



Perioperative Medicine Summit

Evidence Based Perioperative Medical Care

Geriatric Syndromes and Perioperative Implications

Holly M. Holmes, MD, MS

Associate Professor, Division Director
Geriatric and Palliative Medicine



UTHealth[®]

The University of Texas
Health Science Center at Houston

McGovern
Medical School

Disclosures: Holly Holmes, MD, MS

- No relevant financial relationships to disclose
- Will not discuss unlabeled/unapproved uses of drugs or products in this presentation.
- Full Disclosure statement on file with AML Events

Objectives

- Know how common age-related physiologic changes can impact the fitness of an older person.
- Understand the impact of geriatric syndromes on outcomes in surgically treated older patients.
- Be able to assess older patients for common geriatric syndromes.

ARS Question #1



Perioperative Medicine Summit
Evidence Based Perioperative Medical Care

I am a/an:

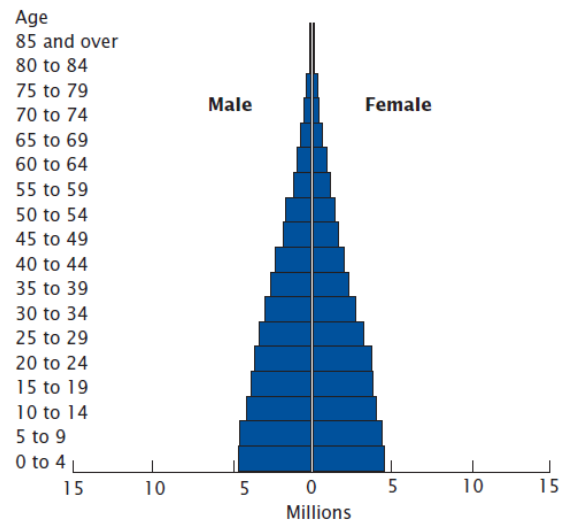
- A. Anesthesiology type
- B. Surgery type
- C. Internal/Family Medicine Type
- D. Other

Guiding Principles of Geriatrics

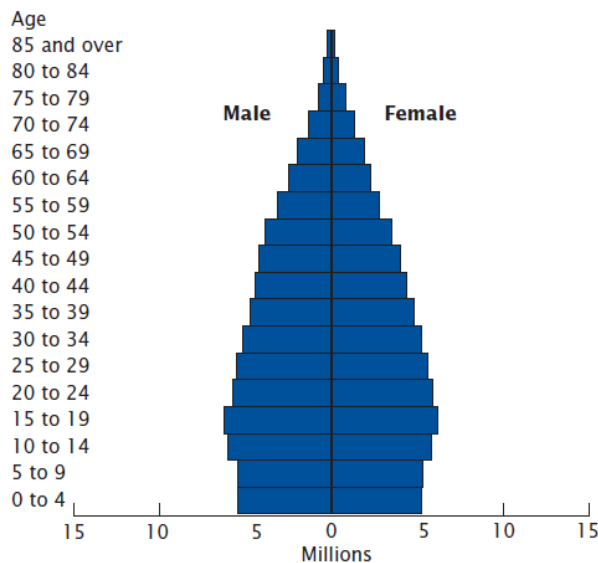
- Age only provides a little bit of information about a person. As we get older, we are less and less like other people our age.
- The extent of aggressiveness of care should be determined in part by the functional status and wishes of the person.
- Remember that for many of our patients, there are fates worse than death, and we want to prevent them whenever possible.

There are 3.6 geriatricians for every 10,000 people >75 years in the US.

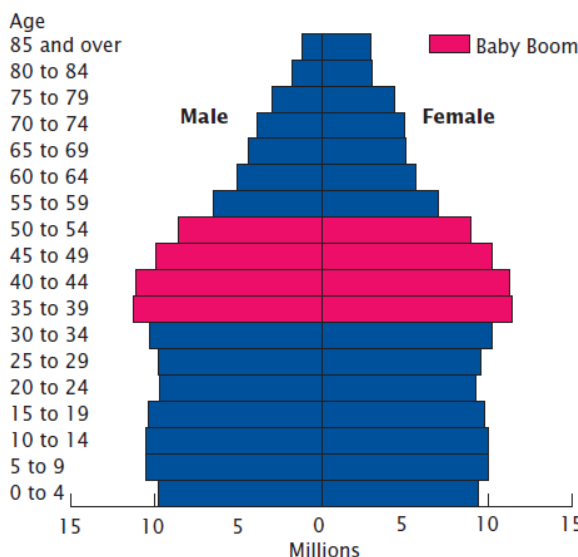
Population by Age and Sex: 1900



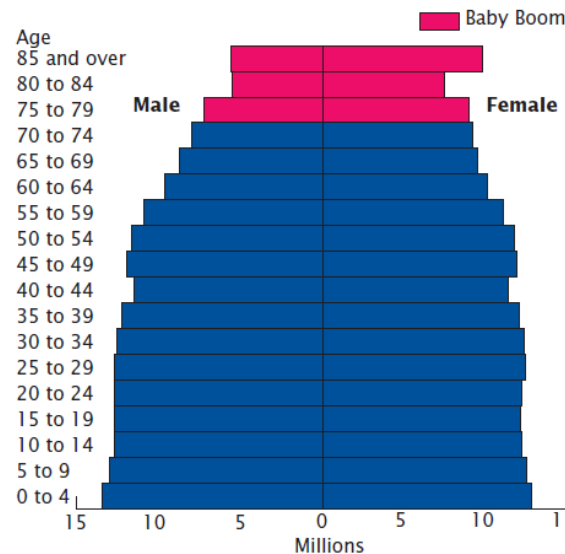
Population by Age and Sex: 1940



Population by Age and Sex: 2000



Population by Age and Sex: 2040

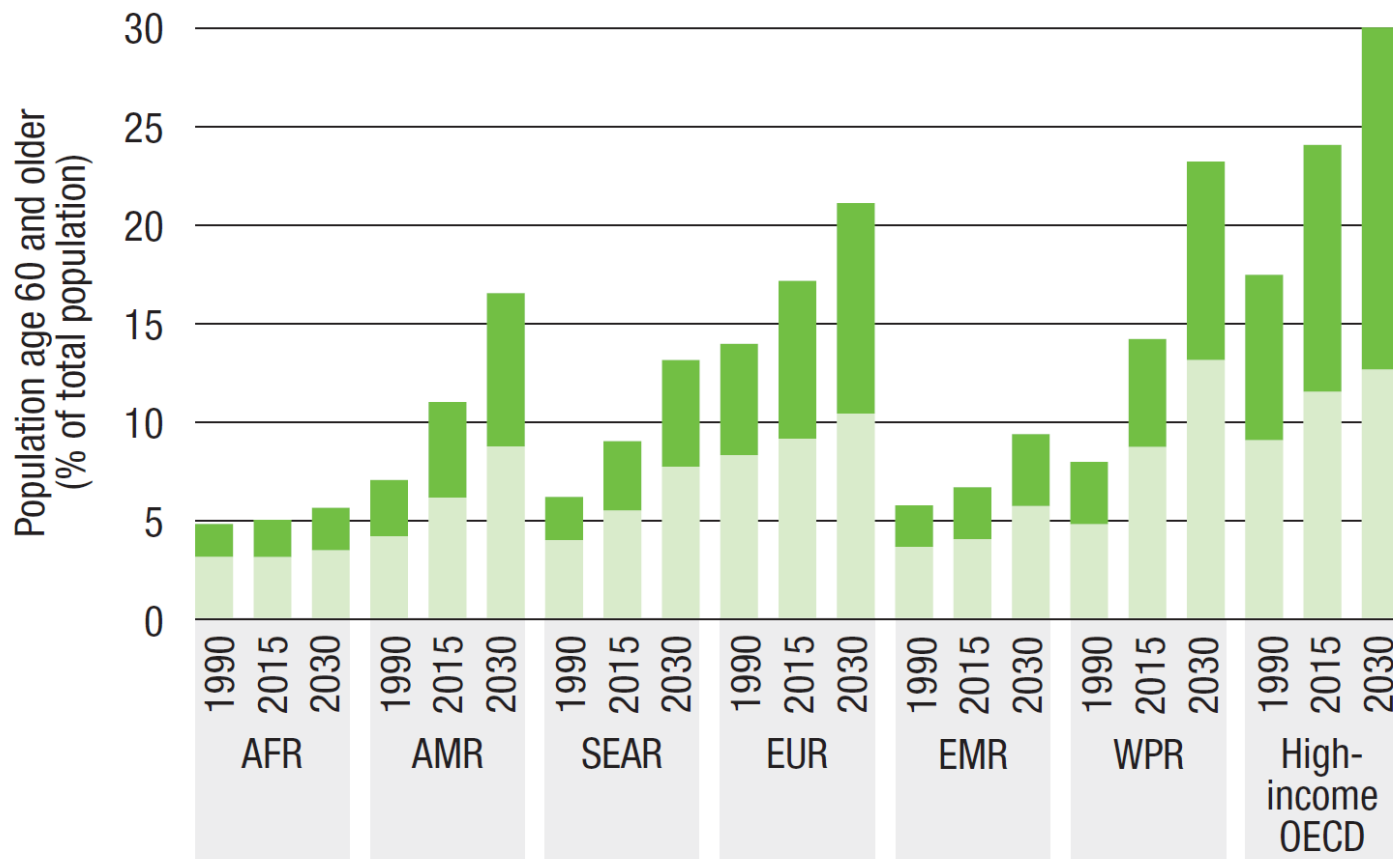


Source: He, Wan, et al. U.S. Census Bureau, Current Population Reports, P23-209, 65+ in the United States: 2005, U.S. Government Printing Office, Washington, DC, 2005.

