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Principles of Normal Growth and Development

Brent C. Williams, MD, MPH
Associate Professor of Internal Medicine
University of Michigan

Spring 2009
Outline

- Overview of course objectives, small group sessions and themes.
- Review principles of normal growth and development.
- Understand the demographic imperative of aging.
- Define life expectancy and life span.
Growth and Development Course
Objectives - 1

- Understand normal growth and development across the lifespan.
  - apply this knowledge in the approach to the patient

- Demonstrate knowledge of ways to optimize function for independent living.
  - nutrition
  - exercise
  - medications
Growth and Development Course
Objectives - 2

- Recognize and appreciate parallels at opposite ends of life span with respect to:
  - impaired homeostasis and limitations in functional reserve
  - functional assessment
  - vulnerable populations; role of psychosocial support / caregivers
  - Team care
GD Resources

-1-

Lecture presentations and handout materials on Course Tools web site.

Recommended reference:

» Nutrition in Primary Care.
» Deen and Hark
» Blackwell Publishing – 2007
» Chapters 1-10
GD Course Components

- General Lectures
- Age-specific
  - Lectures
  - Small Groups
- Nutrition session
  - Preparatory self-assessment exercise
- Multi-disciplinary conference
GD Requirements (1)

- Attendance required for:
  - Introductory lecture
  - 4 small group sessions.
  - Body composition / nutrition assessment session in Learning Resource Center.
  - Multidisciplinary conference
    » (Mon May 18; 10:00-12:00)
GD General Lectures

- Basic concepts
- Energy and Metabolism in Aging
- Pharmacology in Aging
- Biology of Aging
**Ages in the Life Span**

- Lecture + small group
  - Neonatal / Perinatal
  - School Age
  - Adolescent
  - Older Adult
Objectives for Small Group Sessions

• Characterize normal growth & development (e.g. body composition changes) across life span.
• Discover implications for approach to the patient history and physical.
• Present age-specific nutrition assessment: Anthropometry, Biochemical, Clinical, Dietary intake, Energy expenditure.
• Focus on primary prevention.
Objectives for Nutrition Segments

- Calculate BMI, BMR
  - Know norms
  - Apply in clinical practice
- Nutritional requirements (Cals// Prot/ Fat/Carbs)
- Pt’s experience of nutrition counseling
- Selected topics
- Demographics of obesity
Nutrition segments do NOT cover

- Detailed nutrition basics
- Motivational interviewing
- Nutrition Counseling
- Behavioral aspects of nutrition
- Causes of malnutrition (medical, socioeconomic)
GD Requirements (2)

**Nutrition Self-Assessment**
- Log food intake, calculate BMI, questions for reflection.
- Food log contents are known only to YOU – NOT turned in – for personal use only.
- DO turn in questions for reflection.
- If keeping a food log is deleterious to your health...
  - Email Virginia Uhley for alternate assignment or any questions or concerns.
  - Contact class counselor or class representative.
  - Contact Williams at any time, for any reason.
GD Requirements (3)

- **Evaluation**
  - Attendance at required sessions.
  - Complete Nutrition Self assessment assignment. Due Friday May 22.
  - Final exam. On-line Fri May 22 1:00 PM – 11:59 PM Mon May 25, 2008.
    - Closed book
    - Embryology interim quiz separate.
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As you like it

All the world's a stage,
And all the men and women merely players:
They have their exits and their entrances;
And one man in his time plays many parts,
His acts being seven ages.
Seven Ages of Man

- At first the infant, mewling and puking in the nurse’s arms.
- Breast feeding problems?
- Malnutrition?
- Failure to thrive?

Heather Burrows, MD – Neonatal / Perinatal Development
Seven Ages of Man

- And then the whining school-boy, with his satchel, And shining morning face, creeping like snail unwillingly to school.

- Developmental delay?

- Hypothyroid?

- Learning disability?

Julie Lumeng, MD – School Age Development
Seven Ages of Man

- And then the **lover**, sighing like furnace, with a woeful ballad made to his mistress' eyebrow.

- Normal Sexual development?
- Dyadic relationships?
- Rejection?

David Rosen, MD – Adolescent Development
Seven Ages of Man

- then the justice, in fair round belly with good capon lined, ...
- Obesity
  - Central adiposity
  - Sedentary lifestyle
  - Hyperlipidemia?

Brent Williams, MD – Physiology of Aging
Seven Ages of Man

- the sixth stage shifts into the lean and slipper’d pantaloons, with spectacles on nose, ... his youthful hose well saved, a world too wide for his shrunk shank; and his big manly voice, turning again to childish treble.

- Decline in BMI
- Loss of skeletal muscle mass
- Presbyopia
- Testosterone deficiency?

Brent Williams, MD – Physiology of Aging
Seven Ages of Man

- Last scene of all, … is second childishness and mere oblivion, sans teeth, sans eyes, sans taste, sans everything.

