A Primer on Safe Prescribing to the Elderly

➔ Dr. John Puxty
Learning Objectives

- Describe an approach to safe prescribing for older patients.
- Appreciate the significance and causes of Polypharmacy.
- Identify contributory factors to medication related problems and ways to avoid them.
Polypharmacy is an Issue for the Elderly

"I feel a lot better since I ran out of those pills you gave me."
Medication Use in Older Adults

- Seniors in Canada account for:
  - 14% of the population
  - 25% MD visits
  - 28-40% of prescription medications
  - 44% of drug costs
  - 80% of our seniors have a chronic medical condition

(CIHI 2005)
Medication Use in Older Adults

In 2005
- 35 prescriptions/person aged 60-79
- 74 prescriptions/person aged 80+
- 14 prescriptions/person for the average Canadian

In the previous 2 days,
- 97% of institutionalized seniors had used medication
- 76% of community dwelling seniors

(Ramage-Morin, Health Reports 2009)
Polypharmacy is an Issue for the Elderly

- Drug expenditures in Canada have been on a steady increase for more than 20 years, going from $3.8 billion in 1985 to an estimated $25 billion in 2005 (according to CIHI).

- In 2006 drugs accounted for nearly 16% of health care costs (physicians only take up 12.9%, while hospitals eat up 29.9%).

- Seniors account for up to 40% of prescriptions.

- Older patients take 3 x as many prescription medications as younger patients and purchase 70% of non-prescription medications (reviewed in Gallagher et al, 2007).

- Over 75 year old individuals take on average nearly four (4) prescribed medications and two (2) across the counter meds daily!

- 50% of elderly take one or more unnecessary meds.
Healthcare Provider Factors that Contribute to Polypharmacy

- No regular medical review.
- Belief that patient expects medications.
- Prescribing for “symptoms” without sufficiently investigating clinical situation.
- “Evidence” that a particular drug is the “best” drug for a problem.
- Existence of co-morbidities and multiple providers.
- Unclear, complex or incomplete instructions about medications.
- No effort to simplify medication regimen.
- Ordering automatic refills.
- Lack of knowledge of geriatric clinical pharmacology.
- Fear of accusations of ageism or cultural bias.
Factors that contribute to Polypharmacy

- Increasing age associated with higher prevalence of many diseases (aging with co-morbidity).
- High volume of contacts by “frail sub-group” to multiple sites.
- Seeing multiple providers and using multiple pharmacies.
- Hoarding medications and insisting on taking medication that no longer maybe appropriate.
- Inaccurate reporting of symptoms or meds taken, can result in duplicate meds.
- Assume that once medication started it should be continued.
- Use of non-prescribed drugs, across counter, herbals, alcohol.
- Inappropriate prescribing.
OVER and UNDER the Counter

→ Surveys report an average of two (2) pharmacologically active substance per day:
  ▪ Alcohol
  ▪ Benadryl
  ▪ Gravol
  ▪ Cough and cold medicines
  ▪ Antacids
  ▪ Aspirin and Advil
  ▪ Tylenols (including Tylenol #1)
  ▪ Pepto Bismol
  ▪ Loperamide
  ▪ Topical analgesics
  ▪ Grapefruit
Pharmacokinetic and / or Pharmacodynamic Alterations with Age
Pharmacokinetics

- **Absorption**
  - Gastrointestinal (GI) unchanged
  - Intramuscular (IM) reduced
  - Transdermal reduced

- **Distribution**
  - Protein binding reduced
  - Volume of Distribution
    - Water soluble reduced
    - Fat soluble increased

- **Metabolism**
  - Oxidation/reduction reduced
  - Conjugation unchanged
  - CYP 450 activity unchanged

- **Elimination**
  - GFR reduced
Pharmacodynamics

- Changes are seen in:
  - **Numbers of receptors**
    - Decreased baroreceptor sensitivity
  - **Sensitivity of receptors**
    - Beta-adrenergic receptors
    - Blood-Brain Barrier re Benzodiazepines
  - **Counter-regulatory mechanisms**
Medication-Related Problems

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

J Gurwitz, M Monane, S Monane, J Avorn Brown University Long-term Care Quality Letter 1995
Medication-Related Problem (MRP)

As defined by Hepler & Strand:

“An event or circumstance involving a patient’s drug treatment that actually, or potentially, interferes with optimal outcome.”
Seven Categories of Medication-Related Problems

