

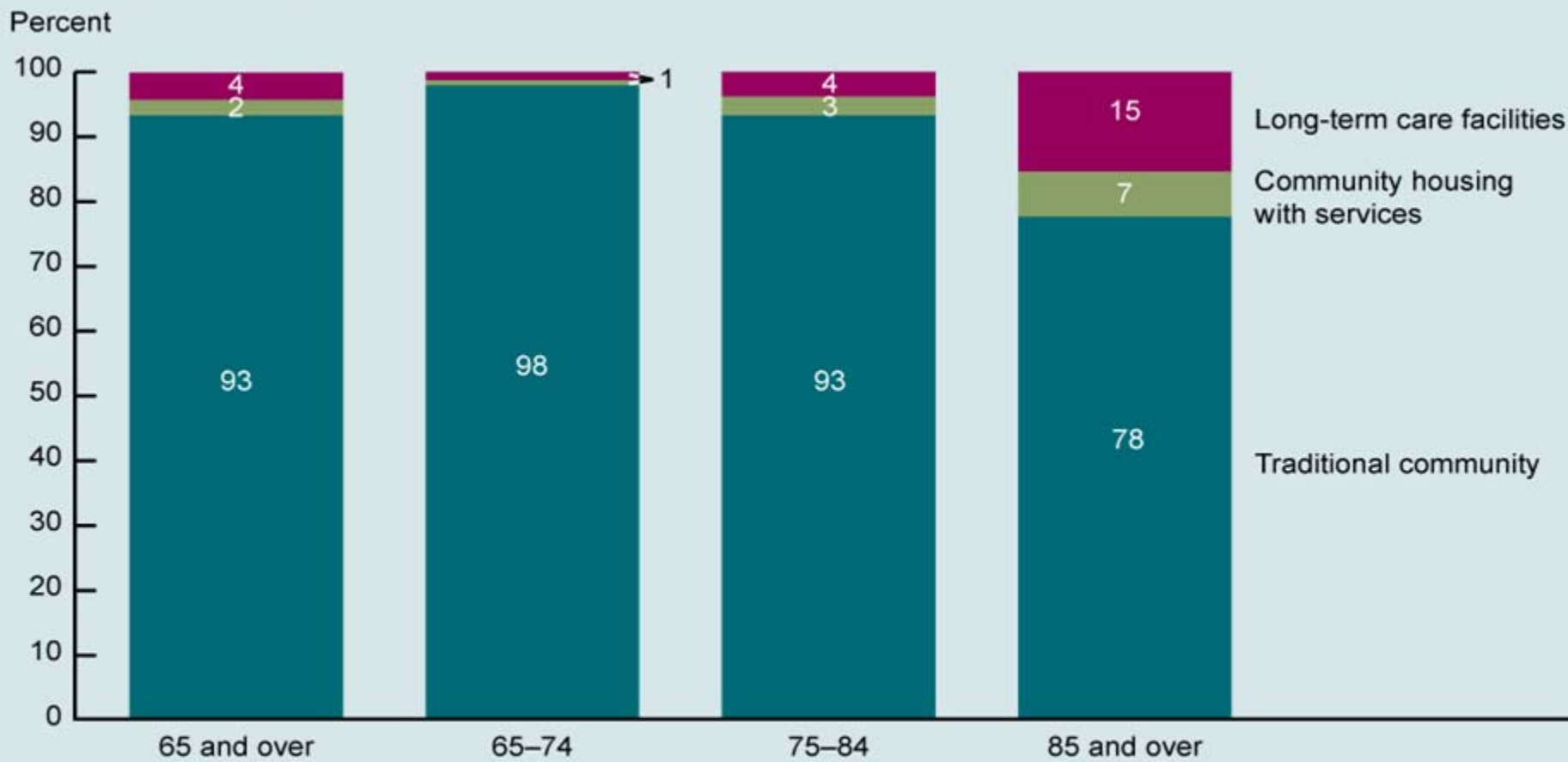
Prescribing for the Aging Adult

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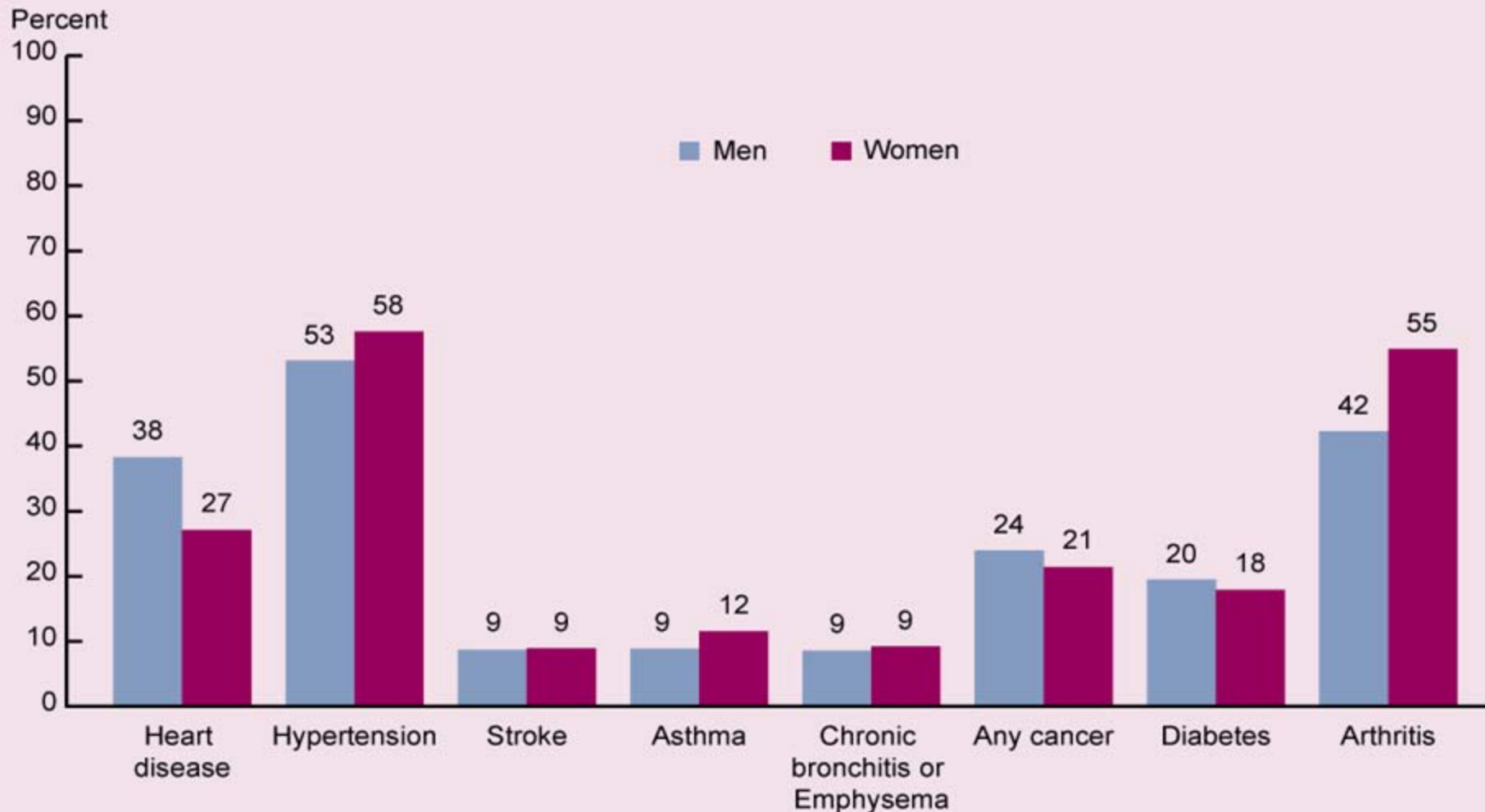
Percentage of Medicare enrollees age 65 and over in selected residential settings, by age group, 2007



NOTE: Community housing with services applies to respondents who reported they lived in retirement communities or apartments, senior citizen housing, continuing care retirement facilities, assisted living facilities, staged living communities, board and care facilities/homes, and other similar situations, AND who reported they had access to one or more of the following services through their place of residence: meal preparation; cleaning or housekeeping services; laundry services; help with medications. Respondents were asked about access to these services, but not whether they actually used the services. A residence (or unit) is considered a long-term care facility if it is certified by Medicare or Medicaid; or has three or more beds and is licensed as a nursing home or other long-term care facility and provides at least one personal care service; or provides 24-hour, seven-day-a-week supervision by a non-family, paid caregiver.

Reference population: These data refer to Medicare enrollees.
 SOURCE: Centers for Medicare and Medicaid Services, Medicare Current Beneficiary Survey.

Chronic health conditions among the population age 65 and over, by sex, 2007–2008



NOTE: Data are based on a 2-year average from 2007–2008. See Appendix B for the definition of race and Hispanic origin in the National Health Interview Survey. 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.

