

Medications and Falls Prevention

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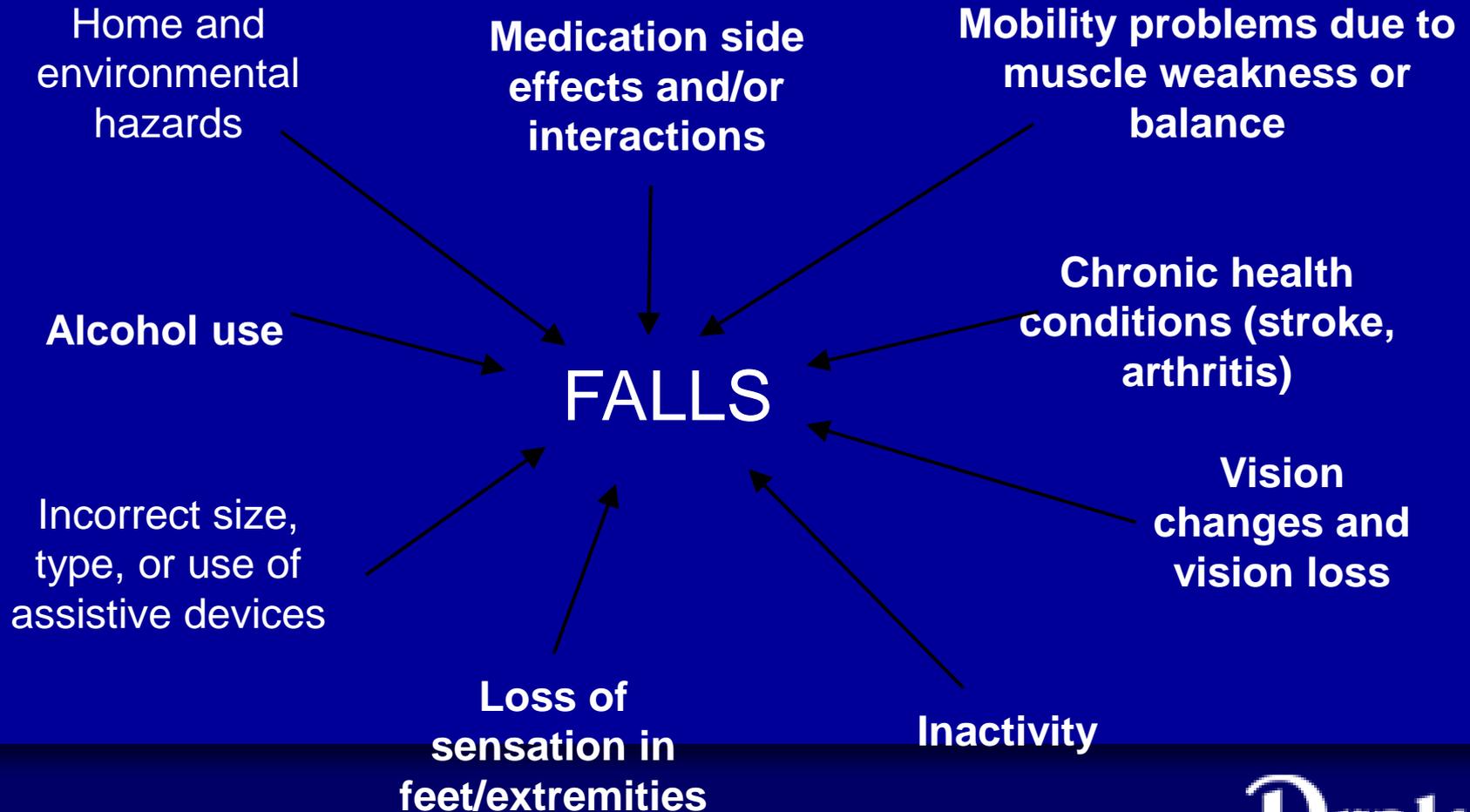
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Objectives

- Discuss chronic conditions that may predispose patients to falls and how proper medication management can minimize fall risk.
- List medications implicated in falls and implement strategies to decrease use of these medications.
- Apply knowledge of medications to a patient case and demonstrate the role of your respective health profession in a team approach to falls reduction.

