

PowerPlay

POST-VISIT

Body Mass Index (BMI)

Students investigate how Body Mass Index (BMI) values are calculated and how the information can be used in research.

TIME

Two 45-minute class periods

M A T E R I A L S

PER STUDENT

- CDC's Child and Teen BMI Calculator (<http://apps.nccd.cdc.gov/dnpabmi>) and CDC's Children's BMI Tool for Schools (http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/tool_for_schools.html)

Note: If you do not have Internet access, see "Explore," item 4 on page 2.

- Computer with Internet access
- Student worksheets

During their visit to the PowerPlay exhibit, students were asked to measure their body weight and height. But accurate measurements are just one part of an investigation. The ability to interpret and make sense of the information gathered is at least as important. This skill requires careful examination and analysis of data, and a capacity to draw solid conclusions based on the evidence available. In this activity, students will calculate body mass index (BMI),

using measurements of height and weight for six different fictitious individuals. Although BMI is not a direct measure of body fatness, it is a fairly reliable indicator of a person's fat levels, and an elevated BMI can be a sign of future health risks. BMI can be measured in children (aged 2–19), but is interpreted differently for girls and boys of different ages. In addition to calculating their own BMI, students will use data from the Centers for Disease Control and Prevention (CDC) to draw conclusions regarding obesity in the United States.

Results from the 2007–08 National Health and Nutrition Examination Survey, using measured heights and weights, indicate that approximately 17% of US children and adolescents aged 2–19 years are obese. Obese children have an increased risk of heart disease caused by high cholesterol and high blood pressure, Type 2 diabetes, asthma, sleep apnea, and social discrimination.

For additional information, see the following pages on the CDC website: "Overweight and Obesity" (cdc.gov/obesity) and "Make a Difference at Your School" (cdc.gov/healthy-outh/keystrategies/index.htm).

According to the World Health Organization, health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.

TEXAS ESSENTIAL KNOWLEDGE AND SKILLS (TEKS) OBJECTIVES

SCIENCE

2. B; 4. 2. A-F; 5. 2. A

Collect and record data by observing and measuring, using the metric system, and using descriptive words and numerals. Measure, compare, and contrast physical properties of matter, including size.

3. 4. A; 4. 4. A; 5. 4. A

Students know how to use a variety of tools, materials, equipment, and models to conduct science inquiry by collecting, recording and analyzing information using tools while using appropriate safety equipment.

HEALTH

3. 1. A; 4. 1. D,F; 5. 1. E

Students will recognize and explain ways to enhance and maintain health and recognize and perform behaviors that reduce health risk throughout their lifespan.

3. 11. F; 4. 11. B; 5. 9. D-E

The student recognizes critical-thinking, decision-making, goal-setting, and problem solving skills for making health-promoting decisions.

ENGAGE

1. Ask students to define the word, "healthy." Follow by asking, *What determines if a person is healthy? Can our weight influence our health?*

BCM
Baylor
College of
Medicine

- 2. Divide the class into groups of four and have each group compile a list of reasons for being overweight. Every student should provide at least one reason. Record group lists on the board.

EXPLORE

1. Healthcare providers and scientists use a measure, called the Body Mass Index (BMI), to help determine if a person is underweight, normal weight, overweight or obese.
2. Explain that BMI is a fairly reliable indicator of body fatness for most people.
3. Tell students that they will need the following information to determine BMI: weight (pounds or kilograms), height (inches or centimeters), gender (male or female), and age. Students will load these data into the CDC's Child and Teen BMI Calculator (<http://apps.nccd.cdc.gov/dnpabmi>) to determine the BMI for the six individuals listed on the student sheet.
4. If you do not have Internet access, or wish to have students calculate BMI values themselves, use one of the formulas below.

- **English Units (pounds and inches):**
BMI = [weight / (height x height)] x 703
- **Metric Units (kilograms and meters):**
BMI = [weight / (height x height)]

5. Have students calculate the BMI values as a group project or a full class activity. Be sure that students record the BMI value and the Weight Status (underweight, normal, overweight or obese) for each child.

