and represents an unhealthy score; a score of 8 would mean that all factors scored 1 for a total sum of 8, or healthy. The index represents the number of factors most likely to have an impact on overweight and therefore suggests the complexity of the interventions that are needed.

A child aged 6 to 17 who scores 8 (most healthy) would have demonstrated low use of screen time on the television and high environmental support for healthy eating and physical activity, as shown in the figure below. The average child in Delaware has a HEPA Index score of 5.

The Healthy Eating and Physical Activity Index

Factors Reflected in A HEPA Index Score of Eight

HEPA Initiative	HEPA Factors
Family/child	"Low" Screen Time — TV
	"High" Parent Support of Physical Activity
Environmental Support	"High" School Physical Activity
	"High" Community Support for HEPA
	"High" Access to PA in Community
	"High" Walkability of Community
	"High" Access to Fruits and Vegetables
	"High" Primary Care Promotion of HEPA

Of all the *5-2-1-Almost None* behaviors promoted as part of NHPS' healthy lifestyle modification program/practice, only screen time was found to be significantly associated by itself with overweight and obesity. The risk of a child age 6-17 being classified as overweight (BMI ≥ 85th percentile) was double for children who watched two or more hours of television per day compared with those who watched less than two hours. This finding is consistent with the existing literature showing significant association between TV viewing and overweight attributable to increased energy intake as well as decreased physical activity.[7,8]

The HEPA Index is associated with overweight for children in the 6 to 17 age range. This is an important finding. The HEPA Index is guiding NHPS in its program evaluation and refinement.

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The Healthy Eating and Physical Activity Index

Development of the HEPA Index is a continuous process, which will be refined with different questions and measures as they become available in coming years. It represents an initial and promising attempt to quantify the impact of prevention activities and to focus attention on the possibility of conducting rigorous evaluation in an arena in which it is lamentably scarce.

The Significance of the HEPA Index

As currently constructed, the HEPA Index is associated with overweight for children in the 6 to 17 age range. This is an important finding. It suggests the possibility of developing a tool that can be used to guide program development. Prevention initiatives need to be designed to reflect the best available evidence regarding effectiveness. The HEPA Index is guiding NHPS in its program evaluation and refinement for children 6 to 17. It also points to:

- The ability to measure the impact of a complex obesity prevention initiative; and
- Potential for developing an index along similar lines to measure the impact of interventions directed at children from birth to 5 years of age.

Perhaps most importantly for NHPS' efforts, initial findings from the HEPA Index suggest that:

- Several risk factors in the child's social ecology could increase the likelihood of overweight/obesity as measured by BMI ≥ 85th percentile.
- A social-ecological campaign to promote healthy eating and physical activity may be successful in leveling or lowering the overweight trajectory of Delaware's under 18 population.

The index has limitations. As noted, longitudinal data are not yet available and predictive validity has therefore not been established. Some important aspects of a healthy lifestyle for obesity prevention are not addressed in the DSCH; others, such as sugar sweetened beverage consumption, were not significantly associated with overweight and obesity in all age groups. It is currently unclear why the index as outlined here is not associated with overweight for children in younger age ranges and additional analyses are in progress. The DSCH uses the best available measures to assess child and caregiver awareness; however the DSCH as an instrument has not been validated.

Development of the HEPA Index is a continuous process, which will be refined with different questions and measures as they become available in coming years. It represents an initial and promising attempt to quantify the impact of prevention activities and to focus attention on the possibility of conducting rigorous evaluation in an arena in which it is lamentably scarce. Ultimately, the HEPA Index and similar efforts are critical steps to measure the effectiveness of interventions in overcoming an extraordinarily complex public health crisis.

The Healthy Eating and Physical Activity Index

RECOMMENDATIONS

1 Leaders in obesity prevention across the country should share emerging strategies for distinguishing effective from ineffective programs where multi-sector interventions are being employed. The HEPA Index is one such tool; others should be made available to public health practitioners and researchers in order to encourage the development of an evidence base for childhood obesity prevention.

2 Public and private sector funders of childhood obesity prevention initiatives should support the development of effective measurement tools in the field.

3 Childhood obesity prevention initiatives should incorporate emerging evidence about the effectiveness of various strategies into decisions regarding their programs and practices.

Nemours Health & Prevention Services

252 Chapman Road,
Christiana Building, Suite 200
Newark, Delaware 19702
302.444.9100 • 888.494.5252
nhps_info@nemours.org
www.GrowUpHealthy.org

Notes

1. Ogden CL, Carroll MD, Curtin LR, McDowell MA, Tabak CH, Flegal KM. Prevalence of overweight and obesity in the United States, 1999-2004, Journal of the American Medical Association, 295: 1549-1555. At the time these data were published, the old classification for overweight was in use. Individuals with a BMI equal to or greater than 85 percent and less than 95 percent were classified as "at risk for overweight" and individuals with a BMI equal to or greater than 95 percent were classified as "overweight." Based on the 2007 recommendations released by a national Expert Committee made up of representatives from 15 professional organizations, NHPS describes the previous category of "at risk of overweight" as "overweight" and those previously referred to as overweight are described as "obese."

2. NHPS gathers this data using a household telephone survey, The Delaware Survey of Children's Health.

3. Ogden et al.

4. Barlow SE & the Expert Committee. Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary Report. Pediatrics, 120, S164-S194.

5. Different questions were applied to children below age 6 and those in the 6-17 age range.

6. See 2006 Delaware Survey of Children's Health Technical Report for information regarding the statistical methods used in the analysis.

7. Progress in Preventing Childhood Obesity: How Do We Measure Up?, *Institute of Medicine*. 2006. http://www.iom.edu/Object.File/Master/36/984/11722_reportbrief.pdf Accessed September 28, 2007.

8. American Academy of Pediatrics, Committee on Public Education. Children, Adolescents and Television. *Pediatrics*, 200;1107:423-426.