Figure 2.5

Trends in proportion of population age 60 and older, by region, 1990–2030^{2,3}

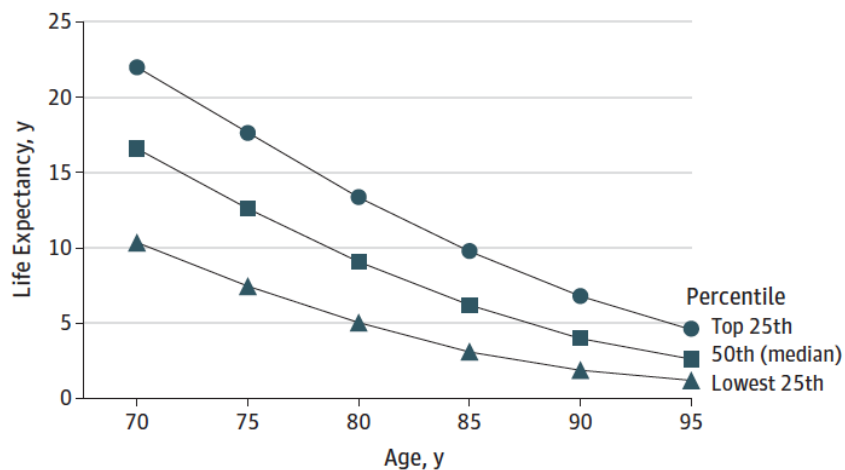
■ 70+ ■ 60–69



From Health in 2015: from MDGs to SDGs. World Health Organization

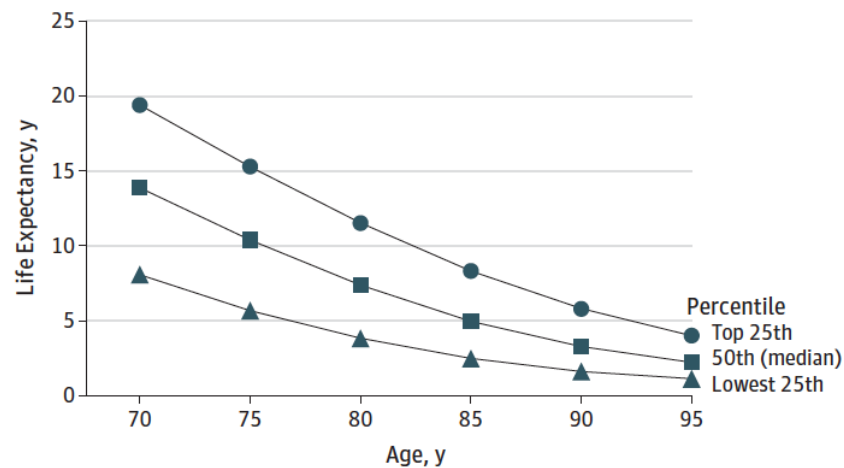
Significant heterogeneity in survival

A Women



Upper, Middle, and Lower Quartiles of Life Expectancy for Women and Men by Age Cohort

B Men



Walter LC and Schonberg MA. JAMA 2014; 311: 1336-47.

ARS Question #2



Perioperative Medicine Summit
Evidence Based Perioperative Medical Care

Which of the following increase with normal aging?

- A. Cardiac output
- B. Glomerular Filtration Rate
- C. Residual volume
- D. Lean mass
- E. None of the above

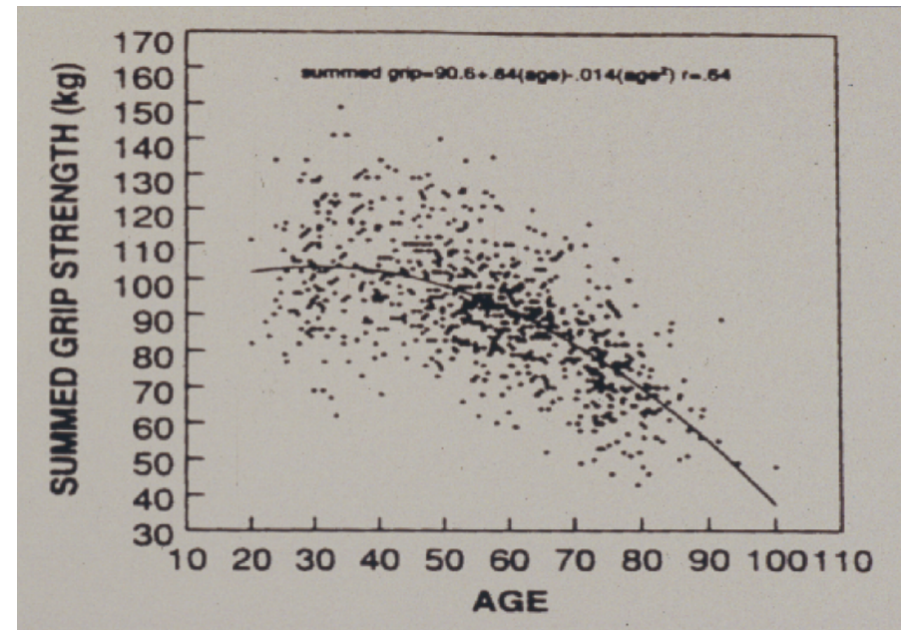
Common Physiologic Changes with Aging

- Renal
 - Decline in function
 - Decreased dilutional and concentration ability

Cheitlin MD. Am J Geriatr Cardiol, 2003;12:9-13.

Common Physiologic Changes with Aging

- Neuromuscular
 - Decreased grip strength
 - Loss of lean muscle mass
 - Decrease and loss of functional motor nerve units

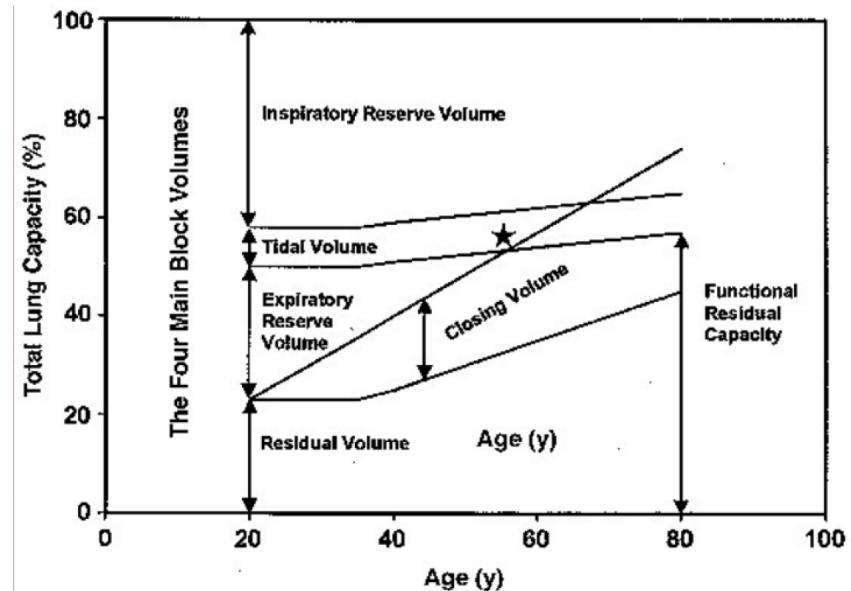


Aniansson, 1988

Cheitlin MD. Am J Geriatr Cardiol, 2003;12:9-13.