Causes and Risk Factors



Medical Conditions Associated with Falls

- Diseases affecting sensory input
 - Cataracts, glaucoma, macular degeneration
- Diseases affecting central processing
 - Stroke, Parkinson's, dementia, depression, orthostasis
- Diseases affecting effector response
 - Foot problems, arthritis

Changes of Aging

Pharmacokinetic

- Decreased renal drug elimination, prolonged half-life, increased potential for side effects
- From 25-85 years old, average renal clearance declines by as much as 50%
- Pharmacists calculate creatinine clearance to estimate renal function and adjust medication doses

Changes of Aging

Pharmacodynamic

- CV system: decreased homeostatic mechanisms increase susceptibility to orthostatic hypotension
- CNS: blood brain barrier more permeable; most medications can cross, lower doses required
- Glucose metabolism: more insulin resistance as age increases, increased risk of hypoglycemia

Polypharmacy

- Definition: taking multiple medications concurrently
- Primary cause of adverse drug reactions in older adults



Community-dwelling elderly:
50% take 5+ medications
12% take 10+ medications

The Prescribing Cascade

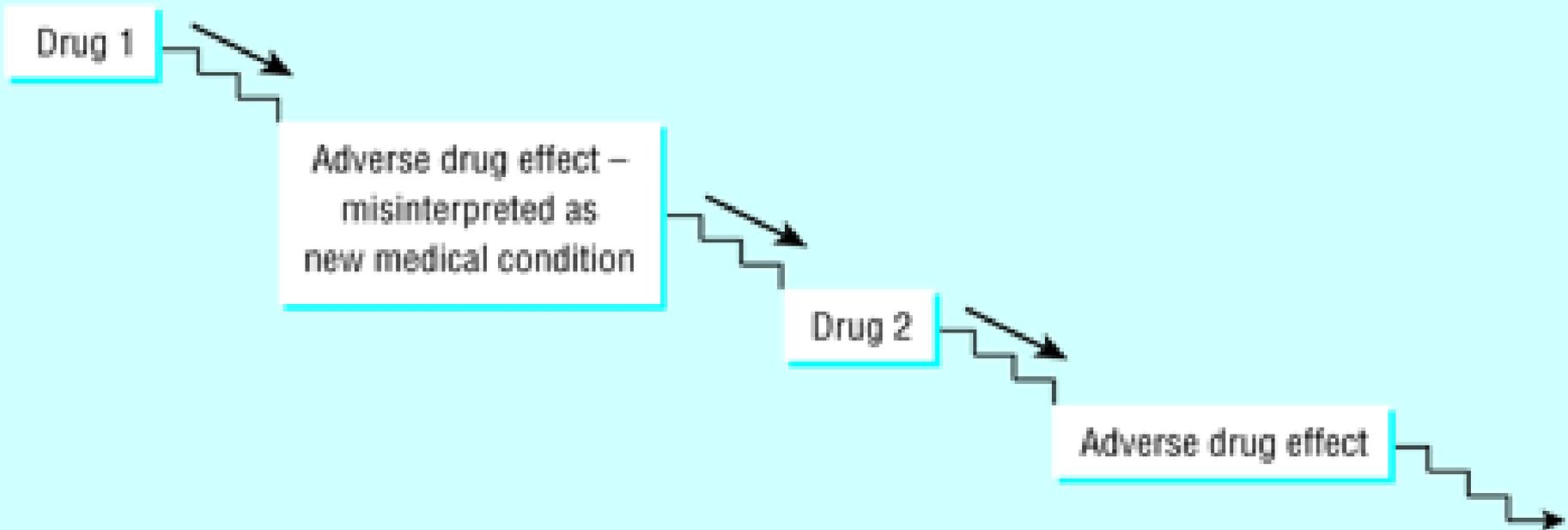


Image available: Rochon PA, Gurwitz JH. Optimising drug treatment for elderly people: the prescribing cascade. *BMJ*. 1997;315(7115):1096-9.