Prescription Use

- JAMA 2008
- Persons over 65-Largest consumer of medications
 - Primary Care: Clinics in Office Practice
 - K. Petrone, MD, P Katz, MD

Prescription Use & Aging Adults

- More than 80% of the elderly take at least one prescription per year
- Prescription use increases with age
 - Age 75+ 4.42/day
 - Age 65-74 4.45/day
 - Age 50-64 3.31/day

AARP Survey, 2005

Medication Use

- 90% of adults > 65 yo use at least 1 medication per week (Rx or OTC)
- 44% Men, 57% Women >65 used 5 or more medications per week
- 12% of both Men & Women used 10 or more medications per week

CHAMP

Care of the Hospitalized Aging Medical
Patient

Drugs and Aging

Paula M. Podrazik, MD
University of Chicago

Portal of Geriatric Online Education

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CHAMP: Drugs and Aging

ADR/ADE--defined

- Adverse Drug Reaction (ADR)

any undesirable or noxious drug effect at standard drug treatment doses

WHO;1996 Technical Report Series No. 425

- Adverse Drug Event (ADE)

ADRs + errors in drug administration

Polypharmacy

- Term describing patients who receive many medications
- Inappropriate meds lead to polypharmacy, ADRs & ADEs, ↑costs
- Beers criteria-meds to avoid due to lack of efficacy or unnecessary high risk

Clin Geriatric Med 23 (2007) 371-390

ADEs

- Account for 10% of Emergency Dept visits
- Up to 10-17% of hospital admissions
- 50% had at least one adverse drug interaction unrelated to reason for presentation