Common Physiologic Changes with Aging

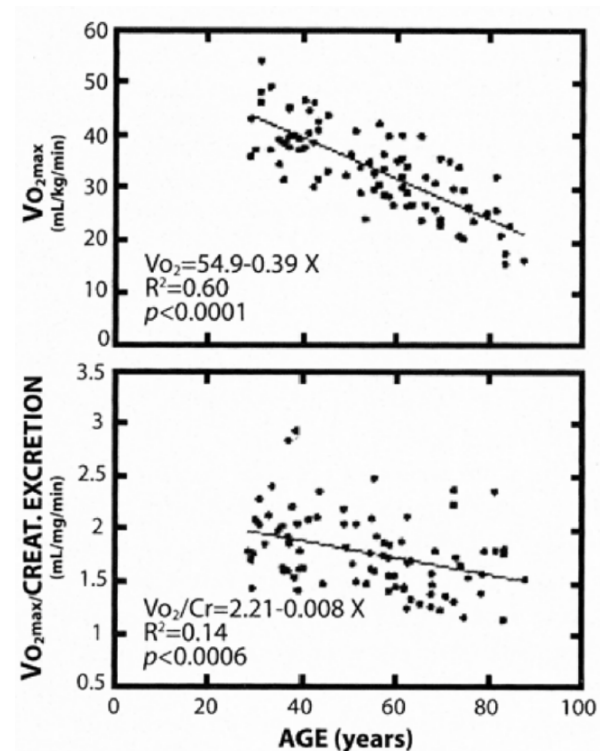
- Pulmonary
 - Decreased elastic recoil and FEV1
 - Collapse of small airways and V/Q mismatch



Cheitlin MD. Am J Geriatr Cardiol, 2003;12:9-13.

Common Physiologic Changes with Aging

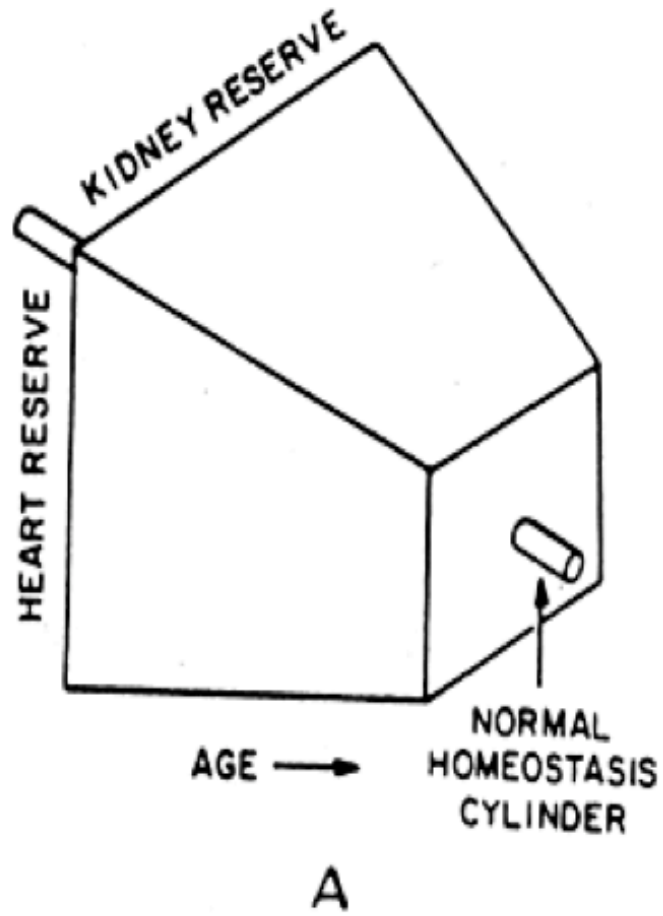
- Cardiovascular
 - Decreased cardiac output
 - Decreased vascular elasticity
 - Decreased beta receptor responsiveness



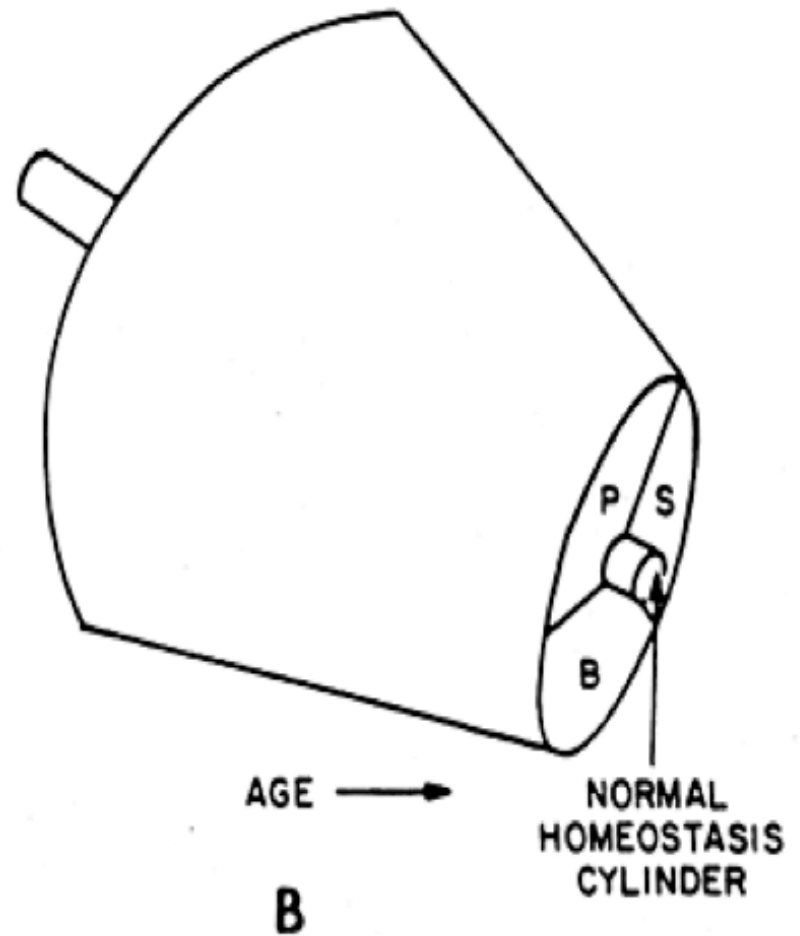
Cheitlin Am J Geriatr Cardiol 2003;12:9-13.

Cheitlin MD. Am J Geriatr Cardiol, 2003;12:9-13.

PHYSIOLOGIC RESERVE



FUNCTIONAL RESERVE



ARS Question #3



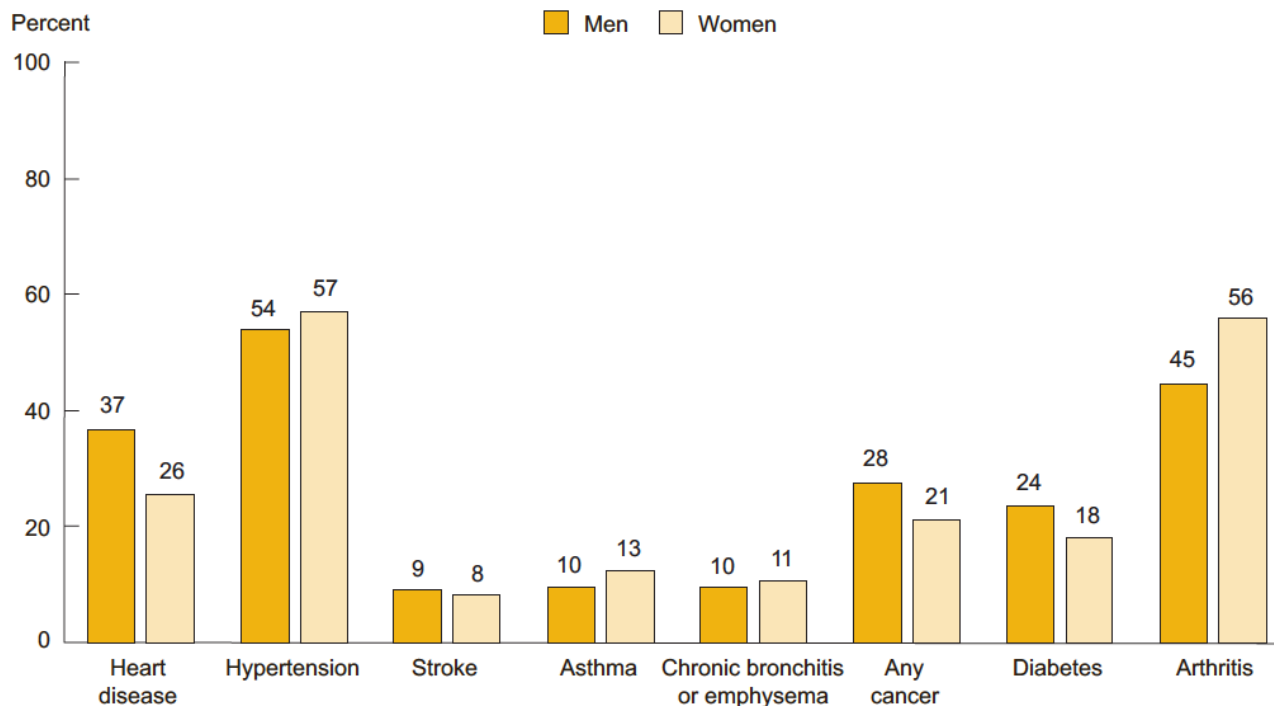
Perioperative Medicine Summit
Evidence Based Perioperative Medical Care

Which of the following are geriatric syndromes?