BMI	WEIGHT STATUS
Below 18.5	Underweight
18.5 – 24.9	Normal
25.0 – 29.0	Overweight
30.0 and above	Obese

EXPLAIN

1. It is possible for one person to be more or less healthy than another person of the same height, weight and BMI. For example, have students discuss how the following factors might influence a person's health.
 - Smoking
 - Eating foods high in fats
 - Exercise
 - Disease
 - Age
3. Ask students, *How were BMI values similar for the three boys and three girls listed on the student sheet? How were they different? What conclusions can you draw about the possible health of the six students, based on their BMI values?*
4. Lead a class discussion about the affects of different factors (e. g. , age, gender, genetics, level of physical activity, access to fresh and healthy foods, etc.) on a person's health.
5. Instruct students to create a T-chart with factors that can lead a person to become overweight on one side and factors that promote a healthier weight on the other side.

ELABORATE

Have students examine charts 1 and 2 on the student sheets and answer the questions below each. Discuss their answers as a class.

EVALUATE

Calculate the average height and weight for students in the class, and ask students, either individually or working in groups, to calculate the average BMI for the class. Conduct a discussion about the results. Have students come up with list of changes that people can make in their activities or diet to help improve a BMI that falls within the range of overweight or obese.

Funded by a Science Education Partnership Award (SEPA) R25RR022697, from the National Center for Research Resources, a component of the National Institutes of Health.

The activities described herein are intended for school-age children under direct supervision of adults. The authors, Baylor College of Medicine, the Children's Museum of Houston and funders cannot be responsible for any accidents or injuries that may result from conduct of the activities, from not specifically following directions, or from ignoring cautions contained in the text.



CALCULATING BMI LEVELS

BOYS

Boy 1

Height: 4 feet 8 inches
Weight: 90 pounds
Birth date: January 1989

BMI _____

Weight Status _____

Boy 2

Height: 3 feet 2 inches
Weight: 60 pounds
Birth date: March 1995

BMI _____

Weight Status _____

Boy 3

Height: 4 feet 0 inches
Weight: 90 pounds
Birth date: January 1989

BMI _____

Weight Status _____

GIRLS

Girl 1

Height: 4 feet 0 inches
Weight: 75 pounds
Birth date: January 1989

BMI _____

Weight Status _____

Girl 2

Height: 4 feet 2 inches
Weight: 60 pounds
Birth date: March 1995

BMI _____

Weight Status _____

Girl 3

Height: 4 feet 0 inches
Weight: 90 pounds
Birth date: January 1989

BMI _____

Weight Status _____

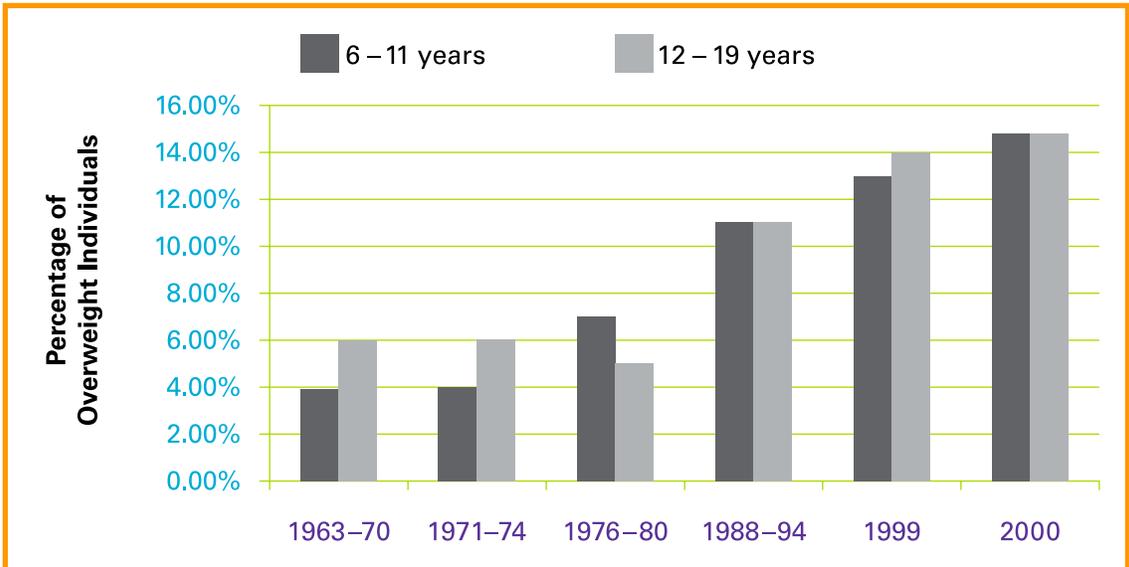
Question for discussion

How did the different BMI values compare?