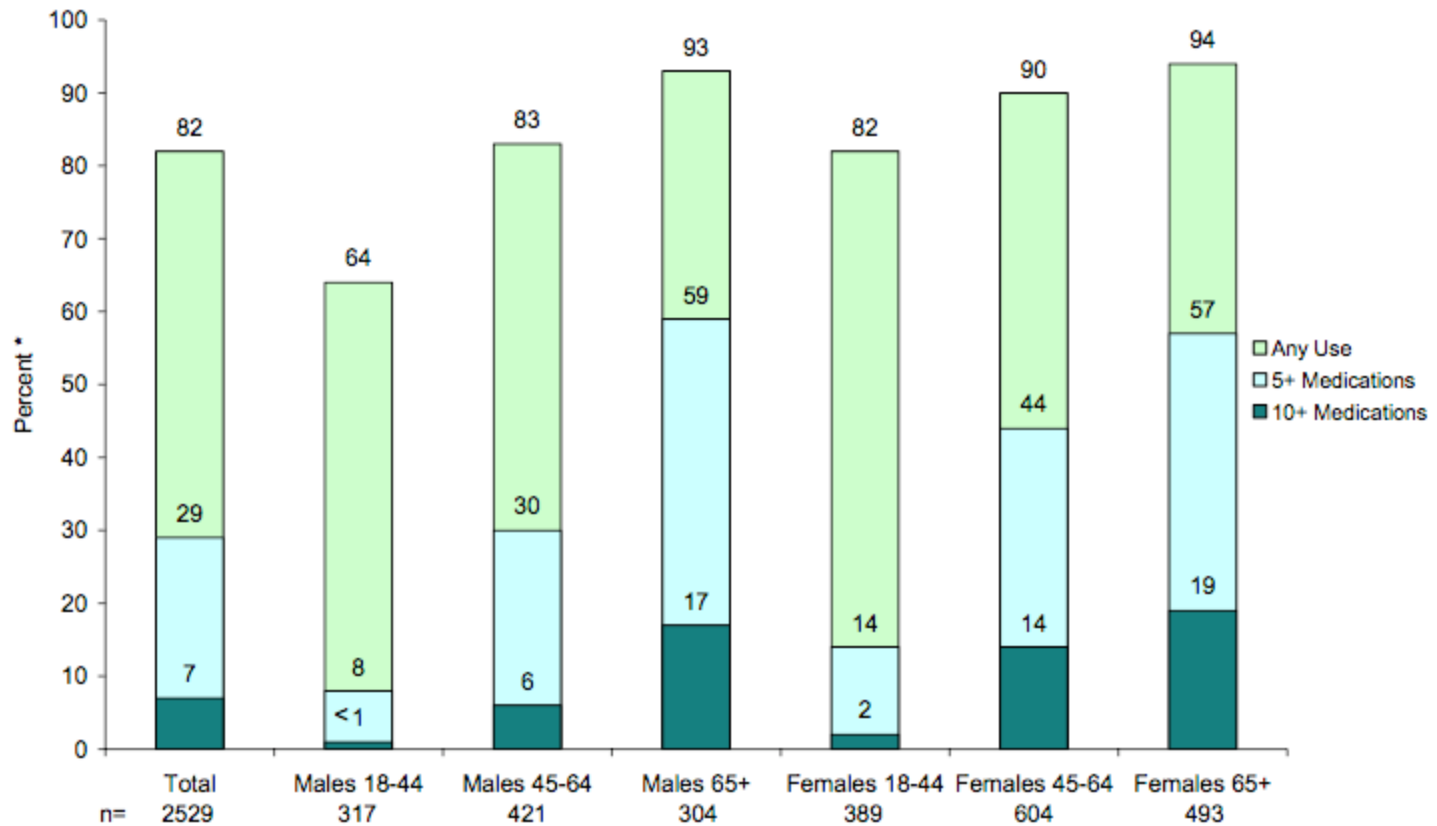
Drug Interactions

- Risk factors include
 - Polypharmacy
 - Increased # of treating physicians
 - Concomitant use of drugs causing sedating, hypotensive or anticholinergic effects
 - Increased with # of meds used
 - 13% of patients taking 2 medications
 - 82% of patients taking more than 6 medications

