What If a Disease…

• was declared pandemic internationally?
• affected children and adults?
• was directly related to comorbidities in children previously found mainly in adults?
• had a known cure, but the cure was not fully incorporated into the delivery of health care?
• did not have a well organized government intervention program.
• could be prevented but the people didn’t engage in preventive practices?
What If the Onset of This Disease Was Caused Primarily By...

- individual behaviors, or
- the local & state educational system, or
- the policies of local and state governments, or
- marketing efforts and practices of private or corporate food services?

What should you do? How would you help?

Some Ideas to Start

- Educate – individuals, families, others
- Motivate – individuals (behavior change)
- Activate – community resources
- Advocate – prevention in the public arena
INCREASED PREVALENCE OF CHILDHOOD OBESITY

• Heralded from the roof tops of national government for over 3 decades (healthy people 1979) and is now well known.
• Despite the awareness:
  – Obesity rate in children increased 2-3 fold over last 3 decades.

• Not just an American problem:
  – Childhood Obesity & CV Risk factors reported widely in literature from,
    • European,
    • Asian,
    • South American, and
    • African countries in addition to
    • other North American countries and,
    • Australia & elsewhere.
• Certain demographic groups
  – e.g., race, economic status, education level
  – tend to have higher rates of obesity, or, higher rates of specific risk factors

MORE IMPORTANTLY,

• ALL Children who are overweight or obese
  – Increased risk of cardiovascular disease when compared to their normal weight peers

Obesity Definitions

• Old \(^{(1)}\)
  – At risk for overweight
    • = 85\(^{th}\) percentile and <95\(^{th}\) percentile for
      – Sex- and age-specific body mass index (BMI)
  – Overweight
    • =95\(^{th}\) percentile for respective age- & sex-specific BMI

• Opinion: Confusing terminology, softened the seriousness of childhood obesity and related comorbidities
• New $^{(2)}$
  – Overweight
    • $= 85^{th}$ percentile and $<95^{th}$ percentile for
  – Obese
    • $=95^{th}$ percentile for respective age- & sex-specific BMI

• The new definitions should be our national definitions as of 2007. Old terminology still in literature.
• Not the only definition(s) in literature…
  •

• International Obesity Task Force (IOTF)
  – Defines overweight and obesity as;
    • Age- and sex-specific BMI measures that correspond to adult BMI measures of 25 and 30 kg/m$^2$, respectively $^{(3)}$
  – Obesity reported near the 97$^{th}$ percentile for age- & sex-specific BMI ~ adult BMI of 30.$^{(4)}$
  – May underestimate obesity vs. U.S. & U.K. definitions $^{(5)}$
    • useful for international comparisons
    • Not intended for clinical use
Current Child Obesity Rates

• Preceded by, and mirrors, rate in adults
• Recent NHANES suggests leveling off, but prevalence remains high & above national goals. (6, 7)
• Current CDC Reports of Obesity Rates\(^{(8)}\) are as follows:

• Adults (prevalence of obesity)
  – 6 states equal to or greater than 30%
  – 27 states equal to or greater than 25%
  – Only 1 state (Colorado) less than 20%
• Children (prevalence of obesity, new def)
  – 2-5 yrs of age: 12.4%
  – 6-11 yrs of age: 17%
  – 12-19 yrs of age: 17.6%
• Additionally, 25-29% of children are overweight (new def)
  – ~ 40% - 45% children overweight or obese
Healthy People 2010 Target Objectives for Obesity Rates\textsuperscript{(9)}

- Adults: 15%  
- Children: 5%

Recent CDC Featured Report\textsuperscript{(10)}

- Children with BMI > 95\textsuperscript{th} percentile

<table>
<thead>
<tr>
<th></th>
<th>Ages 6-11</th>
<th>Ages 12-17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>1976-1980</td>
<td>6.7</td>
<td>6.4</td>
</tr>
<tr>
<td>2005-2006</td>
<td>16.2</td>
<td>14.1</td>
</tr>
</tbody>
</table>