1. Medical condition that requires new or additional drug therapy.
2. Patient taking unnecessary drug given present condition.
5. Correct drug, dose too high.
6. Adverse drug reaction.
7. Patient not taking drug correctly.
“Symptoms” of Medication-Related Problems

- Confusion
- Depression
- Delirium
- Insomnia
- Parkinson’s-like symptoms
- Incontinence
- Weakness or lethargy
- Loss of appetite
- Falls
- Changes in speech
- Nausea / GI upset
Recognition of Drug-Induced Reactions

- Be mindful of new symptoms that might be an ADE.
- Review the medications.
- Examine temporal relationships between new meds or increased/decreased dosage or discontinuation and onset of symptoms.
- Hyperactive state – suspect cholinergic toxicity, alcohol intoxication, stimulant intoxication, serotonin syndrome, alcohol or benzodiazepine withdrawal.
- Hypoactive state – suspect sedative or narcotic intoxication, alcohol or benzodiazepine intoxication.
- **Always, Always, Always** consider medications with acute confusion.
The significance of Medication-Related Problems (MRPs)

- Risk of clinically serious ADR is four (4) per 100 prescriptions, one (1) in 1,000 will die (Simonson et al. Medication Related Problems in the elderly, *Drugs & Aging*, 2005.) 25% of interactions are due to prescribing by multiple physicians.
- Prescription drugs 80% of ADR, OTC 20% of ADR.
- Between 19 – 28% of hospital admissions for those over 50 are due to medication-related problems. It is suggested that as many as 75% of these admissions could have been prevented if medications had been used appropriately (reviewed in Gallagher et al, 2007).
  - 60% of MRP-related admissions are due to adverse drug reactions (ADRs).
  - 40% of MRP-related admissions are due to non-compliance.
- In a study of 247 ADEs, 70 deemed preventable. Analgesics, sedatives and antipsychotics ⇒ 46% of preventable ADEs (Bates DW, et al *JAMA* 1997;277:307-311).
- In USA, the number of deaths per year due to MRPs is equivalent of three (3) jumbo jet crashes every two days!
- If MRPs were ranked as a disease by cause of death, it would be the 5th leading cause of death in USA (Lasorou et al. Incidence of adverse drug reactions in hospitalized patients: a meta-analysis of prospective studies. *JAMA*, 1998 280(20):1741-44).
Medication-Related Problems

Some medications are more commonly associated with problems in seniors:

- Anticholinergics (e.g. benztropine and other medications with anticholinergic effects)
- Psychotropics
- NSAIDs
- Hypoglycemics
- Diuretics
- Cardiovascular medications (e.g. digoxin)
- Warfarin
Risk Factors for ADRs

➔ Personal Characteristics
  ▪ > 85 years of age
  ▪ Isolated
  ▪ Low literacy

➔ Medical History
  ▪ Six (6) or more meds (multiple prescribers)
Polypharmacy and ADRs

- 6 or more meds (15-20% of seniors)
- 35% experience ADR
- 95% were predictable
- 63% required MD intervention
- 10% required ER visit
- 11% required hospitalization

(Hanlon TJ et al JAGS 1997 45:945-948)
Risk Factors for ADRs

➔ Personal Characteristics
  ▪ > 85 years of age
  ▪ Isolated
  ▪ Low literacy

➔ Medical History
  ▪ 6 or more meds (multiple prescribers)
  ▪ Prior ADRs
  ▪ > 6 chronic health problems
  ▪ Cognitive impairment

➔ Findings of:
  ▪ BMI < 22 (frail)
  ▪ CLCR < 50ml/min
Estimating Creatinine Clearance

Cockcroft-Gault Equation

\[\text{CrCl}_{\text{men}} = \frac{(140 - \text{Age}) \times \text{IBW}}{\text{Scr} \times 72}\]

\[\text{CrCl}_{\text{women}} = \text{CrCl}_{\text{men}} \times 0.85\]

\[\text{IBW}_{\text{men}} = 50 \text{ kg} + (2.3 \times \text{inches} > 5 \text{ ft})\]

\[\text{IBW}_{\text{women}} = 45.5 \text{ kg} + (2.3 \times \text{inches} > 5 \text{ ft})\]
Drugs and Aging: ADR Risk Factors

- # of drugs
- # Co-Morbidities
- High risk drugs
- Aging pharm.
- Prior ADRs
- ? Fragmented care
# Common Drug-Drug Interactions