Slone Survey 2006

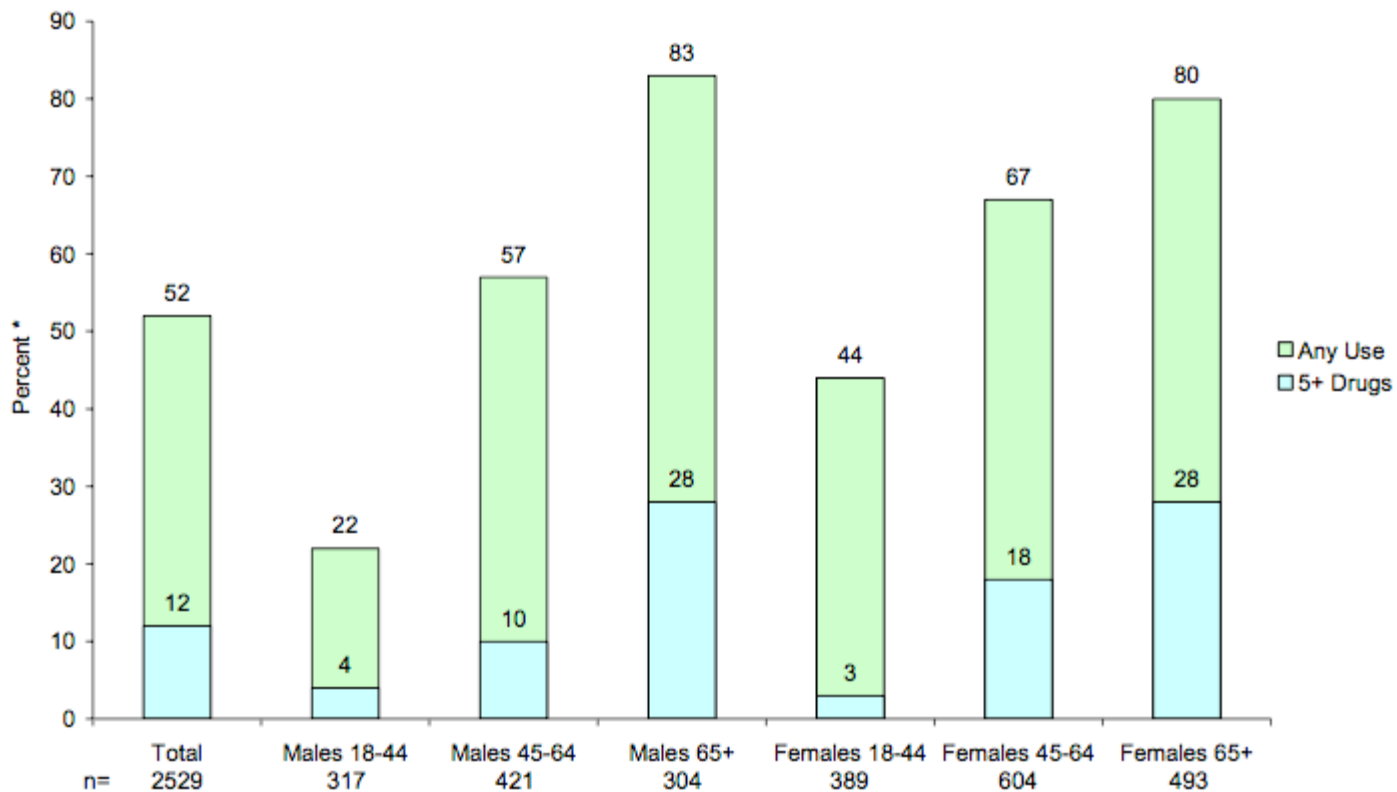
- Patterns of Medication Use in the United States, Slone Epidemiology Center at Boston University

Figure 1. Use of Medications During the Preceding Week Among U.S. Adults, by Sex and Age



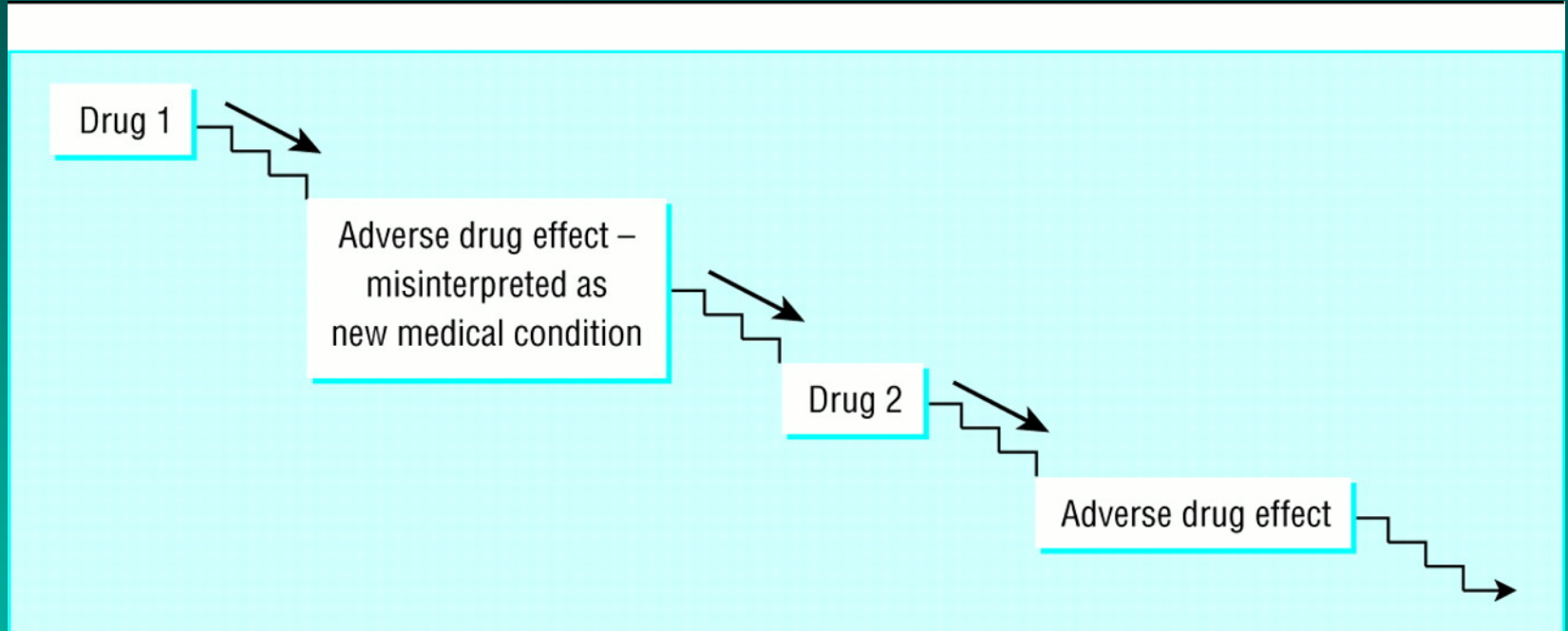
* Percents weighted according to household size. Total prevalence estimates also adjusted to the age/sex distribution of the U.S. 2006 Population Projections.

Figure 2. Use of Prescription Drugs During the Preceding Week Among U.S. Adults, by Sex and Age



* Percents weighted according to household size. Total prevalence estimates also adjusted to the age/sex distribution of the U.S. 2006 Population Projections.