- Percentages for 6-11 age group (2005-2006) is lower than 2003-2004 data but still high compared to earlier data
COMORBIDITIES & RISK FACTORS RELATED TO CHILDHOOD OBESITY

• Short Term (for obese child or adolescent)
  – Psychosocial problems
  – Increased risk of asthma-like symptoms
  – Various orthopedic problems
  – Chronic inflammation
  – Type 2 diabetes mellitus
  – Increased blood pressure
  – Adverse lipid profile
  – Obstructive sleep apnea

• Short Term cont…
  – Abnormalities in left ventricular mass and function
  – Hyperinsulinemia/insulin resistance
  – Nonalcoholic fatty liver disease
  – Clustering of several of these factors

• Long Term (for adult who was obese as child)
  – Persistence of obesity
  – Social and economic disadvantage
  – Persistence of cardiovascular risk factors
  – Greater morbidity and,
  – Increased risk of premature mortality
Out of the Forest

• Important to note that obesity is associated with numerous poor health and quality of life measures – even in childhood.
• Focus of the following section will be on cardiovascular risk factors related to childhood overweight & obesity

Article Review
Freedman et al., 2007

• 5-17 yr olds, n=2392, tracked into adulthood
• For obese children:
  – 70% one CVD risk factor (rf), 39% two or more
  – As BMI increased from 95th P to 99th P
    • % with one rf increased from 52% to 87%
    • % with two or more rf rose steadily from 21% to 87%
    • % of children obese as adults increased as BMI category increased; 90th-94th, 64%; 95th-98th, 84%; and ≥99th, 100%.
• If BMI <85th P, multiple risk factors =9%
Article Review
Freedman et al., 2009(13)

- Risk factors comparable with either BMI or skinfold thickness measures of adiposity
- Proportion of children with a CVD risk factor
  - 2-5 times greater if BMI =95th P vs. =50th=84th P
- Prevalence of CVD risk factors fairly stable if BMI<84th P with notable increase if BMI=85th P

Take Home Message from Articles

- CVD risk factors such as those related to cholesterol and blood pressure abnormalities or diabetes are present to a greater extent in overweight and obese children.
- The prevalence of these risk factors increase as adiposity increases within obese population
- The likelihood of carrying adiposity and CVD risk factors into adulthood increases as childhood adiposity increases.
Brief look into Select Risk Factors

<table>
<thead>
<tr>
<th>INCREASED CV RISK FACTORS FOR OBESE CHILDREN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipid Abnormalities</td>
</tr>
<tr>
<td>Blood Pressure Elevation</td>
</tr>
<tr>
<td>Impaired Glucose or Insulin Regulation</td>
</tr>
<tr>
<td>Arterial Abnormalities</td>
</tr>
<tr>
<td>Metabolic Syndrome</td>
</tr>
<tr>
<td>Carry-over Into Adulthood</td>
</tr>
</tbody>
</table>
Lipid/Cholesterol Abnormalities

- Higher triglyceride levels in children who were obese vs. normal weight (16, 14)
- Low HDL Cholesterol (obese vs. overweight & normal) (14)
- Odds ratio for abnormal lipid profile for those with BMI >85th P ranged ~ 9-15 vs. <85th P
  - Significant correlations between anthropometric variables and all lipid profile measures. (17)

Cont...