<table>
<thead>
<tr>
<th>Combination</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE inhibitor + diuretic</td>
<td>Hypotension, hyperkalemia</td>
</tr>
<tr>
<td>ACE inhibitor + potassium</td>
<td>Hyperkalemia</td>
</tr>
<tr>
<td>Antiarrhythmic + diuretic</td>
<td>Electrolyte imbalance, arrhythmias</td>
</tr>
<tr>
<td>Benzodiazepine + antidepressant, antipsychotic, or benzodiazepine</td>
<td>Confusion, sedation, falls</td>
</tr>
<tr>
<td>Calcium channel blocker + diuretic or nitrate</td>
<td>Hypotension</td>
</tr>
<tr>
<td>Digitalis + antiarrhythmic</td>
<td>Bradycardia, arrhythmia</td>
</tr>
</tbody>
</table>
Common Drug-Disease Interactions

- Obesity alters VD of lipophilic drugs.
- Ascites alters VD of hydrophilic drugs.
- Dementia may ↑ sensitivity, induce paradoxical reactions to drugs with CNS or anticholinergic activity.
- Renal or hepatic impairment may impair detoxification and excretion of drugs.
Drug-Disease Interactions to avoid

- In **Dementia** use of benzodiazepines or anticholinergics.
- In **Bladder Outlet Obstruction** use of anticholinergics, TCAs, antispasmodics, antihistamines.
- In **CRF** or **CHF** use of NSAIDS.
- In **Constipation** use of anticholinergics, TCAs, calcium channel blockers.
- In **Falls** use of TCAs, benzodiazepines.

Fick DM Arch Intern Med 2003;163:2716-2724
Beers MH Arch Intern Med 1997;157:1531-1536
What Drugs should we avoid?

A consensus panel of experts in Geriatric Medicine and Pharmacology developed a list of Drugs that are Inappropriate in the elderly, known as: “The Beers Criteria”.

(Arch Int Med 2003, 163:2716-2724)
BEERS Criteria

- A list of 48 individual medications or classes of medications to avoid in the older adult.
- A list of 20 diseases or conditions and medications to be avoided in the older patients with these conditions.
- These criteria have been used extensively for evaluating and for intervening in medication use in older adults over the past decade.
- A tool to help decrease MRPs.
## Drugs with Proven Benefit in Older Adults

<table>
<thead>
<tr>
<th>Clinical Indication</th>
<th>Drug of Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Past MI, CAD, TIAs, stable and unstable angina, PVD, stroke prevention, embolic stroke prevention in those unable to take Warfarin</td>
<td>Aspirin</td>
</tr>
<tr>
<td>Status post MI</td>
<td>Beta blockers</td>
</tr>
<tr>
<td>Heart failure</td>
<td>ACE inhibitor, Spironolactone</td>
</tr>
<tr>
<td>Chronic non-valvular atrial fibrillation</td>
<td>Warfarin</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>Statins</td>
</tr>
</tbody>
</table>

(American Fam Phy Nov 15,2002 Vol 66, Number 10)
Unsafe Herbs

- Arnica
- Butterbur
- Chaparral, Creosote bush
- Coltsfoot
- Comfrey
- Indian tobacco
- Jimson weed
- Pennyroyal oil
- Pokeweed root
- Rauwolfia
- Sassafras
Compliance

"Your green pills are all gone. Do you wanna take a blue and a yellow?"
Seniors are not… “TAKING AS DIRECTED”

→ 20% of prescriptions are not filled because of belief that drug is unnecessary.

→ 80% of compliance problems are due to perception that drug leads to ADRs.

“What Drugs are our Frail Elderly taking?” CFP 2001, Vol 47: 1145-1152 C.Frank and A.Kelly
Compliance

- Compliance 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 non-compliance after discharge

Factors Modifying Compliance

- Comprehension (instructions, labels)
- Cognition
- Dexterity
- Number of medications
- Side-effects
Proposed Primary Care Approach to Medications in the Elderly
Medication Review (3D CARE)

- Is the **Drug** indicated and best choice (Beers list Fick et al, 2003)?
- Is the **Dosage** and **Duration** correct?
- Are there **Compliance** issues?
- Are there **Adverse Reactions** as result of:
  - Drug-drug interactions?
  - Drug-disease/condition interactions?
- Is this drug the least **Expensive** alternative compared to others of equal utility?
Who is at Risk for ADR?