Prescribing Cascade Examples

- Warfarin + NSAID -> GI bleed -> iron tablets -> laxatives -> GI bleed -> iron tablets -> laxatives
- NSAID → GERD → cimetidine → delirium → haloperidol
- NSAID → HTN → hydrochlorothiazide → gout → more NSAID → uncontrolled HTN → amlodipine → edema → furosemide

Most Common Medications Associated with Falls in the Elderly

- Psychoactive Agents
 - Psychotropics, Opioids, Parkinson & Seizure agents, Muscle Relaxants, Antihistamines
- Psychotropic Agents
 - Anxiolytics (Benzodiazepines)
 - Hypnotics (Ambien)
 - Antipsychotics (Haloperidol)
 - Antidepressants (SSRIs)
- Cardiovascular Agents
 - Antihypertensives



Medication Fall Statistics

Drugs	Odds ratio (95% CI)
Any psychotropic	1.73 (1.52, 1.97)*
Antipsychotics	1.50 (1.25, 1.79)*
Sedative/hypnotics	1.54 (1.40, 1.70)*
Benzodiazepines (any)	1.48 (1.23, 1.77)*
Short acting	1.44 (1.09, 1.90)*
Long acting	1.32 (1.09, 1.90)*
Antidepressants	1.66 (1.41, 1.95)*
TCAs	1.51 (1.14, 2.00)*
Type 1a anti-arrhythmics	1.59 (1.02, 2.48)*
Digoxin	1.22 (1.05, 1.42)*
Centrally acting antihypertensives	1.16 (0.87, 1.55)
Nitrates	1.13 (0.95, 1.36)
ACE inhibitors	1.20 (0.92, 1.58)
β-Blockers	0.93 (0.77, 1.11)
Calcium channel blockers	0.94 (0.94, 1.14)
Any diuretic	1.08 (1.02, 1.16)*
Thiazide diuretics	0.97 (0.78, 1.20)
Loop diuretics	0.90 (0.73, 1.12)
Opioids	0.97 (0.78, 1.12)
Non-opioids	1.09 (0.88, 1.34)
NSAIDs	1.16 (0.97, 1.38)
Aspirin	1.12 (0.80, 1.57)

ACE = angiotensin-converting enzyme; CI = confidence interval; NSAIDs = nonsteroidal anti-inflammatory drugs; TCA = tricyclic antidepressant; * indicates statistically significant odds ratio.

- All data based on observational studies and meta-analysis
- We know what classes increase risk of fall
- We know the more medications someone takes the greater their risk of fall
- No research to state specifically what percentage of falls is due specifically to medications
- Many factors to consider
 - Extrinsic vs Intrinsic

Medication Fall Statistics

Drugs	Study (publication date range)			
	Leipzig et al. ^[42,43] (1966–1996) pooled OR (95% CI)	Woolcott et al. ^[44] (1996–2007) random effects pooled OR (95% CI)	Woolcott et al. ^[44] (1996–2007) pooled Bayesian OR (95% CI)	Bloch et al. ^[45] (1981–2007) pooled OR (95% CI)
Antihypertensives	Non-informative*	1.26 (1.01, 1.50)*	1.24 (1.01, 1.50)*	–
Diuretics	1.08 (1.02, 1.16)*	1.03 (0.84, 1.26)	1.07 (1.01, 1.14)*	–
β-Blockers	0.93 (0.77, 1.11)	1.14 (0.97, 1.33)	1.01 (0.86, 1.17)	–
Any psychotropic drug	1.73 (1.52, 1.97)*	–	–	1.78 (1.57, 2.01)*
Antidepressants	1.66 (1.41, 1.95)*	1.72 (1.40, 2.11)*	1.68 (1.47, 1.91)*	1.59 (1.46, 1.73)*
Benzodiazepines	1.48 (1.23, 1.77)*	1.60 (1.46, 1.75)*	1.57 (1.43, 1.72)*	1.39 (1.24, 1.54)*
Antipsychotics	1.50 (1.25, 1.79)*	1.71 (1.44, 2.04)*	1.59 (1.37, 1.83)*	1.50 (1.32, 1.71)*
Sedatives/hypnotics	1.54 (1.40, 1.70)*	1.31 (1.14, 1.50)*	1.47 (1.35, 1.62)*	1.54 (1.40, 1.69)*
Tranquilizers	–	–	–	1.34 (1.07, 1.67)*
Opioids	0.97 (0.78, 1.20)	0.89 (0.50, 1.58)	0.96 (0.78, 1.18)	1.38 (1.23, 1.56)*
NSAIDs	1.16 (0.97, 1.38)	1.65 (0.98, 1.58)	1.21 (1.01, 1.44)*	–

CI = confidence interval; **OR** = odds ratio; **NSAIDs** = nonsteroidal anti-inflammatory drugs; * indicates statistically significant OR.