- A. Delirium
- B. Hypertension
- C. Elder abuse
- D. Chronic kidney disease
- E. A & C
- F. All of the above

Comorbidity: More than ½ of adults 65 and older have 3 or more chronic conditions.

Percentage of people age 65 and over who reported having selected chronic health conditions, by sex, 2009–2010

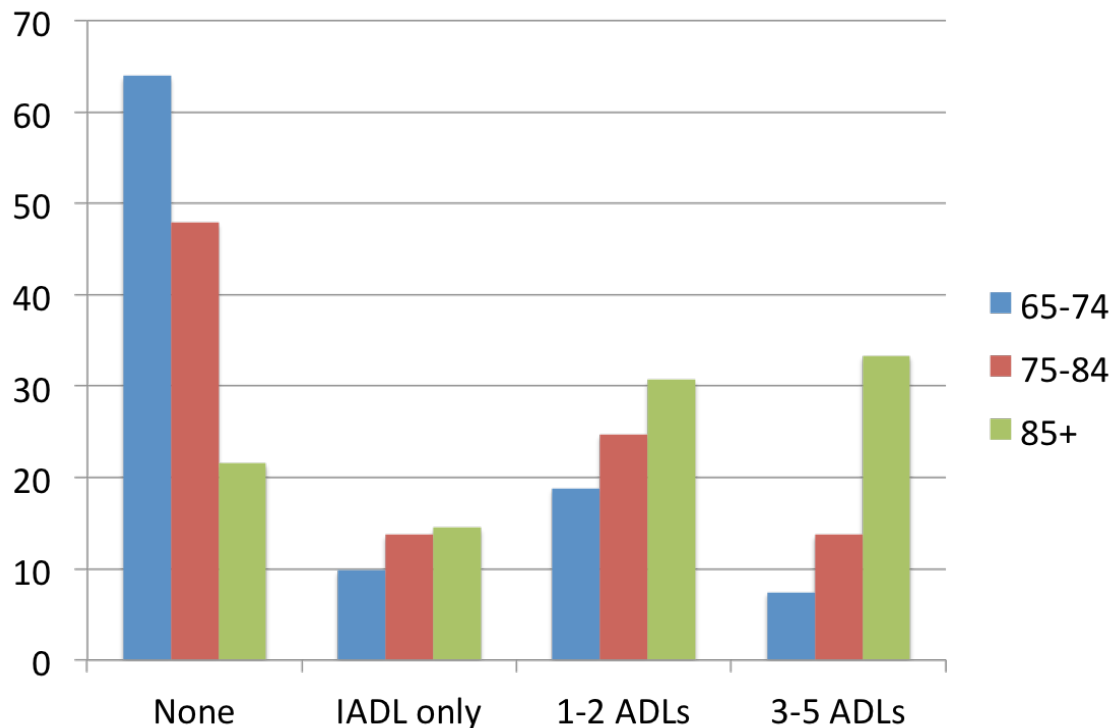


NOTE: Data are based on a 2-year average from 2009–2010.

Reference population: These data refer to the civilian noninstitutionalized population.

SOURCE: Centers for Disease Control and Prevention, National Center for Health Statistics, National Health Interview Survey.

Functional Status: The risk of disability increases with age.



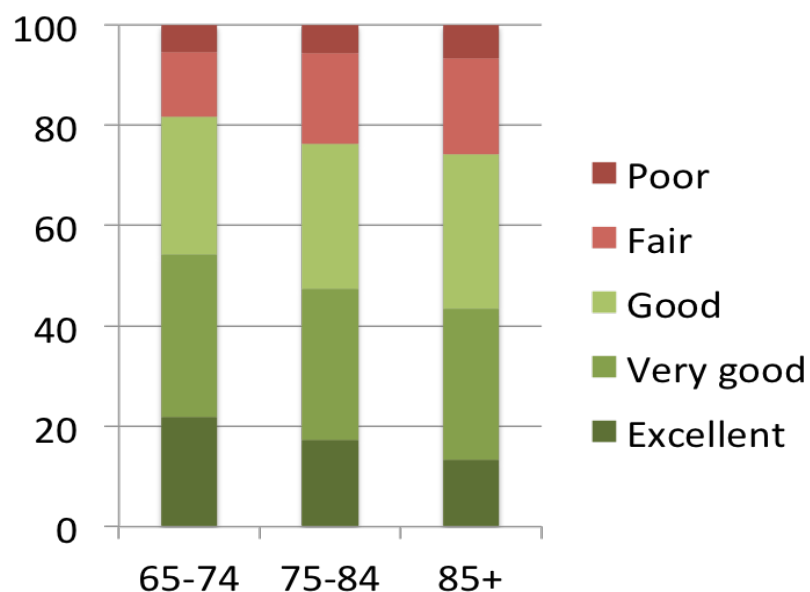
ADLs: eating, bathing, dressing, grooming, feeding, transferring, continence

IADLs: finances, phone, medications, shopping, cooking, cleaning, laundry, transportation

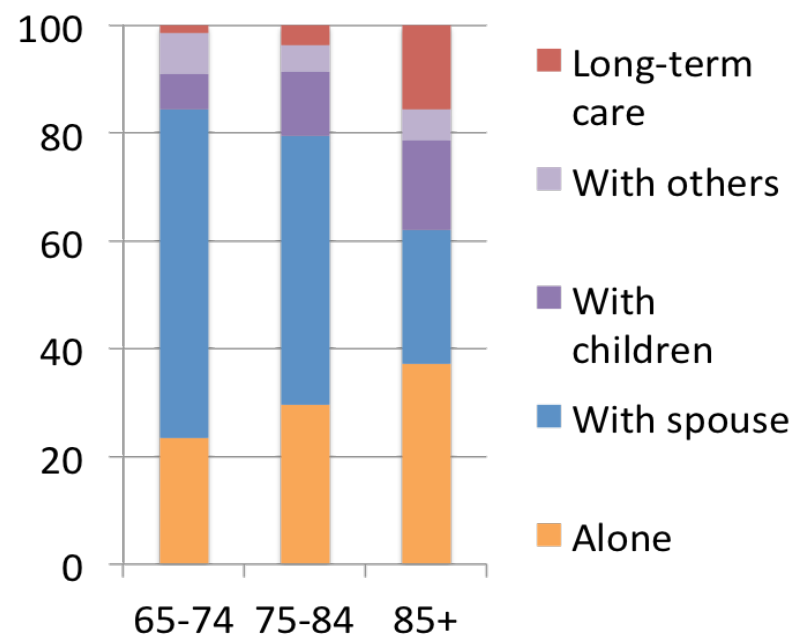
Source: Medicare Current Beneficiary Survey 2012, Table 2.1

Poor Social Support and Self-rated Health

Percent with fair/poor self rated health by age



Living arrangements by age



Source: Medicare Current Beneficiary Survey 2012, Table 2.1

Geriatric syndromes are as important as comorbidities for disability risk

- Depression
- Dementia
- Delirium
- Incontinence
- Falls
- Polypharmacy
- Sensory impairment
- Malnutrition
- Frailty