» Personal Characteristics
  ▪ > 85 years of age
  ▪ Isolated
  ▪ Low literacy

» Medical History
  ▪ 6 or more meds (multiple prescribers)
  ▪ Prior ADRs
  ▪ > 6 chronic health problems
  ▪ Cognitive impairment

» Findings of:
  ▪ BMI < 22 (frail)
  ▪ CLCR < 50ml/min
Practical Points

➔ Under-treatment/lack of treatment can also be defined as “inappropriate”, e.g.:
  ▪ Sub-therapeutic doses of antidepressants
  ▪ Failure to prevent osteoporosis, failure to optimize risk factors for DM and Hypertension
  ▪ Failure to achieve effective pain control.

➔ Start low, go slow, but GO!
At Discharge

- For elderly patients, it is reported that 40% of all admission meds are discontinued by discharge & 45% of discharge meds were newly started in hospital (Kripalani, 2007)

- Nearly 50% of elderly patients who are discharged will be re-admitted within 1-2 months because of medication problems (Sullivan 2000)

- It is vital to communicate with the family doctor, the community pharmacist and the PATIENT/family…

- Combination of initiatives may be needed in a complex geriatric patient (Al-Rashed, 2002)
Conclusion

- The fact that many older individuals are on multiple medications to treat co-morbid conditions is not by itself problematic. Polypharmacy occurs when there is inappropriate or unnecessary prescribing that results in negative outcomes (Hajjar et al., 2007).

- The challenge for clinicians is to develop safe and evidence-based medication regimens that minimize the risk of adverse drug reactions.

- To achieve this outcome, clinicians must be aware of the typical characteristics of patients with medication problems, have a clear understanding of what constitutes polypharmacy, and implement specific strategies in practice to reduce this problem.
Prevention of Polypharmacy

- Clear treatment goals with monitoring criteria.
- Careful written medication instructions.
- Counseling to take meds even though feeling well.
- Discourage pill-sharing.
- Assess other remedies patient maybe ingesting.
- Encourage pill boxes, phone checks, pill counts or other med monitoring plans.
- At least yearly have patient bring in all meds, Rx, OTC, vitamins, supplements, herbal preps, etc.
Minimize Challenges

"Your green pills are all gone. Do you wanna take a blue and a yellow?"

Review medications and their use
Summary

➡ To prevent an iatrogenic illness caused by over prescribing, it is important to consider any new signs and symptoms in an older patient to be a possible consequence of current drug therapy.

➡ A change in a patient’s function may be related to a medication. (Amer. Fam Phys, 2002)

➡ “Any symptom in an elderly patient should be considered a drug side effect until proved otherwise”… (Gurwitz et al 1995)
The challenge for clinicians is to develop safe and evidence-based medication regimens that minimize the risk of adverse drug reactions.

To achieve this outcome, clinicians must be aware of the typical characteristics of patients with medication problems, have a clear understanding of what constitutes polypharmacy, and implement specific strategies in practice to reduce this problem.
THANK YOU!
New BEERS Criteria Slides
## New BEERS Criteria

<table>
<thead>
<tr>
<th>MEDICATION</th>
<th>DON’T USE IF:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long acting BDZ</td>
<td>COPD, depression, falls</td>
</tr>
<tr>
<td>BDZ</td>
<td>Syncope, falls</td>
</tr>
<tr>
<td>Calcium channel blocker</td>
<td>Constipation</td>
</tr>
<tr>
<td>Bupropion</td>
<td>Seizures</td>
</tr>
<tr>
<td>Olanzapine</td>
<td>Obesity</td>
</tr>
</tbody>
</table>
New BEERS Criteria

<table>
<thead>
<tr>
<th>MEDICATION</th>
<th>DON’T USE IF:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antispasmodics, muscle relaxants, stimulants</td>
<td>Cognitive impairment</td>
</tr>
<tr>
<td>Propranolol</td>
<td>COPD, asthma</td>
</tr>
<tr>
<td>Tolterodine &amp; decongestants</td>
<td>Bladder outflow obstruction</td>
</tr>
<tr>
<td>Metoclopramide, traditional antipsychotics</td>
<td>Parkinson’s disease</td>
</tr>
<tr>
<td>TCAs</td>
<td>Syncope, falls, stress incontinence</td>
</tr>
</tbody>
</table>
### New BEERS Criteria