2015 Beers Criteria

- First published 1991, most recent 2015
- THE authority on potentially inappropriate medications for older adults
- Intended to be used as a means of preventing adverse drug events in the elderly
- NOT a substitute for clinical judgment

Table 7. Drugs with Strong Anticholinergic Properties

Antihistamines	Antiparkinsonian agents	Skeletal muscle relaxants
Brompheniramine	Benztropine	Cyclobenzaprine
Carbinoxamine	Trihexyphenidyl	Orphenadrine
Chlorpheniramine		
Clemastine		
Cyproheptadine		
Dexbrompheniramine		
Dexchlorpheniramine		
Dimenhydrinate		
Diphenhydramine (oral)		
Doxylamine		
Hydroxyzine		
Meclizine		
Triprolidine		
Antidepressants	Antipsychotics	Antiarrhythmic
Amitriptyline	Chlorpromazine	Disopyramide
Amoxapine	Clozapine	
Clomipramine	Loxapine	
Desipramine	Olanzapine	
Doxepin (>6 mg)	Perphenazine	
Imipramine	Thioridazine	
Nortriptyline	Trifluoperazine	
Paroxetine		
Protriptyline		
Trimipramine		
Antimuscarinics (urinary incontinence)	Antispasmodics	Antiemetic
Darifenacin	Atropine (excludes ophthalmic)	Prochlorperazine
Fesoterodine	Belladonna alkaloids	Promethazine
Flavoxate		
Oxybutynin	Clidinium-chlordiazepoxide	
Solifenacin	Dicyclomine	
Tolterodine	Homatropine (excludes ophthalmic)	
Trospium	Hyoscyamine	
	Propantheline	
	Scopolamine (excludes ophthalmic)	

STOPP/START

- STOPP
 - 65 risky drug interactions with diseases or other drugs, therapeutic duplications
 - BZD in a pt who has fallen in last 3 months
- START
 - 22 scenarios where meds are indicated
 - Warfarin for Afib
 - Metformin for diabetes
 - ACE-I for heart failure

Antihistamines

- Diphenhydramine, chlorpheniramine, promethazine, hydroxyzine
- Drowsiness, sedation, confusion, delirium, constipation
- Alternatives/Plan
 - Avoid use
 - Use loratadine, fexofenadine, or cetirizine instead
 - Consider topical agents (saline, nasal steroid)

Tricyclic Antidepressants

- amitriptyline (Elavil), imipramine, nortriptyline, desipramine
- Anticholinergic effects, CNS depression, orthostatic hypotension
- Alternatives/Plan
 - Switch to a different antidepressant (SSRI, SNRI, bupropion)
 - If TCA necessary, nortriptyline may be better
 - Bedtime dose
 - Topical agent if used for neuropathic pain

Sedatives/Hypnotics

- Zolpidem (Ambien), eszopiclone, zaleplon
- CNS depression, behavioral changes
- Alternatives/Plan
 - No recommended drug alternative
 - Address root cause of insomnia
 - Sleep hygiene
 - If necessary, limit use to 90 days duration
 - Use lowest possible dose

Antipsychotics

- Risperidone (Risperdal, clozapine, olanzapine, quetiapine, aripiprazole, ziprasidone, haloperidol, chlorpromazine
- Sedation, cognitive impairment, orthostatic hypotension, extrapyramidal effects
- Alternatives/Plan
 - Avoid in dementia
 - Decrease dose if possible
 - Divide dose
 - Bedtime dose?

Anticonvulsants

- Phenytoin, carbamazepine, divalproex, valproic acid
- Dizziness, drowsiness
- Alternatives/Plan
 - Decrease dose if possible
 - Newer agents preferred for epilepsy patients (lamotrigine, levetiracetam)
 - Change to gabapentin, pregabalin or topical agent (lidocaine, capsaicin) for neuropathic pain

Benzodiazepines

- Lorazepam (Ativan), alprazolam, temazepam, diazepam, chlordiazepoxide
- Cognitive impairment, delirium, paradoxical reactions
- Alternatives/Plan
 - Lorazepam preferred if necessary
 - Use PRN only after non-drug strategies fail
 - Buspirone , SNRI alternatives for anxiety

Narcotic Analgesics

- Hydrocodone/APAP (Norco, Vicodin), morphine, fentanyl, tramadol, oxycodone
- CNS depression, hypotension, constipation
- Alternatives/Plan
 - Switch to APAP for pain management if possible
 - If narcotic is needed, hydrocodone or oxycodone
 - Non-pharmacologic pain reduction measures