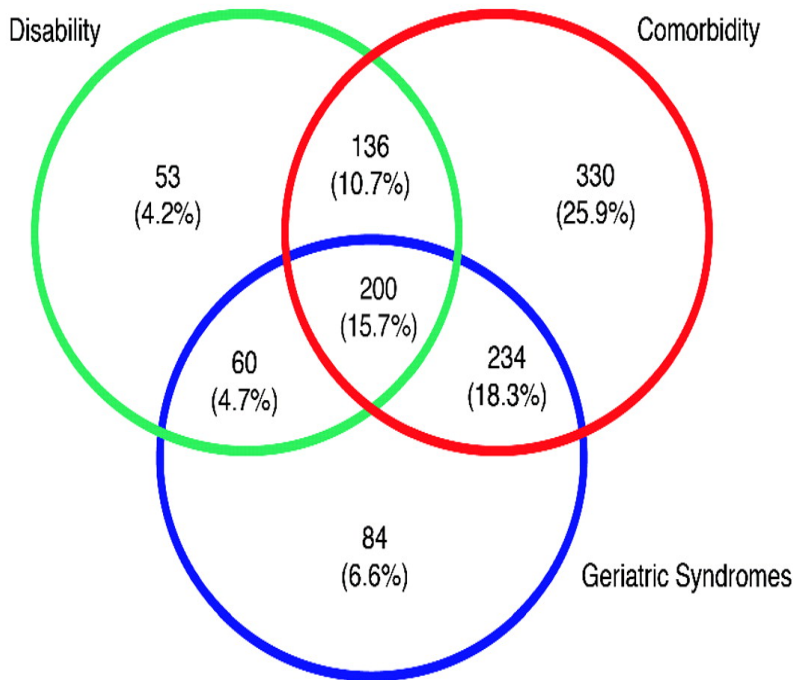
*Table 4. Risk Ratios for Activities of Daily Living Dependency**

Variable	Model 4†
Number of geriatric conditions	
1	2.1 (1.9–2.4)
2	3.6 (3.1–4.1)
≥3	6.6 (5.6–7.6)‡.9)
Number of chronic diseases	
1	–
2	–
≥3	–
Type of chronic disease	
Heart disease	1.2 (1.0–1.3)
Lung disease	1.4 (1.3–1.6)
Diabetes	1.3 (1.2–1.4)
Cancer	1.0 (0.8–1.2)
Musculoskeletal disorder	1.4 (1.3–1.5)
Stroke	3.0 (2.7–3.3)
Psychiatric disorder	1.5 (1.3–1.6)

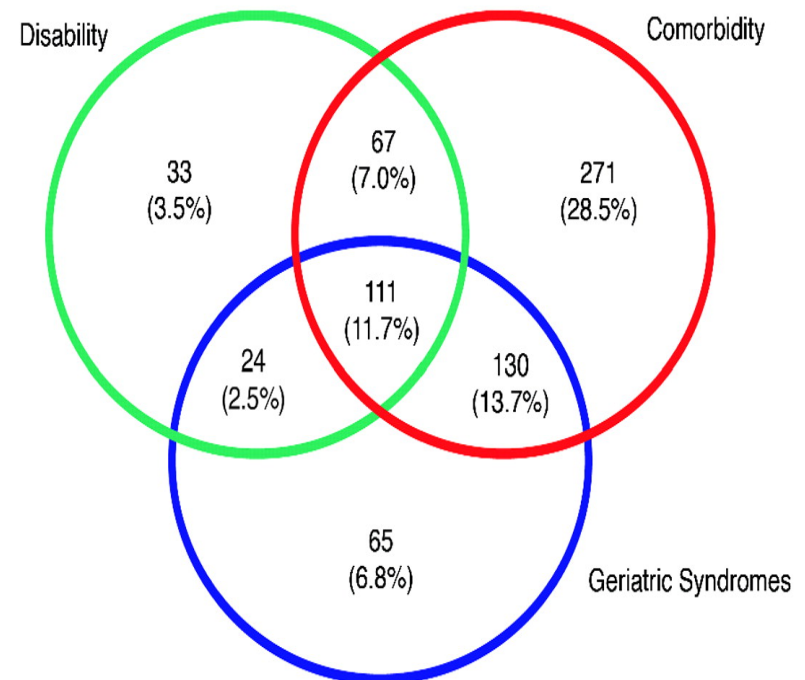
Cigolle et al. Ann Intern Med. 2007;147(3):156-164.

Prevalence of Geriatric Syndromes, Disability, and Comorbidity

Colorectal Cancer



Breast Cancer



Koroukian, S. M. et al. *J Clin Oncol*; 24:2304-2310 2006

Comprehensive Geriatric Assessment

- Test multiple domains that are associated with bad outcomes.
- Use of validated tools to measure common geriatric conditions and geriatric syndromes.
- Ability to diagnose and intervene to fix reversible problems.

Tools Used in CGA

- **Comorbid conditions:** number and severity
- **Medications:** drug interactions, inappropriate meds
- **Cognitive:** screening tools for cognition and executive function
- **Affective:** screening for depression and anxiety
- **Nutritional:** weight loss, nutrition risk
- **Social:** living situation, support at home, ability to get meds
- **Functional:** activities/instrumental activities of daily living
- **Physical:** gait speed, timed-up-and-go, short physical performance battery

Mohile and Rodin. JCO 2007;25:1936–1944;

Geriatric Assessment in older surgical patients

Domain	Measure	Significance
Function	ADLs/IADLs	Predictive of postoperative morbidity and mortality
Comorbidity	Charlson index OARS subscale	Associated with postoperative morbidity and mortality
Cognition	Mini-mental state examination	Increase length of stay, delirium, and disability
Psychological	Hospitalized Anxiety and Depression Scale Geriatric Depression Scale	Risk of postoperative functional disability and mortality
Social support	Medical Outcomes Survey society activity scale	Social isolation associated with increased mortality
Nutrition	Body mass index % weight loss in 6 mos	Increased risk of postoperative infection, mortality
Polypharmacy	Beers criteria	Inappropriate meds associated with delirium and increased length of stay

Cheema FN et al. Annals of Surgery 2011;253:867-74.

ARS Question #4



Perioperative Medicine Summit
Evidence Based Perioperative Medical Care

How much extra time would you be willing to spend to assess an older surgical patient?

- A. 5 minutes
- B. 10 minutes
- C. 30 minutes
- D. None – I refer all my older patients to a specialist
- E. None – I don't think older patients need any extra assessment

CGA and Surgical Outcomes

- Functional status >> mortality, complications, length of stay
- Cognitive impairment >> complications, length of stay, and 6 month mortality
- Frailty >> complications, length of stay, discharge to skilled nursing or assisted living facilities

Major Cancer Surgery in the Elderly

Results From the American College of Surgeons National Surgical Quality Improvement Program

Waddah B. Al-Refaie, MD,* Helen M. Parsons, MPH,* William G. Henderson, MPH, PhD,†
Eric H. Jensen, MD,* Todd M. Tuttle, MD, FACS,* Selwyn M. Vickers, MD, FACS,*
David A. Rothenberger, MD, FACS,* and Beth A. Virnig, MPH, PhD*

TABLE 4. Short-Term Operative Outcomes Divided by Age Groups

Operative Outcomes	40–54 yr (n = 2204) 25.1%	55–65 yr (n = 2470) 28.2%	66–74 yr (n = 2285) 26.1%	≥75 yr (n = 1822) 20.7%	P
30-d mortality	1.09%	1.82%	3.50%	4.83%	<0.0001
Length of stay (d)					
Mean (±SD)	9.3 d (±8.21)	10.2 d (±9.45)	11.2 d (±10.52)	12.3 d (±10.53)	<0.0001
Median	7 d	8 d	8 d	9 d	<0.0001
Percentage of patients with prolonged LOS	19.83%	24.25%	27.26%	33.70%	<0.0001
Total No. postoperative complications					<0.0001
0	74.2%	71.0%	67.9%	65.2%	
1	14.3%	15.2%	15.5%	15.8%	
≥ 2	11.5%	13.8%	16.6%	19.0%	
Types of postoperative complications					
Minor	9.12%	8.71%	9.07%	8.62%	0.92
Major	21.82%	24.86%	27.40%	30.74%	<0.0001
Return to the OR					
Yes	6.4%	7.94%	6.91%	8.12%	0.093

SD indicates standard deviation; LOS, length of stay; OR, operating room.

