Putting the Data Back: Managing Acuity Across Care Environments

THE IMPACT OF OBESITY AND METABOLIC SYNDROME

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Set the Stage

- 43 y.o. AA female with a BMI = 49
- Elective bariatric surgery – Roux-en-Y procedure
- PMH:
  - HTN, OSA, b/l knee OA, DM, GERD
- Medications/devices:
  - NSAIDs, metformin, insulin
  - CPAP
- Functional History
  - Independent ambulation short distances limited by knee pain; no assistive device

The Scope of the Problem

- What are the issues?
  - Non-communicable lifestyle-related conditions
    - Ischemic heart disease
    - Smoking-related conditions
    - Hypertension
    - Stroke
    - Cancer
    - Type 2 diabetes
- Most are preventable
- Starting to appear in children and adolescents
- The traditional medical model approach is clearly not working!
- Let's look deeper at the problem

Active Living?

- Key Facts – Sad hard truths!
  - At least 40% of adults and 80% of adolescents do not meet the Physical Activity Guidelines for Americans
  - Aerobic activities – at least 10 minutes at a time
    - Moderate: 2.5 hr/week (30 minutes 3x/week)
    - Vigorous: 1 hr and 15 minutes/week
  - Strengthening activities
    - At least 2 days/week
    - Include legs, hips, back, chest, stomach, shoulders, and arms

Lifestyle-related conditions

- Most are preventable
- Starting to appear in children and adolescents
- The traditional medical model approach is clearly not working!
- Let’s look deeper at the problem

Active living – How are we doing?

- Less than 4% of elementary schools, 8% of middle schools, and 2% of high schools provide opportunities for daily physical education.
- Only 13% of children walk or bike to school, compared with 44% a generation ago
- The average 8- to 18-year old is exposed to nearly 7.5 hours of passive screen time (e.g., television, videos, computers, smart phones, video games) every day.
Active Living?

- **Key Facts**
  - More than ¼ of trips made by car are within one mile of home
  - Physical activity levels are lower in low-income communities and among racial/ethnic minority children due in part to people feeling unsafe in their communities.
  - Activity levels decline with age, despite physical (e.g., falls prevention) and emotional (e.g., decreased levels of depression) benefits.
  - Physical inactivity is a primary contributor to 1/3 of the adult population being overweight or obese and one in six children and adolescents being obese.


Our New Epidemics

- **Obesity**
  - Type 2 Diabetes
  - We have to do something more proactive!!

Obesity

- **Definition:**
  - Excess body fat that contributes to numerous chronic diseases as well as early mortality and morbidity
    - In particular – visceral fat
  - 2 times age predicted body weight
  - When energy intake > energy output
  - "Bariatric medicine"


- **Complex multi-factorial disease**
- **BMI as the yard stick**
- **NHLBI and WHO classifications**

<table>
<thead>
<tr>
<th>Classification</th>
<th>BMI (kg/m²)</th>
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<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5 (&lt;17.5 = anorexic)</td>
</tr>
<tr>
<td>Normal</td>
<td>18.5-24.9</td>
</tr>
<tr>
<td>Overweight (preobese)</td>
<td>25-29.9</td>
</tr>
<tr>
<td>Obesity Class 1</td>
<td>30-34.9</td>
</tr>
<tr>
<td>Obesity Class 2</td>
<td>35-39.9</td>
</tr>
<tr>
<td>Obesity Class 3</td>
<td>&gt; 40 (morbid obesity)</td>
</tr>
</tbody>
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- **Additional Data Points (NHLBI)***
  - Abdominal circumference
    - Indicator of abdominal fat ⇒ independent risk predictor for type 2 DM, dyslipidemia, HTN, CVD, sleep apnea and gallbladder dx
      - Men > 40 inches
      - Women > 35 inches
  - Both BMI and abdominal circumference should be used in the initial evaluation

  - * NHLBI = National Heart Lung and Blood Institute of the NIH

Obesity

- **Fat Distribution**
  - Android or central obesity
  - Gynoid obesity
  - More weight above waist
  - More weight below waist

- www.lookfordiagnois.com
Predisposing Factors for Excessive Weight Gain

- Eating patterns
- Eating environment
- Food packaging (saturated fats, processed, high-glycemic carbs)
- Low BMR and temperature

Dietary induced thermogenesis
- Consuming food → increased energy metabolism because digestion, absorption, and assimilating nutrients
- Thermal affect is higher from protein and carbs than fat
  - Fat is stored at a lower metabolic cost than carbs or protein
  - A low carb diet is more successful in weight loss than a low fat diet.