Prescribing Cascade



Rochon P A , Gurwitz J H BMJ 1997;315:1096-1099

CHAMP: Drugs and Aging

Objectives

- Content-based objectives

Define & Review key topics in Aging PharmacoRx

- Factors that add to ↑ risk of ADRs/ADEs
 - polypharmacy
 - aspects of aging pharmacology
 - high risk/low benefit drugs-Inappropriate Drugs (Beers)
- Medication review and dosing

- Teaching method-based objectives

- Trigger to teach □MAR
- Use of the CHAMP acronym to teach
- Use of audit tools

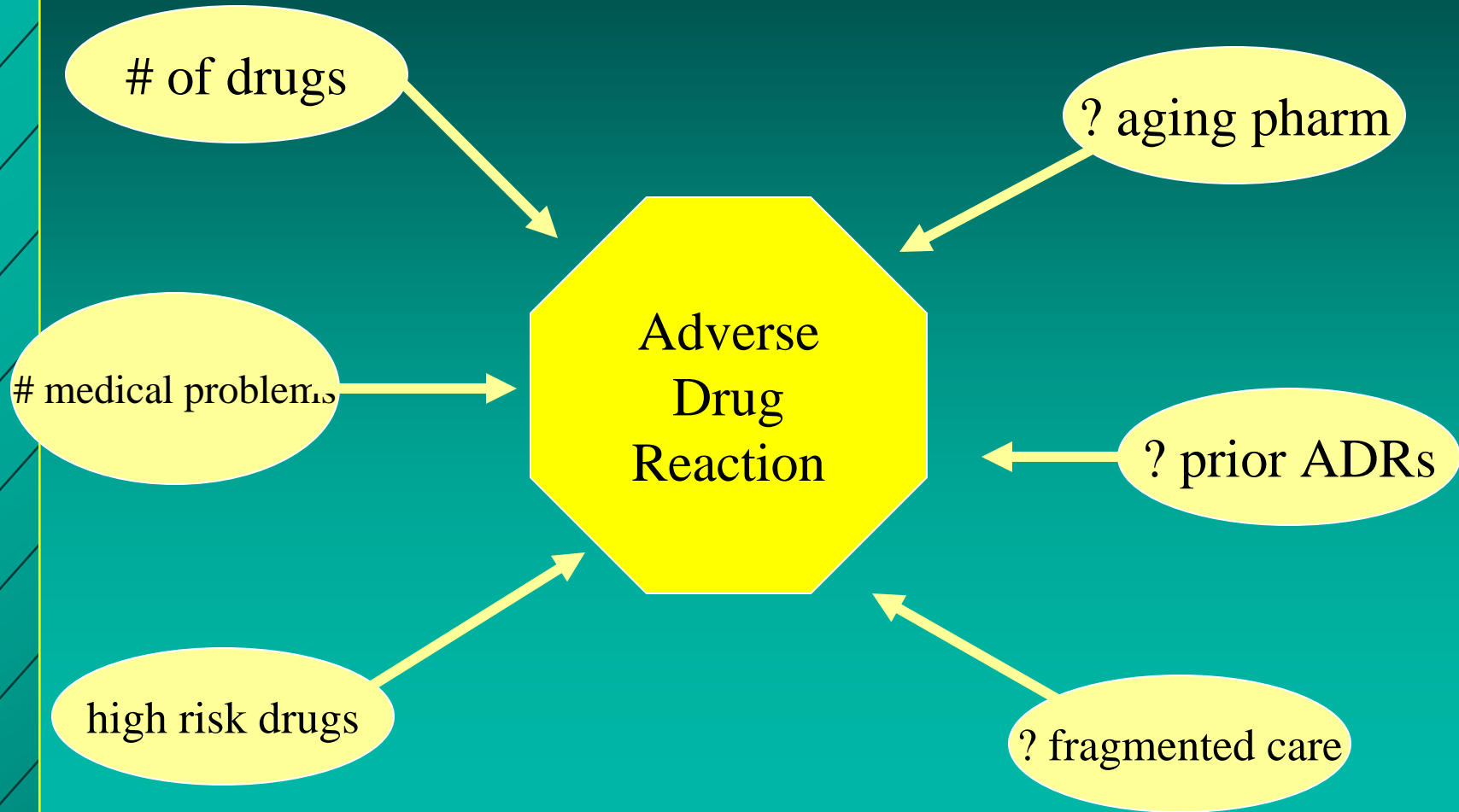
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Overview

- Prevalence of drug use in the elderly
- Risk factors for ADRs
- Drugs & the inpatient setting
 - Etiology of admission complaint
 - ADRs/ ADEs while in-hospital
 - Discharge meds
- Link to geriatric syndromes, e.g., delirium, falls, UI
- Med Review--guidelines