TABLE 5. Odds Ratios for Factors Significantly Predictive of Short-Term Operative Outcomes After Major Cancer Surgery*

Factor	30-d Mortality	Increased Total Number of Postoperative Complications	Major Postoperative Complications	LOS >12 d
Demographics				
Age at diagnosis				
40–54 yr	Ref	Ref	Ref	Ref
55–65 yr	1.87	—	—	—
66–74 yr	2.75	1.21	—	—
≥75 yr	4.11	1.41	1.35	1.76
ASA classification				
3 or 4	1.74	1.24	1.33	1.47
Risk factors/comorbidities				
Cardiac				
Yes	—	1.23	—	—
Pulmonary				
Yes	1.83	1.28	1.25	1.32
Smoking status				
Never	—	Ref	Ref	Ref
Previous	—	—	—	—
Current	—	1.49	1.43	1.25
Bleeding disorders	—	1.47	1.41	1.39
Preoperative laboratory values				
Preoperative HCT				
<37	—	—	—	1.23
38%–44.9%	—	—	—	Ref
Platelet count				
151–399 K/uL	Ref	Ref	Ref	Ref
<150 K/uL	2.21	1.27	1.27	1.38
Albumin g/dL				
≤2.5	2.54	1.36	—	1.41
≥2.6	Ref	Ref	—	Ref
Sodium (mmol/L)				
<135	—	1.21	1.27	1.43
136–144	Ref	Ref	Ref	Ref
≥145	2.24	—	—	1.49
Intraoperative factors				
Wound class				
Clean	Ref	Ref	Ref	Ref
Clean-contaminated	—	1.31	1.34	1.69
Contaminated/infected	—	1.94	1.95	1.93
RBCs units transfused				
0	Ref	Ref	Ref	Ref
1–2	—	1.41	1.39	1.45
≥3	2.69	2.04	2.08	2.37
Type of resection				
Whipple, esophagectomy, and lung resection vs. others	—	1.24	1.20	2.07
Number of events	175	1943	1658	1580
Total sample size	6207	6207	6207	5875
Event rate	2.9%	31.3%	26.71%	26.89%
C-Index of model	0.778	0.639	0.679	0.743

*We report factors that were statistically significant for short-term operative parameters. Factors that were found to be significant on our bivariate analyses in Table 1 to 4 were also assessed in all our logistic regression models and were found to be nonsignificant predictors of short-term operative outcomes. LOS indicates length of hospital stay; Ref, referent; ASA, American Society of Anesthesiologist classification; RBCs, red blood cells.

TABLE 5. Odds Ratios for Factors Significantly Predictive of Short-Term Operative Outcomes After Major Cancer Surgery*

Factor	30-d Mortality	Increased Total Number of Postoperative Complications	Major Postoperative Complications	LOS > 12 d
Demographics				
Age at diagnosis				
40–54 yr	Ref	Ref	Ref	Ref
55–65 yr	1.87	—	—	—
66–74 yr	2.75	1.21	—	1.24
≥75 yr	4.11	1.41	1.35	1.76
Race/ethnicity				
White	—	—	—	Ref
African American	—	—	—	1.25
Hispanic	—	—	—	—
Other	—	—	—	1.61
Sex				
Male	—	1.22	1.21	1.17
Overall status				
Functional status				
Independent	Ref	Ref	Ref	Ref
Other	2.31	1.79	2.05	2.93
ASA classification				
3 or 4	1.74	1.24	1.33	1.47
Risk factors/comorbidities				
Cardiac				
Yes	—	1.23	—	—
Pulmonary				
Yes	1.83	1.28	1.25	1.32
Sodium (mmol/L)				
<135	—	1.21	1.27	1.43
136–144	Ref	Ref	Ref	Ref
≥145	2.24	—	—	1.49
Intraoperative factors				
Wound class				
Clean	Ref	Ref	Ref	Ref
Clean-contaminated	—	1.31	1.34	1.69
Contaminated/infected	—	1.94	1.95	1.93
RBCs units transfused				
0	Ref	Ref	Ref	Ref
1–2	—	1.41	1.39	1.45
≥3	2.69	2.04	2.08	2.37
Type of resection				
Whipple, esophagectomy, and lung resection vs. others	—	1.24	1.20	2.07
Number of events	175	1943	1658	1580
Total sample size	6207	6207	6207	5875
Event rate	2.9%	31.3%	26.71%	26.89%
C-Index of model	0.778	0.639	0.679	0.743

*We report factors that were statistically significant for short-term operative parameters. Factors that were found to be significant on our bivariate analyses in Table 1 to 4 were also assessed in all our logistic regression models and were found to be nonsignificant predictors of short-term operative outcomes. LOS indicates length of hospital stay; Ref, referent; ASA, American Society of Anesthesiologist classification; RBCs, red blood cells.

ARS Question #5



Perioperative Medicine Summit
Evidence Based Perioperative Medical Care

What preoperative assessments are recommended in older patients?

- A. Depression screening
- B. Decisional capacity
- C. Nutritional status
- D. Substance Abuse
- E. All of the above

Preoperative Assessment

In addition to conducting a complete and thorough history and physical examination of the patient, the following assessments are strongly recommended:

- Assess the patient's **cognitive ability** and **capacity** to understand the anticipated surgery (see Section I.A, Section I.B, and Appendix I).
- Screen the patient for **depression** (see Section I.C).
- Identify the patient's risk factors for developing postoperative **delirium** (see Section I.D).
- Screen for **alcohol** and other **substance abuse/dependence** (see Section I.E).
- Perform a preoperative **cardiac** evaluation according to the American College of Cardiology/American Heart Association (ACC/AHA) algorithm for patients undergoing noncardiac surgery (see Section II and Appendix II).
- Identify the patient's risk factors for postoperative **pulmonary** complications and implement appropriate strategies for prevention (see Section III).
- Document **functional status** and history of **falls** (see Section IV).
- Determine baseline **frailty** score (see Section V and Appendix III).
- Assess patient's **nutritional status** and consider preoperative interventions if the patient is at severe nutritional risk (see Section VI and Appendix IV).
- Take an accurate and detailed **medication history** and consider appropriate perioperative adjustments. Monitor for **polypharmacy** (see Section VII, Appendix V, Appendix VI, and Appendix VII).
- Determine the patient's **treatment goals** and **expectations** in the context of the possible treatment outcomes (see Section VIII).
- Determine patient's **family** and **social support system** (see Section VIII).
- Order appropriate preoperative **diagnostic tests** focused on elderly patients (see Section IX).

ACS NSQIP®/AGS BEST PRACTICE GUIDELINES: Optimal Preoperative Assessment of the Geriatric Surgical Patient



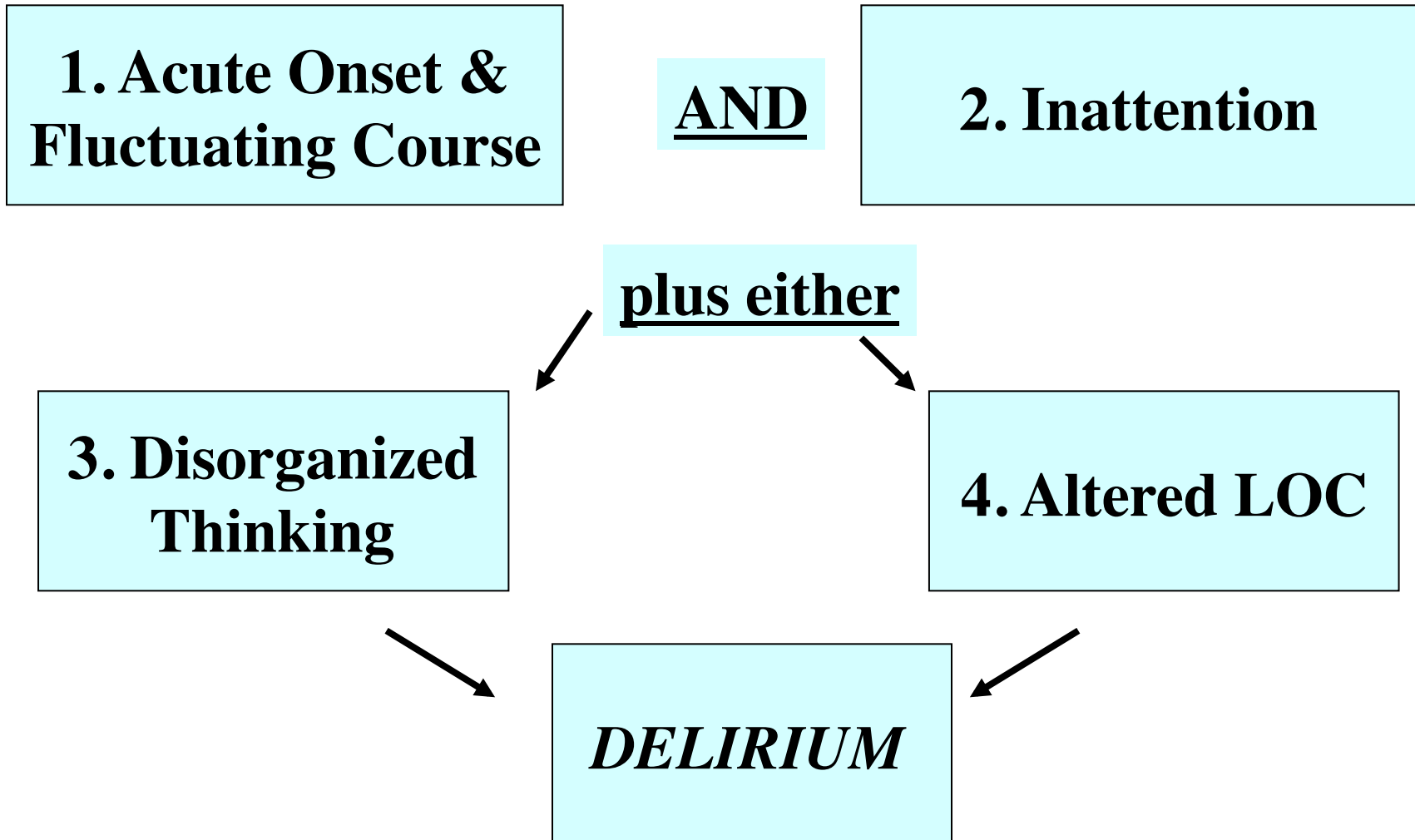
AGS

Available at <http://site.acsnsqip.org/wp-content/uploads/2011/12/ACS-NSQIP-AGS-Geriatric-2012-Guidelines.pdf>