- 22.3% of children who were obese had dyslipidemia (11)
  - Authors’ note CVD risk factors worsened at onset of puberty and improved in late puberty in children who maintained weight status.
- Children who were obese had higher triglyceride levels and lower HDL levels than their overweight peers (15)
- Children with BMI 85th to =95th P were 2-3 times more likely to have high triglycerides and LDL cholesterol and low HDL cholesterol. (13)
Lipid Summary

• Lipid abnormalities exist in children who are overweight or obese
  – High triglycerides and LDL, low HDL
• Occurrences increase above BMI 85\textsuperscript{th} percentile.
  – Further increases when BMI >95\textsuperscript{th} percentile
• Possible changes from childhood into puberty
  – Possible improvement for those who do not increase BMI during this phase

Blood Pressure Abnormalities

• SBP\textsuperscript{(19)}
  – Odds of elevated SBP 2.9-3.6 times higher in children who are overweight vs. normal weight
    • Higher among Hispanic boys vs. White > Black after adjusting for BMI
      – No race differences found in girls.
    • Odds slightly higher in adolescents than children
• DBP
  – Odds of elevated DBP 1.6-2.6 times higher in children who are overweight vs. normal weight
    • Boys after BMI adjustment: Hispanic>Black>White
      – No race differences found in girls
• Kovacs et al., 2009; n=3,678\(^{(20)}\)
  – SBP higher in boys with abdominal obesity vs. those with normal waist circumference both in normal and in overweight BMI categories.
    • DBP – similar to above for both boys and girls
  – Children who were obese with abdominal obesity had higher prevalence of prehypertension and hypertension than overweight peers.
  – Abdominal obesity in children was:
    • 3.7% normal weight
    • 51.7% overweight
    • 89.9% obese

• Zhao, et al., 2009, n=3,409 \(^{(21)}\)
  – Descriptive for BP
    • Normal BP & BMI, n = 2185
    • PreHTN/HTN & Normal weight, n = 626
    • Overweight (OW) or Obese (OB), n = 272
    • OW/OB & preHTN/HTN, n = 326
  – 55% of the OW/OB group had abnormal BP
BP Summary

- BP abnormalities exist in children who are overweight or obese
- Occurrence of these abnormalities is much greater:
  - As the level of obesity increases
  - If abdominal obesity is also present
- Occurrence is likely greater:
  - In boys
    - Culture/Race equivocal in obese population

Risk for Atherosclerotic Cardiovascular Disease

Overview (23, 24, 25, 26, 28, 30)

- Focus on carotid intima-media thickness as one measure of atherosclerotic risk and predictor of future vascular problems.
  - Other risk factors usually included
- Agreement that risk exists if childhood BMI high
Cont…

- Children with high BMI have increased measures of arterial intima-media thickness, inflammatory markers, etc…
  - Obese = Overweight > Normal weight
- Risk more dependent upon childhood obesity carrying (tracking) into adulthood
  - Children of normal weight that are obese as adults have same risk as obese-obese.
    - Obese-normal similar to Normal-normal
- Importance of addressing obesity, and other risk factors, BOTH in children and adults.
  - Especially, preventing obesity tracking into adulthood.

Glucose/Insulin Regulation Impairment

- Prevalence highest among those with BMI >95th percentile (17)
- Significant fasting glucose elevation present early childhood (Tanner stage 1)
  - Normal BMI < Overweight BMI < Obese BMI
- Insulin resistance measures greater among those with BMI =95th P vs. normal (<85th P) (16) & vs. those with overweight BMI (15)
- Increased impairment notable beginning at BMI =85th percentile (13)
Metabolic Syndrome

From Steinberger et al., 2009 (27)

- Combination of: Obesity (especially central) and abnormal glucose, lipid, cholesterol, insulin & blood pressure regulation.

- Recent working definitions from International Diabetes Federation vary by age (6-10; 10-16; & >16) – common factor is obesity in definitions from multiple organizations.
  - Insulin resistance is closely related but not necessary for metabolic syndrome.