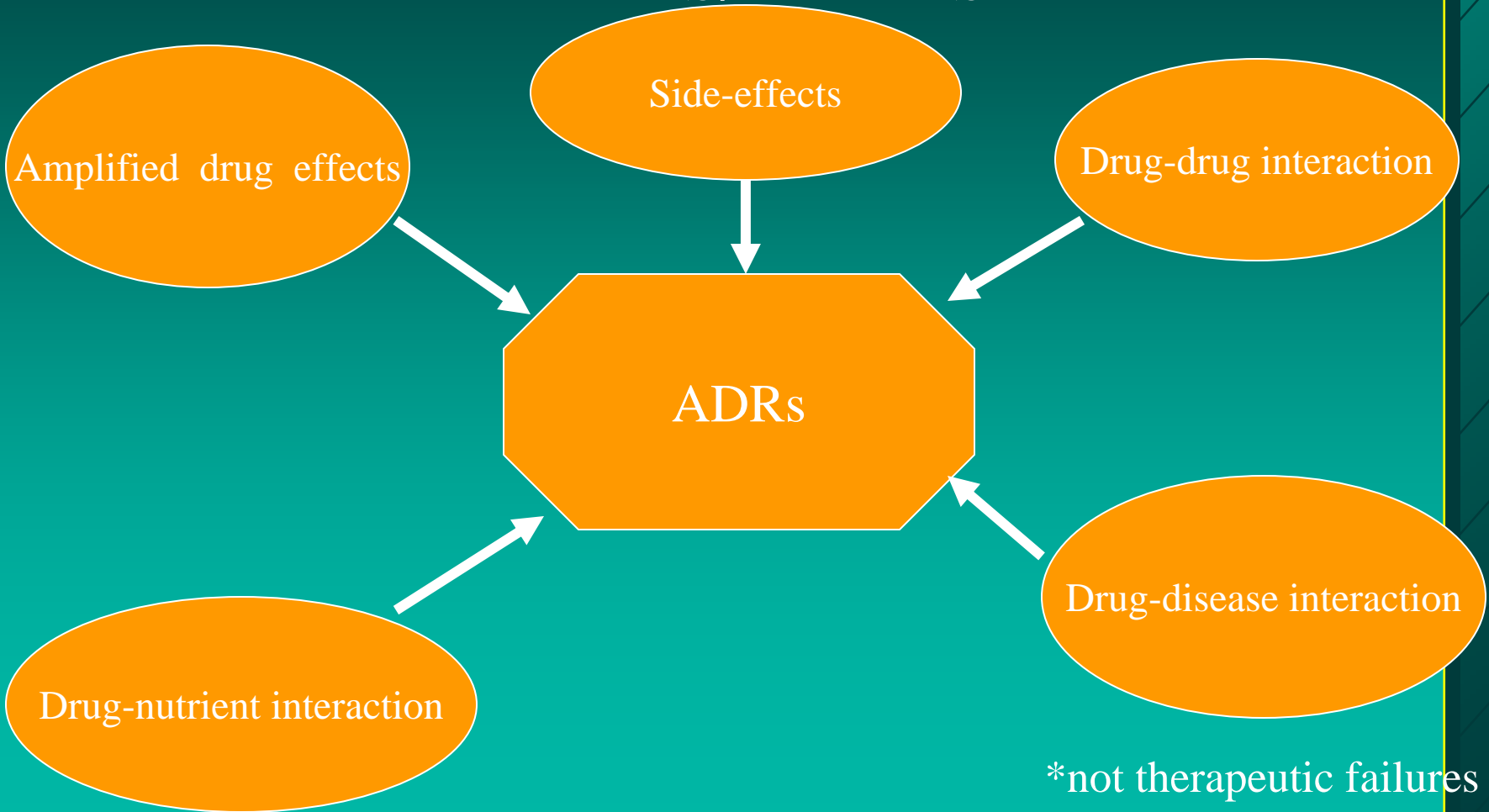
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ADR Risk Factors



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ADRs/ADEs



*not therapeutic failures

*not ADWEs

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ADEs and Hospitalization

Recent in hospital studies look at ADEs

How big a problem?

- 4th-6th leading cause of hospital death (serious ADRs 6.2%, fatal ADRs 0.32%)
- Increased length of stay
- Increased cost

Lazarou J, et al JAMA 1998; 280(20):1741-44

Classen D, et al JAMA 1997; 277(4): 301-6

CHAMP: Drugs and Aging ADEs and Hospital Cost

Preventable error?

Preventable cost?

- 4031 adult admissions to 700-bed Harvard teaching hospitals
- Look at ADEs & preventable ADEs
- ~\$ 5.6 million/year for all ADE
- **~\$ 2.8 million/year in preventable ADEs**

Bates DW, et al JAMA 1997;277: 307-311

CHAMP: Drugs and Aging MAR as the Teaching Trigger

An acronym for teaching that captures the factors that put the elderly at risk for ADRs and more...

- C--Cost, compliance
- H--Hazardous interactions
- A--Aging pharmacology
- M--Medications to avoid
- P--Polypharmacy

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Polypharmacy Summary

Polypharmacy

- Administration of more drugs than clinically indicated
- Risk of ADR greatly ↑↑ on >5 meds
- ~50 % of elderly take one or more unnecessary meds
- at hospital D/C, elderly take greatest # meds

Schmader K, et al JAGS 1994;42:1241-47

Lipton HL, et al Med Care 1992;30:646-58

CHAMP: Drugs and Aging Cost of Polypharmacy?