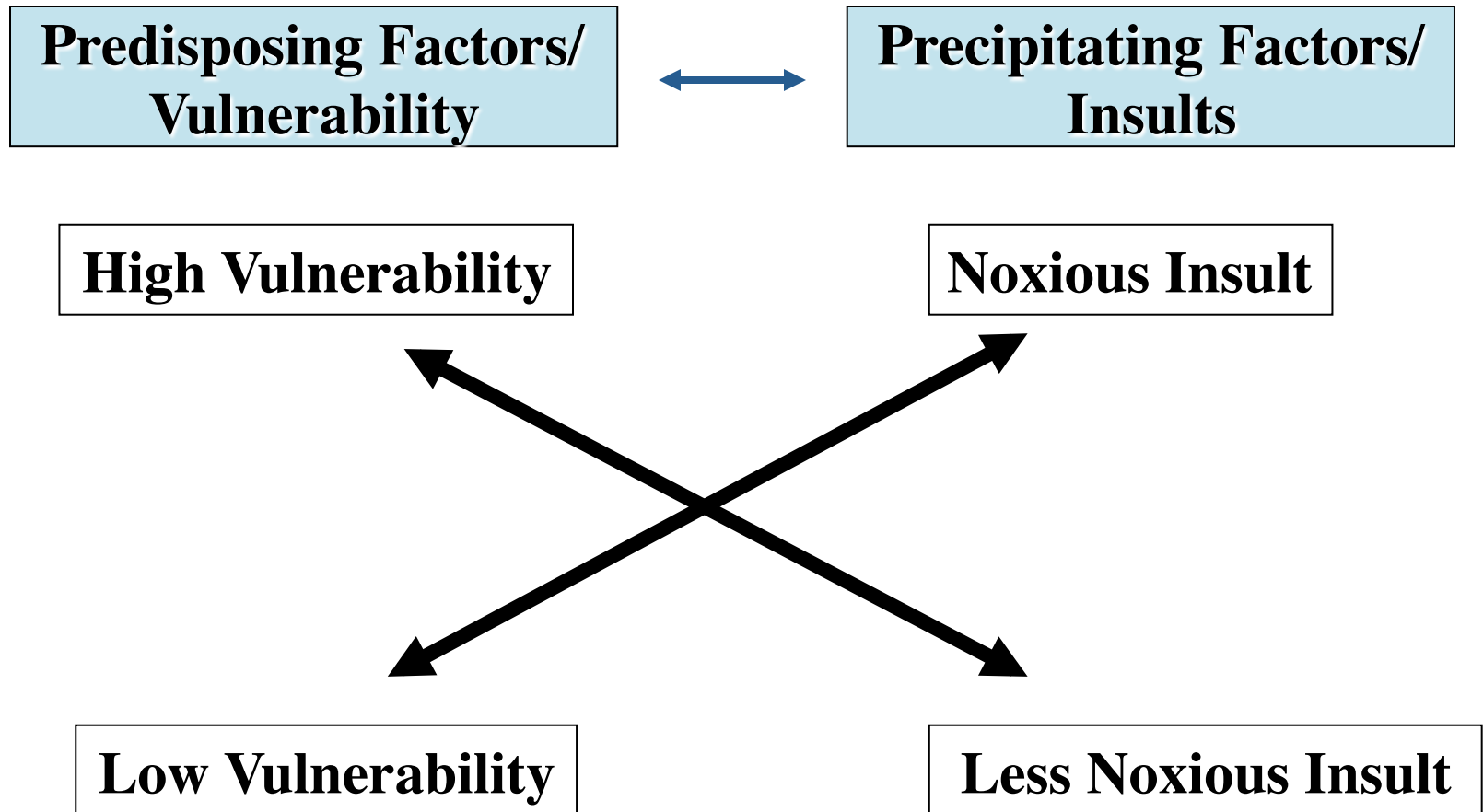
Delirium: the classic geriatric syndrome

- Independent risk factor for
 - Mortality
 - Functional decline
 - Nursing home placement
 - Increased length of stay
 - Later diagnosis of dementia?
- **COSTLY AND PREVENTABLE**

Delirium: the Confusion Assessment Method



Delirium: Multifactorial Model



Inouye, S, et. al. JAMA. 1996; 275:852- 857.

Delirium: Predisposing Factors

Development Cohort (n=107)

Factor	Relative Risk
Vision Loss (vision >20/70)	3.5 (1.2-10.7)
Severe Illness (APACHE II>16 or Charlson rated severe)	3.5 (1.5-8.2)
Cognitive Impairment (MMSE<24)	2.8 (1.2-6.7)
Dehydration (BUN/Cr >18)	2.0 (1.1-4.6)

Validation Cohort (n=174)

# of Factors	Relative Risk
Low Risk (0 factors)	1.0
Intermediate Risk (1-2 factors)	2.5
High Risk (3-4 factors)	9.2

Inouye SK , et al. Ann Intern Med. 1993;119:474-481

Delirium: Precipitating Factors

Development Cohort (n=196)

Factor	Relative Risk
Physical Restraints	4.4 (2.5-7.9)
Malnutrition	4.0 (2.2-7.4)
3 or more new meds	2.9 (1.2-4.7)
Bladder catheter	2.4 (1.2-4.7)
Iatrogenic event	1.9 (1.1-3.2)

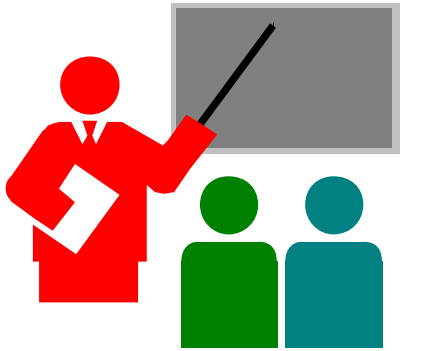
Validation Cohort (n=312)

# of Factors	Relative Risk
Low Risk (0 factors)	1.0
Intermediate Risk (1-2 factors)	7.1 (3.2-15.7)
High Risk (3-5 factors)	17.5 (8.1-27.4)

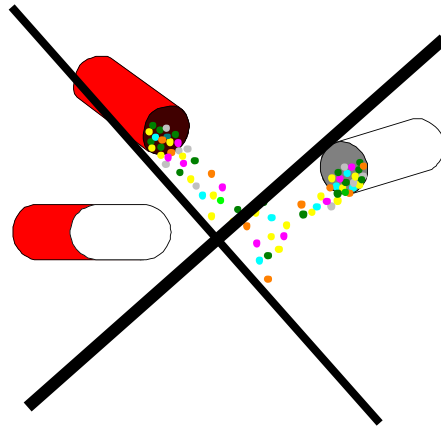
Inouye SK, et. al. JAMA 1996; 275; 852- 857

Interventions for Delirium

Non-drug approach to insomnia



Orientation/Activities



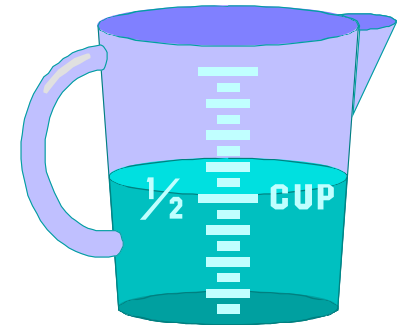
Early Mobilization



Visual Aids,
Devices



Hearing devices,
Remove earwax



Early recognition
& po repletion

Pharmacologic Delirium Prevention

Medication	Dose	Incident	NNT	LOS	Duration	Severity
Haloperidol	0.5 mg po tid on admit through POD #3	↔		↓	↓	↓
	0.5 mg IV after surgery, then 0.1 mg/hour IV to total of 1.7 mg			↓ ICU only		
	2.5 mg IV q 8 x 14 days			↔	↔	↔
Risperidone	1 mg po on emerging from anesthesia	↓	4.85	↔		↓↓
Olanzapine	x 2 doses, 5 mg before and immediately after surgery	↓	4		↑	↑

Korc-Grodzicki B. J Geriatr Oncol; 2015:6:60-69.