Genetic influence
- Can lower the threshold for the development of obesity by 25%
- Normally, the "obese" gene in adipose cells creates the hormone leptin which is responsible for satiety
  - Leptin impacts on hypothalamus
  - Hypothalamus causes reduction or cessation of drive to eat
- A genetic mutation of the gene → decreased secretion of leptin
- Hypothalamus "under-assesses" the amount of adipose → increased urge to eat
- Supports theory that obesity is a disease and not just a psychological flaw or "weakness" that can be overcome with will power

Physical activity
- Time spent in physical activity is inversely proportional to body fat levels
- Physical activity increases the efficiency of the body's use of calories and reduces appetite

Energy Balance Concepts

- Homeostasis
  - Energy intake = energy expenditure
  - No change in body mass
- Negative energy balance
  - Intake < expenditure → decrease in body mass
- Positive energy balance
  - Intake > expenditure → increase body mass
  - Can lead to obesity
Obesity – Scope of the problem in adults

- Source: CDC
- 34.9% of US adults are obese and another 30% or more are overweight
- Annual medical cost of obesity in the US = $150 billion in 2010 US dollars; $1,429 higher per capita costs than those of normal weight

Incidence
- Non-Hispanic blacks 47.8%
- Hispanics 42.5%
- Non-Hispanic whites 32.6%
- Non-Hispanic Asians 10.8%
- Middle age: 39.5%
- Younger adults: 30.3%
- > 60: 35.4%

Obesity – Facts and Figures

- Non-Hispanic black and Mexican-American men with higher incomes are more likely to be obese
- Higher income women are less likely to be obese than low-income women
- Dramatic increase in the US from 1990 through 2010.
- No state met the Healthy People 2010 goal to lower obesity prevalence to 15%
- In 2000 no state had an obesity prevalence > 30%. In 2010, 12 states had > 30% prevalence

Obesity in Children (CDC)

- Obesity – BMI at or above the 95th percentile on the CDC BMI-for-age growth charts
- Ages 2-19 y.o. – 17% (12.5 million) are obese
  - Prevalence of obesity among children 2-5 y.o. has decreased from 15.9% in 2003-2004 to 8.4% in 2011-2012
- Racial disparities (2011-2012)
  - Hispanic youth – 22.4%
  - Non-Hispanic black youth – 20.2%
  - Non-Hispanic white youth - 14.1%
  - Non-Hispanic Asian youth – 8.6%

Obesity in Children

- Age disparities (2011-2012)
  - 2-5 y.o. – 8.4%
  - 6-11 y.o. – 17.7%
  - 12-19 y.o. – 20.5%
  - Obesity and extreme obesity among US low-income, preschool aged children went down for the first time in recent years.
However, “perception is reality...”

- 30.2% misperceived their weight status (9.1 million)
  - 76%: “about the right weight” when they were over or underweight
  - 22%: were of a healthy weight but perceived themselves as too fat or too thin
  - Higher among children than adolescents
  - Higher among overweight boys (81%) than overweight girls (77%)

Obesity

- Risk factors
  - Sedentary lifestyle
  - High glycemic diet
  - Underlying illness (hypothyroidism, polycystic ovary syndrome)
  - Genetic disorders
  - Medications (corticosteroids, antidepressants, antihypertensives, anticonvulsants, diabetes meds)
  - Environmental or psychosocial/behavioral factors
  - Age
  - Lack of sleep
  - Smoking cessation
Obesity Complications

- Metabolic syndrome
- Type 2 DM
- Liver disease
- Osteoarthritis
- Sleep apnea
- CVD
- Stroke
- Asthma/COPD
- Cancer
- DVT/VTE
- Morbid obesity
- hypercapnea

Metabolic Syndrome

- A cluster of metabolic risk factors
- When present together, the risk of future cardiovascular disease is greater than any one factor presenting alone
- Also known as pre-diabetes, insulin-resistance syndrome or Syndrome X
- Prevalence = about 35% of adults (AHA) and increases with age
- Other higher risks
  - Type 2 DM
  - Stroke
  - Cause
    - Obesity
    - Overweight
    - Inactivity
    - Genetics