<table>
<thead>
<tr>
<th>MEDICATION</th>
<th>DON’T USE IF:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disopyramide (Norpace)</td>
<td>Heart failure</td>
</tr>
<tr>
<td>Phenylpropanolamine, Pseudoephedrine, Amphetamines</td>
<td>Hypertension</td>
</tr>
<tr>
<td>NSAIDs and ASA&gt;325mg</td>
<td>Gastric or duodenal ulcers</td>
</tr>
<tr>
<td>Clozapine; CPZ; Thioridazine</td>
<td>Seizures or Epilepsy</td>
</tr>
</tbody>
</table>
## New BEERS Criteria

<table>
<thead>
<tr>
<th>MEDICATION</th>
<th>DON’T USE IF:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticholinergics/GI Antispasmodics, muscle relaxants, oxybutynin, Urispas, Detrol, decongestants</td>
<td>Bladder outflow obstruction</td>
</tr>
<tr>
<td>Tricyclics</td>
<td>Arrhythmias</td>
</tr>
<tr>
<td>Decongestants, Theophylline, MAOIs, Ritalin, Amphetamines</td>
<td>Insomnia</td>
</tr>
</tbody>
</table>
**New BEERS Criteria**

<table>
<thead>
<tr>
<th><strong>MEDICATION</strong></th>
<th><strong>DON’T USE IF:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Prozac, Ritalin, DextroAAmphetamine, CNS stimulants</td>
<td>Anorexia and malnutrition</td>
</tr>
</tbody>
</table>
Inappropriate Medications: New BEERS Criteria

- Nitrofurantoin
- Doxazosin
- Estrogen in older women
- Chlorpropamide
- Amiodarone
- Ticlid
- Ethacrynic acid
## Pain

<table>
<thead>
<tr>
<th>Inappropriate</th>
<th>Safer alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Propoxyphene (Darvon)</td>
<td>• Tylenol (up to 4 g per day)</td>
</tr>
<tr>
<td>• Indomethacin</td>
<td>• Hydromorphone</td>
</tr>
<tr>
<td>• Pentazocine (Talwin)</td>
<td>• Care with Codeine &amp; Morphine</td>
</tr>
<tr>
<td>• Meperidine (Demerol)</td>
<td>• Glucosamine</td>
</tr>
<tr>
<td>• Ketorolac</td>
<td>• Pennsaid</td>
</tr>
<tr>
<td></td>
<td>• LaKota roll on</td>
</tr>
</tbody>
</table>
## Blood Pressure

<table>
<thead>
<tr>
<th><strong>Inappropriate</strong></th>
<th><strong>Safer alternatives</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Reserpine</td>
<td>- Hydrochlorothiazide</td>
</tr>
<tr>
<td>- Methyldopa</td>
<td>- ACEI’s</td>
</tr>
<tr>
<td>- Nifedipine short acting</td>
<td>- CCBs</td>
</tr>
<tr>
<td>- Clonidine</td>
<td>- ARBs</td>
</tr>
<tr>
<td>- Dipyridamole</td>
<td>- BBs</td>
</tr>
<tr>
<td>- Guanethidine</td>
<td></td>
</tr>
<tr>
<td>- Propranolol</td>
<td></td>
</tr>
<tr>
<td>- Hydrochlorothiazide &gt; 50mg</td>
<td></td>
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</tbody>
</table>
### Mood

<table>
<thead>
<tr>
<th>Inappropriate</th>
<th>Safer alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Tricyclic antidepressants</td>
<td>- SSRIs: citalopram, Sertraline, (careful with Fluvoxamine and Paroxetine)</td>
</tr>
<tr>
<td>- Prozac (daily)</td>
<td>- NaSSAs: Mirtazapine (Remeron)</td>
</tr>
<tr>
<td>- Triavil (Amitriptyline plus perphenazine)</td>
<td>- SNRI s: Venlafaxine XR</td>
</tr>
</tbody>
</table>
## Sleep / Anxiety

<table>
<thead>
<tr>
<th><strong>Inappropriate</strong></th>
<th><strong>Safer alternatives</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Long-acting BDZ</td>
<td>- Sleep hygiene/education</td>
</tr>
<tr>
<td>- Short-acting BDZ&gt;4 weeks</td>
<td>- Trazodone</td>
</tr>
<tr>
<td>- Barbiturates</td>
<td>- Zopiclone</td>
</tr>
<tr>
<td>- Meprobamate (Equanil)</td>
<td>- Mirtazapine</td>
</tr>
<tr>
<td>- Diphenhydramine</td>
<td></td>
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</tbody>
</table>