- Reports on prevalence in child populations varies from 4.2% to 23%

Cont…

- Prevalence in population of children who are overweight and obese ranges from 5.6% to ~50%
  - Prevalence increases as obesity increases(12, 15)

- Excerpt from Holst-Schumacher et al.(15):

  “Compared with boys, girls were more sedentary and had higher insulin levels … Obese children had significantly higher mean serum concentrations of insulin, hs-CRP, and triglycerides and higher insulin resistance … than overweight children, but lower mean serum levels of HDL cholesterol. … Children with metabolic syndrome had significantly higher body mass indexes, glucose levels, and triglyceride levels and lower HDL cholesterol levels than children without metabolic syndrome.”
Overall Risk Factor Summary

- Prevalence of cardiovascular disease risk factors increase as BMI increases in children.
- Risks for children who are obese always greater than those of normal weight
  - Often greater than those with overweight BMI
- Risks for children who are overweight sometimes greater than those of normal weight
- Likely that childhood risks will lead to adult risks (events?), especially if childhood obesity tracks to adolescence & adulthood.\(^{(5, 28, 29)}\)

Recommendations

- Two Intervention approaches.
  - Reduce weight in children who are obese - behavioral interventions.
  - Promote healthy behavior and activity in children who are overweight.
- Not all overweight or obese children become overweight/obese adults.
  - Likelihood increases if childhood obesity is carried into adolescence.
PARENTAL PERCEPTIONS & INFLUENCES

• Do parents realize that their child is overweight?
• Do parents understand the link between overweight/obesity and risk factors for poor health?
• Do parents influence the activity levels of their children?
• What are other influences on activity levels of children and adolescents?

Parental Perceptions of Obesity
Two Recent Reviews
Towns & D’Auria, 2009(31) and ;
Doolen et al., 2009(32)

Coverage of articles published before early 2006
• Parent participation is mainly from mothers
  – Fathers, few studies mentioned
    • Not as good as moms in identification?
    • Parental behavior & family environment strong influence
• Parents have poor perception of child’s weight status and poor understanding, or concern, of health risk of overweight/obese child.
  – Common theme
• Parents of children who are overweight or obese are more likely to misclassify their child than parents of children with normal weight status.
  – 60-98% misclassification; ~70-98% unconcerned
  – Likelihood of misclassification and lack of concern increased if at least one parent was overweight or obese
  – Concern and correct classification increased for both mom and dad if family history of diabetes or cardiovascular disease

• Implications from both reviews:
  – Parents are main change agents in child and adolescent obesity issues
  – Parents must be motivated to make changes
    • Family activity
    • Household practices
  – Majority of - most parents not aware, therefore may not be ready for change in family practices or environment
  – Parents who perceive weight - health problem more likely to implement changes
Child Perceived as Obese?
Recent Investigations

• Parents with overweight or obese children:
  – 30 – 40% correctly identify child’s weight status\(^{(33, 34)}\)
    • Improves as child gets older\(^{(33)}\)
  – ~80% of mothers misclassify their child lower\(^{(34)}\)
    • Mom who is overweight or obese increases risk of misclassification
    • If child is also overweight or obese, risk of misclassification increases further
  – 18-26% recall a doctor stating concern about child’s weight\(^{(35)}\)

Overview of Other Articles
2006-2009\(^{(36 – 57)}\)

• General support and confirmation of previous articles for preschool-aged, children (5-11), and adolescents (12-17).
• Further investigations into reason’s for misclassifications
  – Cultural (regardless of race)“healthy baby/child”, acceptance of “plump” “thick” “feel good = healthy”, economic & food security of home, education level of parent, emotional intensity of mother toward weight & disease.
Cont…(36-57)

- Doctor’s perceptions:
  - Share misperceptions with patient’s and parents but are more accurate in classifying weight status
  - Are aware of obesity issues and health implications (70-89%).
  - Believe interventions will fail (82%)
  - <50% report managing obesity is gratifying
  - Parental communication disconnect with clinician
    - Better to focus on good health rather than weight
  - Overweight parents with overweight child report poor advice on nutrition and physical activity vs. parents of obese

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Parental Influences on Activity


- Children (ages 4-12)
  - Parental physical activity (boys)
  - Parental support