Metabolic Syndrome

- Three or more of the following clinical findings
  - Abdominal obesity
    - Men: AC > 40 inches; women: AC > 35 inches
  - Triglyceride level of ≥ 150 mg/dL
  - HDL < 40 mg/dL in men and < 50 mg/dL in women
  - SBP > 130 mmHg
  - DBP > 85 mmHg
  - Fasting blood glucose > 100 mg/dL
  - Insulin resistance or glucose intolerance
- Source: American Heart Association

Metabolic Syndrome – Additional Criteria

- A proinflammatory state: elevated C-reactive protein
- A prothrombotic state: elevated plasma plasminogen activator inhibitor and fibrinogen

Metabolic Syndrome

- The primary issue is insulin resistance
  - Created by the cytokines produced by visceral fat
- Results in hyperglycemia
  - More insulin is produced but to no avail
    - Glycogen has to be stored – Where??
    - Result???

Bariatric Surgery – A Growing Trend in the US

- Most effective weight loss and maintenance intervention for class III obesity
  - BMI > 40 or > 35 with life threatening or disabling obesity-related comorbidities
  - Must have failed nonsurgical weight-loss efforts
  - No surgical contraindications
  - Motivated
**Bariatric Surgery - Categories**

- **Restrictive**
  - Gastric banding
  - Decreases the size of the stomach but nutrients pass normally through the small intestine

- **Malabsorptive**
  - Bypasses part of the small intestine to limit absorption of nutrients

- **Combination**
  - Roux-en-Y procedure (RYGB) - 80% of procedures in the US
  - Considered the “gold standard”

**Roux-en-Y Procedure**

- Duodenum
- Jejunum

**Post-operative Management**

- **Dietary Restrictions with RYGB**
  - 12 weeks
    - Clear liquids progressed to full liquids
    - Pureed diet for at least one day
    - 3 months: multiple small meals (pureed to soft foods)
  - After 3 months
    - Regular diet with portions = 1 to 1.5 cups
    - If eat to much – vomiting and/or intense substernal pain
  - Malabsorptive issues
    - Iron, Vitamin B12, Vitamin D → Issues

**Post-operative Precautions**

- **Abdominal precautions – 4 to 8 weeks**
- **In general**
  - Log rolling
  - No lifting > 10 lbs
  - No bending more than 90 degrees at the hips
  - No Valsalva maneuver
  - Must use the abdominal binder

**Post-operative complications**

- **Vomiting – 1/3 to 2/3 of patients**
- **Dumping Syndrome – initially in 75% of pts**
  - From consuming refined sugar or energy-dense food
  - Abdominal cramping/pain
  - Tachycardia
  - Nausea
  - Tremor
  - Flushing
  - Lightheadedness
  - Syncope
  - Diarrhea
Post-operative Complications

- Ulnar neuropathy and/or brachial plexus stretch injuries
  - More common in obesity patients
  - Positioning during surgery
- Skeletal muscle atrophy with RYGB within 6 months
  - Due to rapid fat-free mass weight loss
  - Preventable with resistive and aerobic training

Programmatic Considerations

- Guide to Physical Therapist Practice patterns
  - Musculoskeletal
  - Cardiopulmonary
  - Integumentary
  - Neuromuscular
- Translates into impairments, activity limitations and participation restrictions
- ALL are involved in this population and have to be taken into consideration when designing successful physical activity programs

Musculoskeletal Considerations

- Back pain – linked consistently with morbid obesity
- Osteoarthritis
  - Work restricting pain
  - Knee OA but not hip or generalized OA
    - They try to protect their knees by walking more slowly
    - Poorer outcomes after total knee arthroplasty (TKA)
  - Biomechanical dysfunction of the hips, knees, ankle and foot
- ROM limitations in the LE especially the knees and hips
  - Why?
  - Hilton TN, Tuttle, LJ et al. PTJ 2008
  - Obesity + DM + neuropathy = increased intramuscular fat and lower > upper extremity weakness (especially knee extensors)
- One study found the 69% of 8-9 y.o. obese children needed assistance to rise from a chair.