*BDZ* refers to Benzodiazepines.
## GI Medications

<table>
<thead>
<tr>
<th>Inappropriate</th>
<th>Safer alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Cimetidine</td>
<td>▪ PPIs</td>
</tr>
<tr>
<td>▪ Antispasmodics</td>
<td>▪ Domperidone</td>
</tr>
<tr>
<td>▪ Propantheline; Hyoscyamine; Belladonna</td>
<td>▪ Loperamide</td>
</tr>
<tr>
<td>▪ Antidiarrheals</td>
<td>▪ Laxatives</td>
</tr>
<tr>
<td>▪ Diphenoxilate (Lomotil)</td>
<td>▪ Lactulose</td>
</tr>
<tr>
<td>▪ Mineral oil</td>
<td>▪ Bulk agents</td>
</tr>
<tr>
<td>▪ Long term stimulant laxatives (Cascara)</td>
<td>▪ Senokot</td>
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<td></td>
<td>▪ Colace</td>
</tr>
</tbody>
</table>
Slides on Pharmacological Effects of Herbs
Cardioactive Herbs

- Broom
- Kola nut
- Coltsfoot leaf
- Devil’s claw tubers
- Dogbane root
- Figwort whole plant
- Foxglove whole plant
- Fumitory whole plant
- Ginger root
- Ginseng, Panax root
- Prickly Ash bark
- Golden seal rhizome
- Hawthorn leaf/flower/berry
- Immortal root
- Lily-of-the-valley whole plant
- Lime, Linden flower
- Mistletoe leaf
- Motherwort whole plant
- Night-blooming Cereus fruit
- Pleurisy root
- Quassia, Jamaican stem wood
Anticoagulant Herbs

- Bilberry
- Bladderwrack
- Cat’s Claw
- Coleus
- Evening Primrose
- Fenugreek
- Feverfew
- Garlic
- Green Tea
- Ginger
- Ginkgo
- Guggul
- Horse Chestnut
- Red Clover
- Reishi
- Turmeric
- White Willow
Coagulant Herbs (avoid in bleeding disorders)

- Agrimony
- Golden Seal
- Mistletoe
- Yarrow
### Parasympathomimetic (cholinergic) Herbs

- Horse Chestnut
- HuperzineA, Qian Cengta
- Yohimbe
- Bittersweet
- Blood root
- Blue Flag
- Bryony
- Buckeye, Ohio & California
- Dogbane, Canadian Hemp
- Senega Snakerooot
- Tobacco
- Wahoo
- Dogwood, Jamaican
- False or Green Hellebore
- Immortal
- Indian Tobacco
- Jaborandi
- Leptandra
- Death Cup Mushroom
- Pasque Flower
- Pink Root
- Pleurisy Root
- Pokeweed
HYPERglycemic Herbs

- Gotu Kola
- Ginseng, American
- Elecampane
HYPOglycemic Herbs

- Aloe
- Bilberry
- Bitter Melon
- Fenugreek
- Garcinia
- Garlic
- Gymnema
- Marshmallow
- Stinging Nettle
- Ginseng, American
- Ginger
HYPOtensive Herbs

- Black Cohosh
- Coleus
- Golden Seal
- Hawthorn
HYPERtensive Herbs

- Cayenne
- Ephedra
- Ginger
- Licorice
Diuretic Herbs

- Artichoke
- Dandelion
- Elder
- Horsetail
- Kava Kava
- Uva ursi
Laxative Herbs

- Aloe
- Cascara
- Senna
- Eyebright
- Psyllium
- Rhubarb
- Plantain
Herbs that may alter GI Absorption

- Aloe
- Cascara
- Cayenne
- Horse Chestnut
- Ephedra
- Marshmallow
- Mormon Tea
- American Ephedra
- Senna
- Uva Ursi
- Buckeye (California & Ohio)
- Buckthorn
- Coffee!!
- Spanish Bayonet
- Wafer Ash
- Hop Tree
Herbs that may alter Liver Enzymes

- American Mandrake
- Balmony
- Barberry
- Blue Flag
- Button Bush
- Fringetree
- Golden Seal
- Greater Celandine
- Leptandra
- Pregon Grape
- Sagebrush
- Virginia Snakerooot, Serpentaria
- Wahoo, Burning Bush
Herbs that may cause Hepatotoxicity due to Pyrrolizidine Alkaloids

- Coltsfoot
- Comfrey
- Hound’s Tongue
- Life Root
- Squaw Weed