↑ risk drug interactions

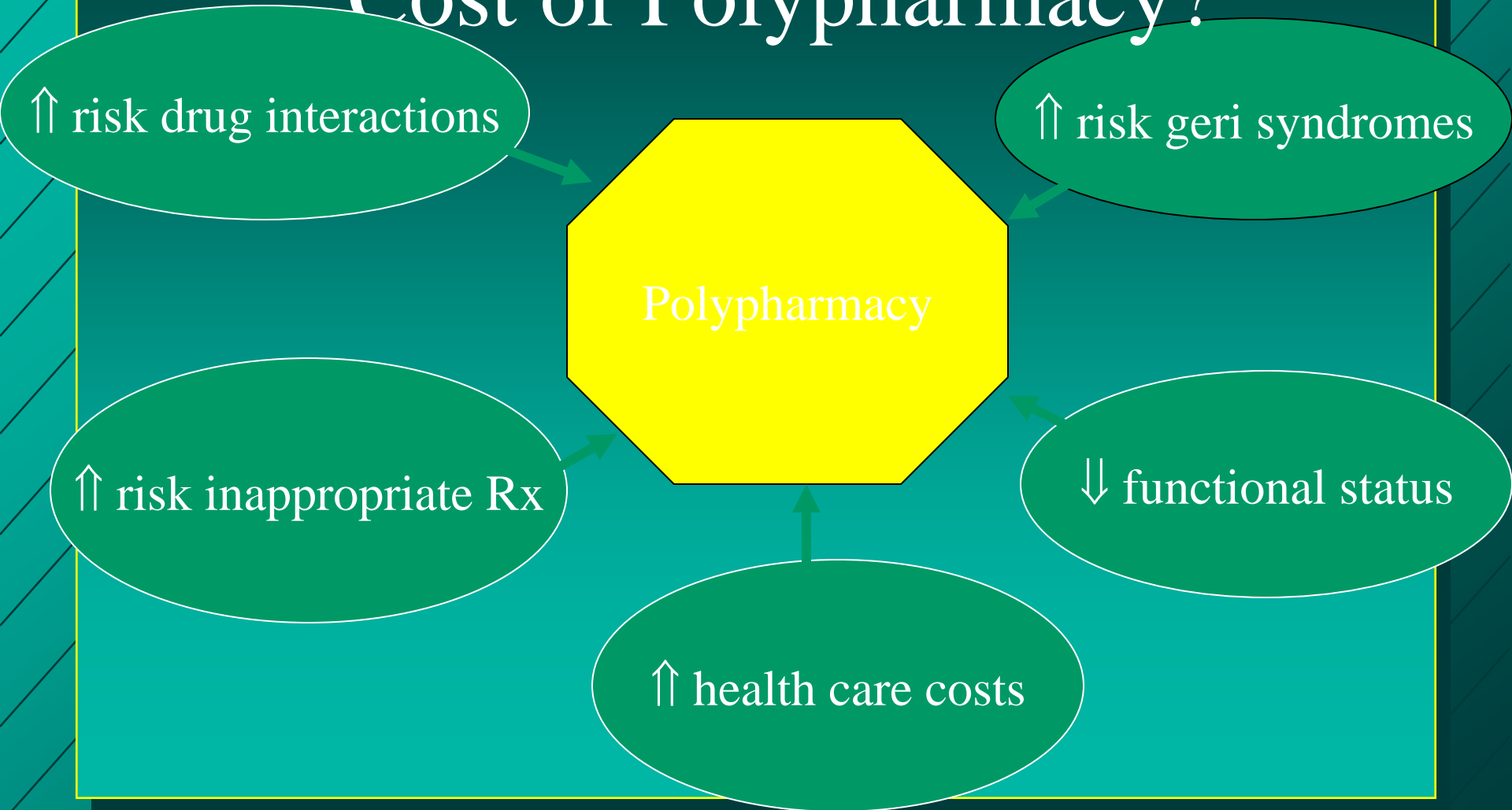
↑ risk geri syndromes

Polypharmacy

↑ risk inappropriate Rx

↓ functional status

↑ health care costs



CHAMP: Drugs and Aging

Drug Pharmacology

Pharmacokinetics

- Rate at which a drug is:
 - Absorbed, Distributed, Metabolized & Eliminated

Pharmacodynamics

- Time course and intensity of the drug's effect on the body at its receptor site
- The clinical effect

Absorption

- Aging has little effect on absorption of most drugs
- May be affected by taking multiple meds
- May be altered GI motility

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Drug Distribution with Aging

- \uparrow body fat to age 60-70 \Rightarrow \uparrow antipsychotics, TCAs
- \downarrow in lean body mass and fat after 70 \Rightarrow \uparrow digoxin concentration
- Decrease in total body water
- Δ protein-binding can effect $V_d \Rightarrow$ no sign. Δ in total protein binding

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Hepatic Biotransformation- Metabolism

- Age- related decline in enzyme activity
 - Reduction in liver blood flow
 - Reduction in hepatic oxidation: CYP450
- No age-related changes
 - Hepatic acetylation
 - Hepatic conjugation

CHAMP: Drugs and Aging Cytochrome P450 Systems

- CYP3A

- Metabolizes >60% of prescribed drugs including: Calcium channel blockers, certain beta-blockers, most “statins”, warfarin, amiodarone

- CYP2D6

- Metabolizes: metoprolol, propranolol, tramadol, codeine, oxycodone, TCAs, SSRIs

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Cytochrome P450 Inhibitors

- CYP3A Inhibitors

- Amiodarone, cimetadine, cyclosporin, erythromycin, itra-/ketoconazole, grapefruit juice

- CYP2D6 Inhibitors

- Cimetidine, SSRIs, quinidine

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Renal Clearance and Aging-Elimination

- ~ age 40, renal function declines 1% per year
- Normal serum Cr \neq normal GFR
- Estimate using Cockcroft-Gault equation

◆ Creatinine clearance =

◆ $\frac{(140 - \text{age}) * \text{Wt (kg)}}{72 * \text{serum Cr}}$ (X 0.85 in women)

72 * serum Cr

- Modified MDRD

◆ GFR estimate =

$186 * (\text{Cr})^{-1.154} * (\text{Age})^{-0.203} * (0.742, \text{ if female}) * (1.21, \text{ if African American})$