- Special senses loss
- Malnutrition
- Cognitive decline
- Palliative care

Multidisciplinary Team – Care of Frail Elderly
As You Like It; Wm. Shakespeare
Act II; Scene VII
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Principles of Growth and Development

Gender differences

- At developmentally equivalent ages, male is larger but with smaller percent fat.
- Male grows for longer time period.
- Longevity greater for females.
Principles of Growth and Development: Growth patterns

- Size at birth determined by maternal variables
- 3 to 4-fold weight gain in first year
- Steady growth in school-age child
- Adolescence/menarche/sexual maturation
  - Great increase in energy requirements
  - Growth spurt; up to 14 cm/yr in males
  - Decrease in fat mass
Principles of Growth and Development

- Development is a dynamic process.
- Individual variation in timing.
- Order, hierarchy to sequence.
  - Increasing complexity in childhood
  - Loss of function in activities of daily living
- Sequential progression in gross motor development
  - Cephalocaudal and proximodistal
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Aging: The Demographic Imperative
Demographics

US Population > Age 65

Source Undetermined
Centenarian population
U.S. Centenarian Population

Thousands

Source Undetermined
Demographic Imperative

Pts >65

- Primary Care
- Surgical Care
- Medical Specialty
- Emerg Med
- Hosp Days

Source Undetermined
Ambulatory Visits by Patients \(\geq 65^*\) % of all visits by Specialty (1999-2001)

<table>
<thead>
<tr>
<th>Specialty</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ophthalmology</td>
<td>52</td>
</tr>
<tr>
<td>Urology</td>
<td>49</td>
</tr>
<tr>
<td>Gen Surg</td>
<td>33</td>
</tr>
<tr>
<td>Otolaryngology</td>
<td>23</td>
</tr>
<tr>
<td>Orthopedics</td>
<td>23</td>
</tr>
</tbody>
</table>

• Represents 14% of U.S. Population

# Number Surgical Procedures: US, 2000 $^{1, 2}$

(Acute Hospital)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>All Ages</th>
<th>&gt; 65 yr (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>40,000</td>
<td>14,380 (37)</td>
</tr>
<tr>
<td>CABG</td>
<td>519</td>
<td>286 (55)</td>
</tr>
<tr>
<td>Cholecystectomy</td>
<td>419</td>
<td>149 (36)</td>
</tr>
<tr>
<td>Prostatectomy</td>
<td>184</td>
<td>134 (73)</td>
</tr>
<tr>
<td>Total knee</td>
<td>299</td>
<td>211 (71)</td>
</tr>
</tbody>
</table>

1. Advance Data No. 329, June 19, 2002
2. Data are in thousands
# Rate of Surgical Procedures, US, 2000

<table>
<thead>
<tr>
<th></th>
<th>All ages</th>
<th>65 and over</th>
</tr>
</thead>
<tbody>
<tr>
<td>All procedures</td>
<td>1,500</td>
<td>4,500</td>
</tr>
</tbody>
</table>

1. Per 10,000 population
## Emergency Department Visits by Age

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number of Visits as Percent of Population/Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Ages</td>
<td>27</td>
</tr>
<tr>
<td>≥ 65</td>
<td>32</td>
</tr>
<tr>
<td>≥ 75</td>
<td>65</td>
</tr>
</tbody>
</table>

Older ED patients are sicker and have higher admission rate.

1. National Hospital Ambulatory Medical Care Survey, 2000
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Life span – (theoretical) Relatively fixed upper limit to human longevity. Approximately 100 years.

Life expectancy – (observed) 50th percentile survival in years.
Average Life Expectancy at Given Ages

Age / Gender | Median LE
--- | ---
65 Men | 16 yrs
65 Women | 19 yrs
80 Men | 7+ yrs
80 Women | 9+ yrs

Average Years of Life Remaining @ Age 65

- **1900**: Source Undetermined
- **1943**: Men (11.3), Women (14.0)
- **1973**: Men (12.5), Women (15.6)
- **1993**: Men (13.8), Women (17.0)
- **2000**: Men (16.3), Women (19.2)

Note: The source for the data is undetermined.
Compression vs. Expansion of Morbidity

PERCENT SURVIVING vs. AGE

Years of Life

1980
Compression vs. Expansion of Morbidity

PERCENT SURVIVING

AGE

Life without disability

1980

Stanford Faculty Development Program. Geriatrics in Primary Care. 2002.
Compression vs. Expansion of Morbidity

PERCENT SURVIVING

AGE

1980
2025

Stanford Faculty Development Program. Geriatrics in Primary Care. 2002.
Compression vs. Expansion of Morbidity

PERCENT SURVIVING

AGE

1980  2025

Stanford Faculty Development Program. Geriatrics in Primary Care. 2002.
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Slide 35: Source Undetermined
Slide 36: Source Undetermined
Slide 42: Source Undetermined
Slide 45: Source Undetermined
Slide 47: Stanford Faculty Development Program. Geriatrics in Primary Care. 2002.