Cardiopulmonary Considerations

- HTN
- Dyslipidemia
- Vascular disease
  - Arterial as well as venous
- T2DM
- Asthma
- Sleep apnea
  - Morbid obesity hypercapnia

Integumentary Consideration

- Skin tears
- Skin maceration because of multiple skin folds
- Difficulty in monitoring skin
- Skin "breakdown"
  - Mobility limitations
  - Circulatory compromise
Resetting the Balance

Energy intake → Energy Expenditure

Programmatic Considerations

- Tripartite approach
  - Dietary restrictions or changes
  - Physical activity
  - Medication for associated CVD risk factors and other system issues
- None of these will work in isolation
- Goal:
  - Decrease body weight by 10% in one year and maintain that 10% loss for one year.
  - High rates of recidivism without good follow-up
    - 33-50% regain initial weight within 1 year

NCEP-ATP III

- National Cholesterol Education Program – Adult Treatment Panel III
  - NHLBI of NIH
  - 3 interventions for obesity and metabolic syndrome
    - Moderate restriction in energy intake to achieve 5-10% weight loss
    - Moderate increase in physical activity (30 minutes most days)
    - Change in dietary intake composition and/or medication to change CVD risk factors

Exercise Testing

- Best to treat them as an individual with cardiovascular risk factors
- Start with a low initial work load
  - 2-3 METS
- Progress stages slowly
  - .5-1.0 MET/stage
- Be VERY vigilant about BP, HR, and RPE monitoring

Exercise Prescription

- FITT principle of Ex Rx
- Primary component = aerobic exercise to maximize caloric expenditure
  - Especially large muscle groups of the LE, UE, and core
  - Add in resistance and flexibility
  - SAID – Specific Adaptation to Imposed Demand

Aerobic Prescription

- The initial goal is moderate intensity
  - 50%-70% of Target Heart Rate
  - 150 minutes/week at least 5 days a week
  - For weight loss progress to 50-60 minutes/day > 5 days/week
  - The client may accumulate the minutes throughout the day
    - The goal is for longer bouts of continuous physical activity
Caloric Expenditures

- You have to do the math!
  - ACSM:
    - Minimum threshold to reduce fat and lose weight → 1000 kcal/week
    - \[
      \left[\text{METS} \times 3.5 \text{ ml O}_2/\text{kg/min x weight kg}/200\right] = \text{kcal/min}
    \]
    - Kcal/min x minutes/session x frequency (times/wk)
    - If less than 3x/week – no weight reduction
      - Goal is 5-7 days/week
    - 300 lb client exercising at 3 METS to start
      - What is the minimal duration and frequency?

Aerobic Exercise Progression

- If the client is asymptomatic progress to a more intense level
  - > 70% THR
  - The goal is caloric expenditure
- Weight Loss Maintenance
  - Progress to > 250 min/week with aerobic activity on 5-7 days/week

Resistance Training

- ACSM recommends lower resistance and increased repetitions with short rests
- Circuit training vs. traditional strength training because of caloric expenditure
  - [http://www.youtube.com/watch?v=kTJqboRkEX8](http://www.youtube.com/watch?v=kTJqboRkEX8)
  - Weight bearing exercises vs NWB exercises → greater improvements in functional mobility
  - Impact on balance?

Flexibility

- What would you perceive to be the challenges?
  - For the client
  - For the PT
- What strategies would you use to overcome the challenges

Potential Complications with This Population

- Onset of angina or myocardial infarction (MI)
- Excessive rise in BP
- Aggravation of OA
- Ligamentous injuries
- Injuries from falls
- Excessive sweating
- Dehydration → decreased blood volume
- Skin disorders/chafing
- Heat illness

Heat Illness - Dehydration

- Exertional heat muscle cramps
  - Abdomen, arms, legs
  - Begin as wandering spasms that can progress to debilitating cramps
  - Muscle fatigue, water and sodium loss
  - Core temperature: 98 to 104 deg F
- Action to take:
  - Rest
  - Prolonged stretching
  - Salt
  - IV fluids
Heat Illness

- Heat Syncope
  - Secondary to venous pooling
  - Sedentary and non-acclimated clients (first 4-5 days)
  - HR and RR are slow
  - Pale
  - "Weakness", vertigo, nausea, tunnel vision
  - Syncope
  - Action to take:
    - Rapid recovery once in supine
    - May take several hours for HR and RR to recover
    - Consider the environment

- Exertional Heat Stroke
  - Hyperthermia (> 104°F)
    - Risk with high intensity exercise when it is hotter than 82°F
    - Seen in inadequate fitness, adiposity, improper clothing, protective pads, incomplete acclimatization, illness or medication
  - CNS dysfunction
    - Disorientation, delirium, irrational behavior, unresponsive, convulsions, coma
  - Hypotension and tachycardia
  - Life-threatening medical emergency ➔ whole body cooling ASAP