CHART 1: BY AGE GROUP

Overweight Children in the United States by Age Group
(6 – 11 years of age and 12 – 19 years of age)



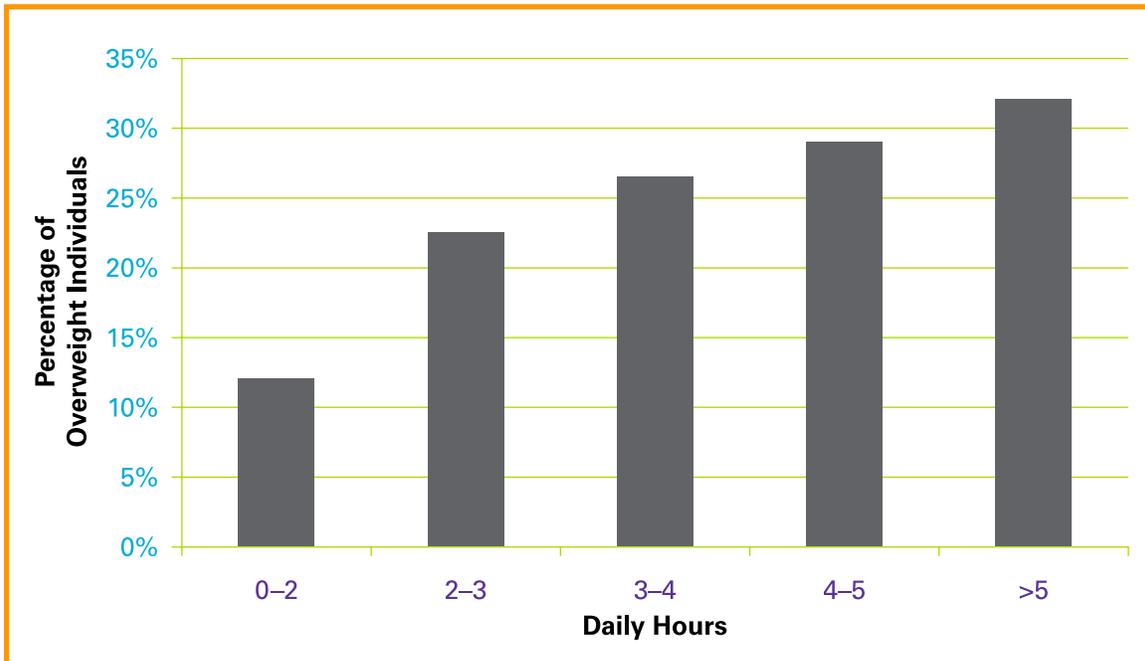
Prevalence of Overweight Among Children and Adolescents: United States, 1999-2000. National Center for Health Statistics, Centers for Disease Control and Prevention (www.cdc.gov).

1. Which age range is represented by the dark gray bars? The lighter bars?
2. How many years are covered by the data in this table?
3. What was the percentage of overweight children, aged 6–11, during 1963–70?
4. How do the percentages change for both groups of students between 1963 and 2000?
5. What do you think the chart would look like if it included data from 2009? Why?



CHART 2: EFFECTS OF TV

Hours of TV Watched and Percentage of Children Who are Overweight
(10 – 15 years of age)



Gortmaker SL, Must A, Sobol AM, et al. (1996). Television Viewing as a Cause of Increasing Obesity Among Children in the United States, 1986-1990. *Arch Pediatr Adolesc Med.* 150 (4):356-62.

1. Based on the information in the chart, who is more likely to be overweight: someone who watches two hours of television per day or someone who watches five hours of television per day?
2. Why might watching television make someone be overweight?
3. How can you reduce the amount of time your family watches television?

Teacher Tips

Follow these guidelines when your students visit the PowerPlay exhibit at the Children's Museum of Houston (CMH).

- Students must wear tennis shoes.
 - The CMH's PowerPlay exhibit is on three levels, connected by the Power Tower. Level 2 of the Power Tower is on the main entry level of the Museum. It is suggested that teachers have a chaperone on each level of the Power Tower or have a chaperone accompany each group.
 - An elevator for handicapped children is available (CMH guide will have key). It is suggested that you inform CMH officials about any special needs your students may have before you arrive at the museum.
 - Before your visit, help students understand the difference between heart rate while resting and after exertion, (see "Activity 3. Heart Rate and Exercise").
 - Also before your visit, explain to students that they will rate (on a 1–10 scale) the amount of effort they expend during some of the activities in the exhibit. This is known as "perceived exertion rate."
 - Ask the CMH guide for a "Kid Card" (Power Tracker) for each student. To set up a card, each student will need the information below before visiting the Museum (see "Kid Card" video). Please make sure your students are ready to enter the following information (or have a chaperone assist).
 - Username (numbers and letters only)
 - Password
 - Male or female
 - Birthday (numerical date)
 - E-mail (optional)
- As a final step, have students measure their baseline heart rates.