- Adolescents (ages 13-18)
  - Parental education
  - Family influences
  - Mostly self attitude/beliefs /goals, PE/sports involvement, and friend support
Cont…

2007 Longitudinal (retrospective?) (13,246 adolescents 1995 & 1996 follow-up)(59)

Males more active than females, no racial differences

Positive Influences

• Family cohesion
  – “understand them”, “have fun together”, “pays attention to them”

• Child-parent communication
  – Life-related talks in recent 4 weeks

• Parental engagement
  – Number of activities involved in last 4 weeks
    • Religious/church, shopping, playing sports, concerts, school project, evening meals at least 5 days/week

Cont…

2008 Longitudinal-prospective data collected in 1998-9 with follow-up 5 years later (2,516 adolescents in middle school or high school)(60)

Positive Influences

• Parental (mom & dad) encouragement to be active
  – Most influential variable
  – Trends for same-sex parent being more influential

• Paternal care for staying fit
  – Significant for all males, trend for older girls

• Strategies for decreasing sedentary behavior need to be different than those increasing moderate to vigorous physical activity
Other Influencing Factors

Sallis et al., 2000(61)

• Review of 108 studies
  – Relationships to activity coded +, -, ?, O
  – 40 Variables for Children (54 studies out of 102)
  – 48 Variables for Adolescents (54 studies)
  – Demographic/biological, psychological, behavioral, social, and physical environment categories for variables

Cont…(61)

• Children (4-12 yrs)
  – (+) boys more active than girls, overweight parents, preference & intention to be active, healthy diet and previous activity, access to facilities & programs, time spent outdoors,
  – (-) perceived barriers
  – (?) Self-efficacy, perceived competence, attitudes, parental physical activity, parent participation in child’s physical activity
Cont…(61)

- Adolescents (13-18 yrs)
  - (+) boys more active than girls, non-Hispanic whites > other ethnicities, achievement orientation, sensation seeking, previous physical activity, participation in community sports, parent & significant other support/help, sibling activity, opportunities to exercise
  - (-) age, depression, sedentary behavior after school and on weekends
  - (?) Self-efficacy, body image, attitudes, knowledge, enjoyment of physical activity

Answers to Questions

- Do parents realize that their child is overweight?
  - The majority do not, especially if OW / OB
- Do parents understand the link between overweight/obesity and risk factors for poor health?
  - Most do not. Those with FH of CVD or diabetes show greater understanding and concern
- Do parents influence the activity levels of their children?
  - Yes, to a large extent & in multiple ways
    - Encouragement, family environment of support & facilitation, (modeling?).
- What are other influences on activity levels of children and adolescents?
  - Multiple factors depending upon age and sex(61)
COMPONENTS OF SUCCESSFUL PROGRAMS

Use of multiple approaches including\(^{(62)}\):

- Nutrition
- Physical Activity
- Public Health Prevention and Health Services
- Built Environment
- Promoting Human Capital

COMPONENTS Cont\dots\(^{(5)}\)

Good evidence for addressing behaviors related to child obesity & CVD risk with:

- Diet/Nutrition
- Physical Activity
- Reducing Sedentary Behavior

With the use of:

- Behavioral Change Methods
- Inclusion of the Family

In an Environment that Includes:

- FUN!! \(^{(me)}\)
- Socially Safe Interaction
- Ease of Access & Frequent Facility Use
Collaboration with:

• Non-professional
  – Health trainers, team leaders, parents, grandparents, community partners, community leaders, government/politicians, media

• Professional
  – Physician (pediatrician/family), nurse (school & non-school), psychologist, dietician, teachers, counselors, other public health professionals, University faculty (health, psychology, & exercise physiology/science)

Clinical Trials:
Some notes

• Large, clinic-center-university-community based investigations
• Vast use of resources
• Minimal, if any, significant positive physical outcomes
• Some positive behavioral outcomes
School-based Models: Some notes

See Cochrane review\(^{(63)}\)

- Some improvement in outcomes related to physical measures and reduction in TV-time
- No reduction in leisure time sedentary behavior or BMI
- Possible that improvement in specific groups masked by population responses?
- Large use of resources for schools

Community Based (non-school) Some notes

Social factors may be as strong or stronger than physical environment factors.