Prevention Perspectives

- Population or public health initiatives
  - It is "modern industrial society, rather than individuals living in that society, that creates conditions that lead to heart disease, cancer stroke, and other major chronic diseases" (Bodenheimer)
  - Examples?
    - "Supersize me!"
      - Mayor Blumberg – what do you think?
    - Ease of ETOH access
    - Societal stress
    - Use of automobiles
    - Unequal distribution of wealth

- A partnership
  - Change high-risk lifestyles of individuals
  - Community-based interventions
  - Medical providers partnering with community members or agencies
    - Physical education
    - Water instead of sweetened beverages
    - Removal of candy machines in schools
    - Ban tobacco advertising to young adults

So, which is better?
So, which is better

- Good evidence that prevention saves billions of dollars as compared to the medical model of intervention
  - Could reduce the medical costs of heart disease, high cholesterol, and HTN by 50%!
  - Which do we choose?
    - Why?

The National Prevention Council

- The strength and ingenuity of America’s people and communities have driven America’s success. A healthy and fit nation is vital to that strength and is the bedrock of the productivity, innovation, and entrepreneurship essential for our future. Healthy people can enjoy their lives, go to work, contribute to their communities, learn, and support their families and friends. A healthy nation is able to educate its people, create and sustain a thriving economy, defend itself, and remain prepared for emergencies.

National Prevention Strategy

- Created by the Affordable Care Act
- Comprised 17 federal department, agencies and offices
- Aim is to move from “sick care” to wellness and prevention in order to
  - Lower health care costs for everyone including employers
    - Together, chronic illnesses (e.g., cancer, obesity, depression) cause Americans to miss 2.5 billion days of work each year, resulting in lost productivity totaling more than $1 trillion
  - Improve quality
  - Provide health care coverage options for the uninsured
- Go back to the determinants of health

National Prevention Strategy’s Vision

- Working together to improve the health and quality of life for individuals, families, and communities by moving the nation from a focus on sickness and disease to one based on prevention and wellness.
- The National Prevention Strategy’s overarching goal is to increase the number of Americans who are healthy at every stage of life.

National Prevention Council

- Four strategic directions
  - Healthy and Safe Community Environments: Create, sustain, and recognize communities that promote health and wellness through prevention.
  - Clinical and Community Preventive Services: Ensure that prevention-focused health care and community prevention efforts are available, integrated, and mutually reinforcing.
  - Empowered People: Support people in making healthy choices.
  - Elimination of Health Disparities: Eliminate disparities, improving the quality of life for all Americans
National Prevention Council

- Seven targeted priorities
  - Tobacco Free Living
  - Preventing Drug Abuse and Excessive Alcohol Use
  - Healthy Eating
  - Active Living
  - Injury and Violence Free Living
  - Reproductive and Sexual Health
  - Mental and Emotional Well-Being

NPC Recommendations

- Encourage community design and development that supports physical activity
- Promote and strengthen school and early learning policies and programs that increase physical activity
- Facilitate access to safe, accessible, and affordable places for physical activity
  - Safe Routes to School Project
    - Walk or bike
    - Reduction in traffic and pollution near the school

NPC Recommendations

- Support workplace policies and programs that increase physical activity
- Assess physical activity levels and provide education, counseling, and referrals

NPC Actions

- The Federal Government will:
  - Promote the development of transportation options and systems that encourage active transportation and accommodate diverse needs
  - Support adoption of active living principles in community design, such as mixed land use, compact design, and inclusion of safe and accessible parks and green space
  - Support coordinated, comprehensive, and multicomponent programs and policies to encourage physical activity and physical education, especially in schools and early learning centers
  - Develop and disseminate clinical guidelines, best practices, and tools on increasing physical activity and reducing the number of overweight and obese individuals.

NPC Partners

- State, tribal, local, and territorial governments
- Business and employers
- Health care systems, insurers, and clinicians
- Early learning centers, schools, colleges, and universities
- Community, non-profit, and faith-based organizations
- Individuals and families

The US National Physical Activity Plan

Ecological Model of Health Behavior

- http://www.acha.org/healthycampus/ecological_model.cfm
National Prevention, Health Promotion and Public Health Council