IDEAS FOR TEACHERS WITHOUT ACCESS TO THE CHILDREN'S MUSEUM OF HOUSTON

- Incorporate any of the lessons into your regular curriculum.
- Plan a special "field day" at your school. Prior to the event, conduct the Pre-visit lessons. After the event, use the Post-visit lessons.
- Create a classroom fitness plan that provides one month of activities. Help students plan a calendar with different fitness activities for each day.
- Participate in the President's Challenge for fitness (www.presidentschallenge.org).

Exhibit Key

	Cardiovascular	Strength	Flexibility	Balance
Power Tower: Climb, leap and jump in a 3-story climbing structure that takes you to other parts of PowerPlay.				
Dance Mania: Listen to music and follow along with different dance moves. Record your heart rate after you play.				
Match My Moves: Capture images of your own body in action and follow the poses you've set through a sequence of quick movements, testing your endurance and raising your heart rate.				
Light Chase: Race around an interactive game board, while increasing your speed and raising your heart rate.				
Jump It Up: Get your heart pumping as you jump over a glowing, virtual rope, which gets faster and faster the more you jump!				
Blast Off: Crank hand pedals as fast as you can to race flying superheroes across the exhibit.				
Adventure Course: Run through a course of climbing and crawling activities along padded, sloping surfaces! Slap each hand whacker along the way and record the level you achieve.				
Mt. Boulder: Face three challenges on a climbing wall and measure how far you've climbed, your grip strength, reach, flexibility and coordination.				
Grip It: Measure your grip strength and record this measurement using your Kid Card.				
Power Course: Grab a scoot and use your upper body strength to push or pull yourself along this wheelchair accessible course.				

© 2013 by Baylor College of Medicine
All rights reserved.
Printed in the United States of America.

ISBN: 978-1-888997-85-9

BioEdSM

**TEACHER RESOURCES FROM THE CENTER FOR EDUCATIONAL OUTREACH
AT BAYLOR COLLEGE OF MEDICINE**

CCIT The Center for Collaborative
and Interactive Technologies

The mark “BioEd” is a service mark of Baylor College of Medicine. The information contained in this publication is for educational purposes only and should in no way be taken to be the provision or practice of medical, nursing or professional healthcare advice or services. The information should not be considered complete and should not be used in place of a visit, call, consultation or advice of a physician or other health care provider. Call or see a physician or other health care provider promptly for any health care-related questions.

Development of PowerPlay educational materials was made possible by a Science Education Partnership Award (R25RR022697) from the National Center for Research Resources, National Institutes of Health. The activities described in this book are intended for school-age children under direct supervision of adults. The authors, Baylor College of Medicine (BCM), the Children’s Museum of Houston and the funding agency cannot be responsible for any accidents or injuries that may result from conduct of the activities, from not specifically following directions, or from ignoring cautions contained in the text. The opinions, findings and conclusions expressed in this publication are solely those of the authors and do not necessarily reflect the views of BCM, image contributors or the sponsoring agencies.

Cover photos and illustrations courtesy of the Children’s Museum of Houston.

Authors: Nancy P. Moreno, PhD, Barbara Z. Tharp, MS, and Sonia Rahmati Clayton, PhD

Designer: Martha S. Young, BFA

ACKNOWLEDGMENTS

The authors gratefully acknowledge the support and guidance of William A. Thomson, PhD, BCM Center for Educational Outreach, and C. Michael Fordis, Jr., MD, BCM Center for Collaborative and Interactive Technologies.

No part of this book may be reproduced by any mechanical, photographic or electronic process, or in the form of an audio recording; nor may it be stored in a retrieval system, transmitted, or otherwise copied for public or private use without prior written permission of the publisher. Black-line masters reproduced for classroom use are excepted.

Center for Educational Outreach, Baylor College of Medicine
One Baylor Plaza, BCM411, Houston, Texas 77030
713-798-8200 | 800-798-8244 | edoutreach@bcm.edu
<http://www.bioedonline.org> | <http://www.superstaar.org>

BCM[®]
Baylor College of Medicine



SEPA SCIENCE EDUCATION
PARTNERSHIP AWARD
Supported by the National Institutes of Health