Pharmacologic Delirium Prevention

Medication	Dose	Incident	NNT	LOS	Duration	Severity
Donepezil	5 mg/day x 3 days post op	↓	3.8	↔		
	5 mg/day x 14 days before and 14 days after	↔				
Rivastigmine	1.5 mg q 8 hrs x 6 days, start 1 d preop	↔		↔	↔	
	Transdermal, started preop	↔		NS		
Melatonin	0.5 mg/day x 14 days	↓	5.26			
Ramelteon	8 mg/day x 7 days	↓	3.45			

Korc-Grodzicki B. J Geriatr Oncol; 2015:6:60-69.

Frailty

- Syndrome characterized by loss of strength and muscle mass, malnutrition, and poor function (and possibly cognition)
- Increased vulnerability to adverse effects
 - Falls
 - Disability
 - Hospitalization
 - Death

Frailty: Definitions

- Fried – 3 or more of the following:
 - Weight loss \geq 10 pounds in past year,
 - Decreased grip strength,
 - Exhaustion
 - Low physical activity
 - Slow gait speed
- Modified: grip strength and weight loss?

Fried, J Gerontol, 2001

Revenig LM. J Am Coll Surg 2015;220:904-11.

ARS Question #6



Perioperative Medicine Summit
Evidence Based Perioperative Medical Care

Do you test grip strength in the preoperative setting?

A. Yes

B. No

C. How do you test grip strength?

Frailty: modified Frailty Index (mFI)

- Diabetes mellitus
- Congestive heart failure
- Hypertension on meds
- TIA or CVA
- Functional status 2 (not independent)
- Hx of myocardial infarction
- Peripheral vascular disease
- CVA with neurologic deficit
- Hx of COPD or pneumonia
- Prior PCI, cardiac surgery, or angina
- Impaired sensorium

The mFI was the strongest predictor of death even using ASA class, wound class, and age.

Kim S. Clinical Interventions in Aging 2015;10:13-27.

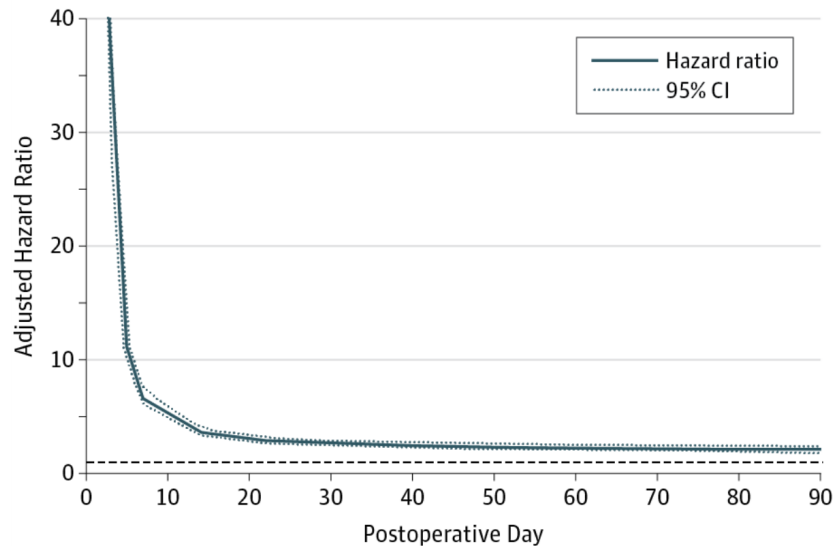
Frailty and Outcomes

- Population based study in Ontario, Canada
 - 202,811 patients, with 6289 (3.1%) frail
- Johns Hopkins ACG Frailty Indicator
 - Malnutrition, dementia, vision loss, decubitus ulcer, urinary incontinence, weight loss, poverty, access barrier to care, difficulty walking, fall

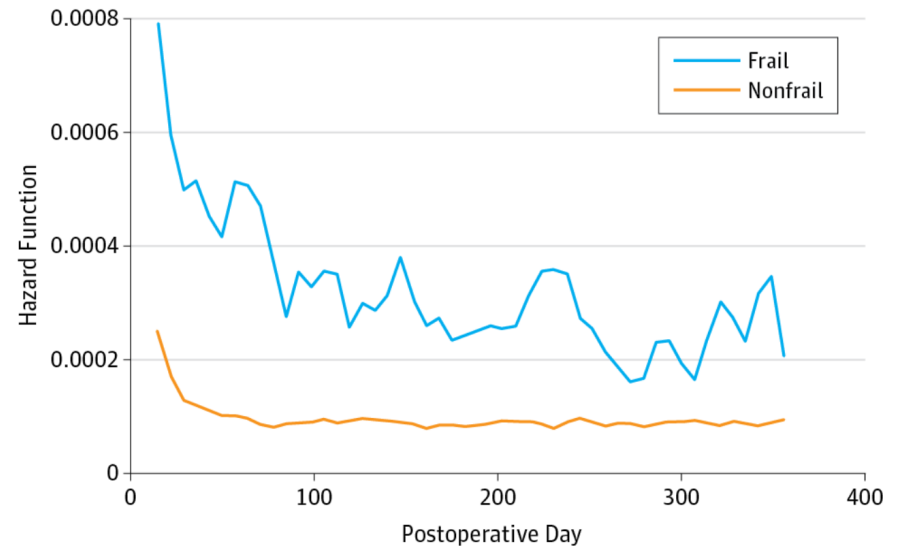
Mclsaac DI. JAMA Surg 2016; doi 10.1001/jamasurg.2015.5085

Frailty and Outcomes

A Hazard ratios



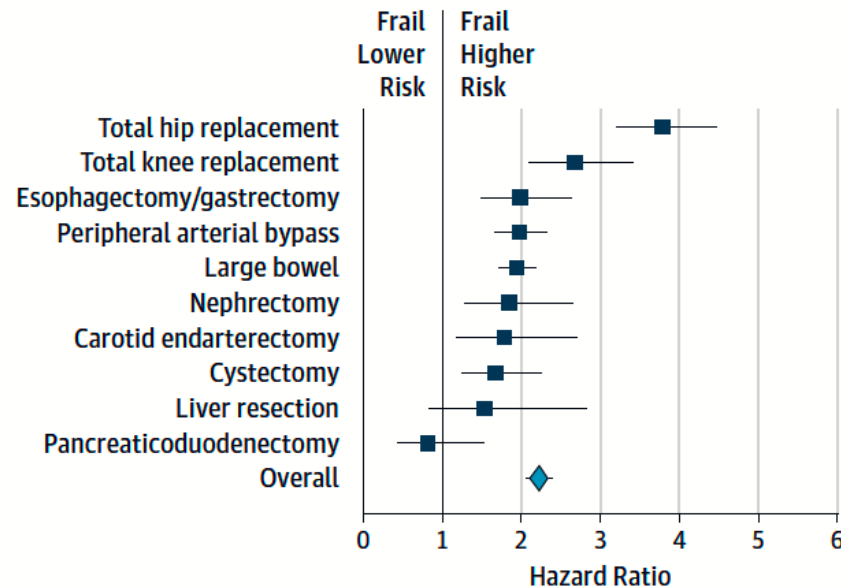
B Hazard functions



Mclsaac DI. JAMA Surg 2016; doi 10.1001/jamasurg.2015.5085

Frailty and Outcomes

Figure 3. Hazard Ratio for Effect of Interaction Between Frailty and Surgery Type on 1-Year Mortality Risk



The hazard ratio (adjusted for patient age, sex, and neighborhood income) measuring the association between frailty and 1-year mortality is presented for each surgical type. Hazard ratios whose lower 95% CI excludes 1 indicate a significantly increased risk of 1-year death in frail patients.

Interventions for Frailty

- Exercise
- Cognitive training
- Improved nutrition

No effect on outcomes, including hospitalizations, falls, or functional status.

Ng TP. Am J Med. 2015;128:1225-36.

Perioperative Interventions for Geriatric Syndromes

- Expanded therapy as part of early recovery after surgery protocols
 - Prehabilitation
 - Non-pharmacologic therapy
 - Pharmacologic therapy
- Full Geriatric Assessment to guide treatment
- Modification of treatment plan

Take home points

- Age is an inadequate predictor of performance status and fitness for surgery.
 - Functional age
 - Physiologic reserve
 - Geriatric syndromes
- Brief assessments can add valuable information while screening for elderly-specific issues.

Thank you!

Holly.M.Holmes@uth.tmc.edu

Twitter: @DrHollyHolmes


UTHealth®

McGovern
Medical School

The University of Texas
Health Science Center at Houston