Antiarrhythmics

- Common at IVH: amiodarone (Cordarone)
- Others in this class
 - Sotalol, flecainide
- How?
 - Bradycardia, hypotension
- Alternatives/Plan
 - Beta blockers (metoprolol)
 - Calcium channel blockers (diltiazem or verapamil)
 - Decrease dose

Diuretics

- Furosemide (Lasix), torsemide, bumetanide
- Orthostasis, dehydration, increased ambulation
- Alternatives/Plan
 - Decrease dose
 - Morning dose

Antihypertensive Agents

- Lisinopril (Prinivil), quinapril, benazepril, enalapril
- Hypotension/syncope
- Alternatives/Plan
 - Decrease dose if at blood pressure goal
 - 150/90 if >60 years old
 - 140/90 if CKD, diabetes

Antidiabetic Agents

- Glyburide (Diabeta), Sliding scale insulin
- Risk of hypoglycemia
- Alternatives/Plan
 - Glipizide, scheduled mealtime insulin
 - Monitor for symptoms of hypoglycemia
 - Educate patient on keeping a snack on hand in case of lows

Antimuscarinics

- Oxybutynin (Ditropan), tolterodine, trospium
- Drowsiness, sedation, confusion, delirium, constipation
- Alternatives/Plan
 - Avoid use
 - Incontinence pads

Skeletal Muscle Relaxants

- Cyclobenzaprine (Flexeril), Carisoprodol, metaxalone
- CNS depression, anticholinergic effects
- Alternatives/Plan
 - Avoid use
 - Focus on non-drug management

Anticoagulation and Falls

- Falls are leading cause of head trauma in elderly
- Age is a significant risk factor for mortality
- Use of anticoagulants may increase relative risk for mortality
- Still more research is needed

Falls-Focused Medication Reviews in Hospital Setting

- Antiemetics, opioid analgesics, anticholinergics acting on the bladder, benzodiazepines/hypnotics
- Finding suitable alternatives for inappropriate meds difficult
- Comprehensive med reviews by pharmacists are time-intensive, limiting feasibility

Multidisciplinary Approach



How Pharmacists Help Decrease Medication Related Fall Risk

- Strong patient-pharmacist relationships
 - Monitor how patients' medications are working
 - Monitor for possible side effects
 - Teach patients about their medications
 - Address patients questions and concerns about medications
 - Avoid patients going to multiple pharmacies
- Other pharmacist Services
 - Comprehensive evaluation of all medications both before and especially after each fall which allows for assessment and recommendation for changes in patients' drug regimen
 - Transition of Care

- 89 yo woman, admitted to nursing facility from home
- PMH: CHF, Afib, HTN, hyperlipidemia, seizure disorder, GERD, osteoporosis s/p hip fracture, hypothyroidism, depression, anemia, insomnia, DJD, CAD s/p angioplasty x2
- Allergies to Indocin, Midrin
- Last PE shows no patient complaints, irregular heart beat, no edema, reports no seizures in two years
- CrCl: ~40 ml/min
- CBC and Chem6 WNL
- LDL: 65, LFTs WNL
- TSH WNL
- INRs stable
- Albumin: 4 g/dL
- Phenytoin level (total): 2 mcg/mL (10-20)

- Medications

- Spironolactone 12.5 mg daily
- Diltiazem ER 240 mg daily
- Morphine sulfate ER 15 mg q 12h
- Warfarin 3.5 mg daily
- Senna S @HS
- Simethicone tab AC & HS
- Mirtazapine 7.5 mg @HS
- Levothyroxine 0.112 mg daily
- Simvastatin 20 mg @HS
- Lisinopril 5 mg daily
- Omeprazole 20 mg BID
- Phenytoin 10 mg BID
- Furosemide 80 mg BID
- Ranitidine 150 mg @HS
- Isosorbide MN 30 mg daily
- Sotalol 120 mg BID
- Alendronate 70 mg weekly
- Paroxetine 20 mg daily
- Oyst. Ca+ D 500 mg BID
- Klor Con ER 20 mEq daily
- PRNs: albuterol, NTG, bi acetyl MOM, Tums, hydrocodone/APAP APAP



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

Summary

- Lots of resources
- Some conflicting info
- Keep the patient at the center
- Work as a team
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