- Franzini et al., 2007\(^{(64)}\)
  - Network of parents who know each other and watch out for neighborhood children (collective socialization of children)
  - Social cohesion and informal control (collective efficacy)
  - Perceptions of neighborhood safety
  - Neighbors watching out for others (exchange)
- Rudolf et al., 2006\(^{(65)}\)
  - Friendships & feelings of acceptance by group and ability to be “normal”
Statewide  
(Arkansas & Act 1220)\(^{(66 \text{–} 68)}\)

- Multiple changes in schools & policies
  - Reporting of child BMI to parent
  - Removal/reduction of vending machines
  - District Nutrition & Physical Activity Committee
    - School district, parent, and community representatives
      - Review Nutrition and PA policies, procedures & curriculum
        “threads”, suggest changes, plan activities for students
- Very slight reduction in OW/OB in yr 3, then leveling of rate in subsequent years, no increase

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Example: Program Components  
Non-School Fitness Center Based

- Planned Exercise Programming (14 weeks total)
- Nutrition Education (Parents)
- Team “competition” & Fun Friday (compliance)
- Pre-participation physical by NEA Clinic M.D.
- Pre vs. Post Measures (weeks 1 & 16)
  - B.P. & blood
  - Anthropometric
  - Physical Performance
- Application followed by Interview
- N=29

Presented at CSM 2009.  
Farris, Taylor, Williamson, & Robinson.
Exercise Intervention

• Two Required Exercise Sessions per week
  – M-W or T-R
  – Fridays = fun: swimming, karate, hiking, cycling, rock climbing wall, skating, active games (eg, DDR, PS2 Gamebikes)

• One hour exercise sessions after school
• All exercise and activities led by Certified Personal Trainer with MS in Exercise Science
• Additional exercise monitors included PT & Exercise Science students

Exercise Intervention cont…

• Parent(s)/Caregivers Exercise Plan
  – Caregivers were encouraged to exercise for a “family lifestyle change”
  – All caregivers were offered a special discounted rate to the NEA Clinic Wellness Center
  – All caregivers were offered use of the running/walking track FREE of charge
Nutrition Education

• Nutrition Class topics
  Dietician lead; Mandatory for Parents
  – Basic Nutrition Overview
  – Label Reading
  – Managing Calories
  – Understanding Hunger
  – Quick, Healthy Meals
  – Best Choices for Eating Out
  – Best Choices for School Lunch
  – Review and Resources

Program Goals

• Introduce new games, sports and activities
• Embrace proper diet and regular exercise as a lifestyle
Program Goals cont…

• **Increase**
  – Muscular Fitness
  – Cardiovascular Endurance
  – Nutritional Knowledge
  – Self Esteem
  – Motivation to Live Healthier

• **Decrease**
  – Weight
  – Body Fat Percentage
  – BMI
  – BP
  – Cholesterol*
  – Triglycerides*
  – Negative Feelings Toward Proper Diet and Exercise

*Blood panel (pre & post) not required until Cohort 3. Voluntary in 2, justified mandate.

Procedures and Outcomes Discussion

• Large population-based
  – Return on investment, minimal
  – Physical Outcomes, minimal
  – Behavioral Outcomes, yes

• Focused, group-based
  – Utilizing multiple components of effective interventions fit to needs and goals of clients
  – Positive results for children (& their parents) who are overweight and obese; physical, behavioral, knowledge
    • Long-term & follow-up information needed
Final Quote

“The problem of physical inactivity is embedded in the social fabric of society.”(63)