Renal Clearance

- Serum creatinine alone is a poor indicator of renal function due to:
 - Decrease lean muscle mass
 - Decrease in creatinine production

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Aging Pharmacodynamics

With aging:

- ***Beta-adrenergic responsiveness*** ↓↓
- Anticholinergic drugs ⇒ ↑↑ CNS effects
- Baroreceptor reflex blunted

CHAMP: Drugs and Aging

Aging Pharmacodynamics

With aging:

- Beta-adrenergic responsiveness ↓
- ***Anticholinergic drugs*** ⇒ ↑↑ ***CNS effects***
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CHAMP: Drugs and Aging

Aging Pharmacodynamics

With aging:

- Beta-adrenergic responsiveness ↓↓
- Anticholinergic drugs \Rightarrow ↑↑ CNS effects
- ***Baroreceptor reflex blunted***

CHAMP: Drugs and Aging Interactions to Beware

Drug-Disease Interactions to Avoid

↑ dementia+ benzodiazepines or anticholinergics

↑ bladder outlet obstruction+ anticholinergics, TCAs,
antispasmodics, antihistamines

↑ CRF, CHF, PUD + NSAIDS

↑ constipation + anticholinergics, TCAs, calcium channel blockers

↑ falls +TCAs, benzodiazepines

CHAMP: Drugs and Aging Compliance

- Compliance → Adherence → Concordance
- Rates of 25 to 59% in the elderly
- Factors associated with non-adherence
 - Physical impairment
 - Psychosocial risks
 - Medication related factors
- Higher risk of re-hospitalization
- Risk of noncompliance after discharge

Ryan AA. *Int'l J Nursing Studies* 1999; 36: 153-62.

Van Eijken M, et al. *Drugs & Aging* 2003; 20: 229-40.

CHAMP: Drugs and Aging Medication Review

- Evaluating appropriateness of prescribing
- Criteria for appropriateness
 - Explicit
 - Implicit
- Use of the criteria in different settings

CHAMP: Drugs and Aging RX Appropriateness --defined

- Weighing drug risk /benefit
- Achieving desired treatment outcomes
- Cost effectiveness
- Drug prescribing based on standards of care

CHAMP: Drugs and Aging

Explicit Criteria --Beers

- List of medications to avoid in elderly nursing home patients
- Developed by consensus panel in 1991
- Updated in 1997 and 2002

Beers, et al. *Arch Intern Med* 1991; 151: 1825-1832.

Beers MH. *Arch Intern Med* 1997; 157(14): 1531-1536.

Fick DM, et al. *Arch Int Med* 2003; 163: 2716-24.

CHAMP: Drugs and Aging Beers Criteria--Application

- Inappropriate prescribing is prevalent in many settings
- Number of medications is a risk factor for inappropriateness
- Links between inappropriate meds and clinical outcomes

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Limitations of Explicit Criteria

- Clinical relevance
 - Many medications outdated or not used
 - Requires update by consensus panel
- Validity of data
 - Criteria developed from nursing home data
 - Applied in many unvalidated settings
- Room for clinical judgement?

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MAI

- Is there an indication for the drug?
- Is the medication effective for the condition
- Is the dosage correct?
- Are the directions correct?
- Are the directions practical?
- Are there clinically significant drug-drug interactions?
- Are there clinically significant drug-disease/condition interactions?
- Is there unnecessary duplication with other drugs?
- Is the duration of therapy acceptable?
- Is this drug the least expensive alternative compared to others of equal utility?

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Med Review Guidelines in Aging Inpt.

- >5-6 meds ⇒ anticipate 50% risk of ADR
- Weigh use of high-risk/low-benefit drugs ⇒ anticipate ADRs
- Weigh use of CNS active RX , esp. in combo
- Consider dose, clearance, drug interaction, baroreceptor reflex blunting when CV drugs added in combo
- Delirium, falls, incontinence ⇒ drugs in DDx
- Med review @ admission and D/C to avoid polypharmacy (e.g., PPI)

CHAMP: Drugs and Aging

Goals for Course Module

- End year #1

As the *teaching* attending:

- teach medication review from the MARs
- teach about polypharmacy, aging pharmacology, better drug choices in the aging hospitalized patient
- use CHAMP acronym as aid to teaching
- use audits as teaching tool

As the *practicing* attending:

- reduce #s of unnecessary drugs
- choose drug/class from high risk/low benefit drug group to target for review, e.g., demerol, anticholinergic drugs

"Any symptom in an elderly patient should be considered a drug side effect until proved otherwise."

J Gurwitz, et al

Brown University LTC Quality Letter, 1995

The Beers Criteria

- Result of a Consensus Panel of Experts-1997 to develop explicit criteria for safe medication use in the elderly
- Adopted by CMS in July 1999 for nursing home regulation
- Revised in 2002
- Evaluate for ADEs

Arch Intern Med 2003;163:2716-2724

2002 Criteria for Potentially Inappropriate Drugs in Older Adults

- propoxyphene
- pentazocine
- diphenhydramine
- barbiturates
- chlorpropamide
- Benzodiazepines-long acting
- muscle relaxants & antispasmodics
- doxepin
- amitriptyline
- methyldopa
- reserpine
- dipyridamole
- ticlopidine
- meperidine
- meprobamate
- prescription and OTC antihistamines

What To Do?

- Epocrates www.epocrates.com
 - Evaluate for drug interactions, black box warnings, creatinine clearance
- Clearance www.nephron.com
- MDCalc
<http://mdcalc.com/creatinine-clearance-cockcroft-gault-equation/>
- GDR – Gradual Dose Reduction
- Frequent review

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