



# Inappropriate Prescribing in Older People

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# What will be discussed

- Beers' Inappropriate Prescribing (IP) criteria
- Origin & validation of STOPP & START criteria
- STOPP and START IP prevalence data
- IP (STOPP criteria) and Adverse Drug Events
- Use of STOPP & START as tools to improve medication appropriateness
- IP (STOPP criteria) and resource wastage
- Role of STOPP & START in optimisation of medication in older people

# Inappropriate Prescribing: Definition

The use of a drug

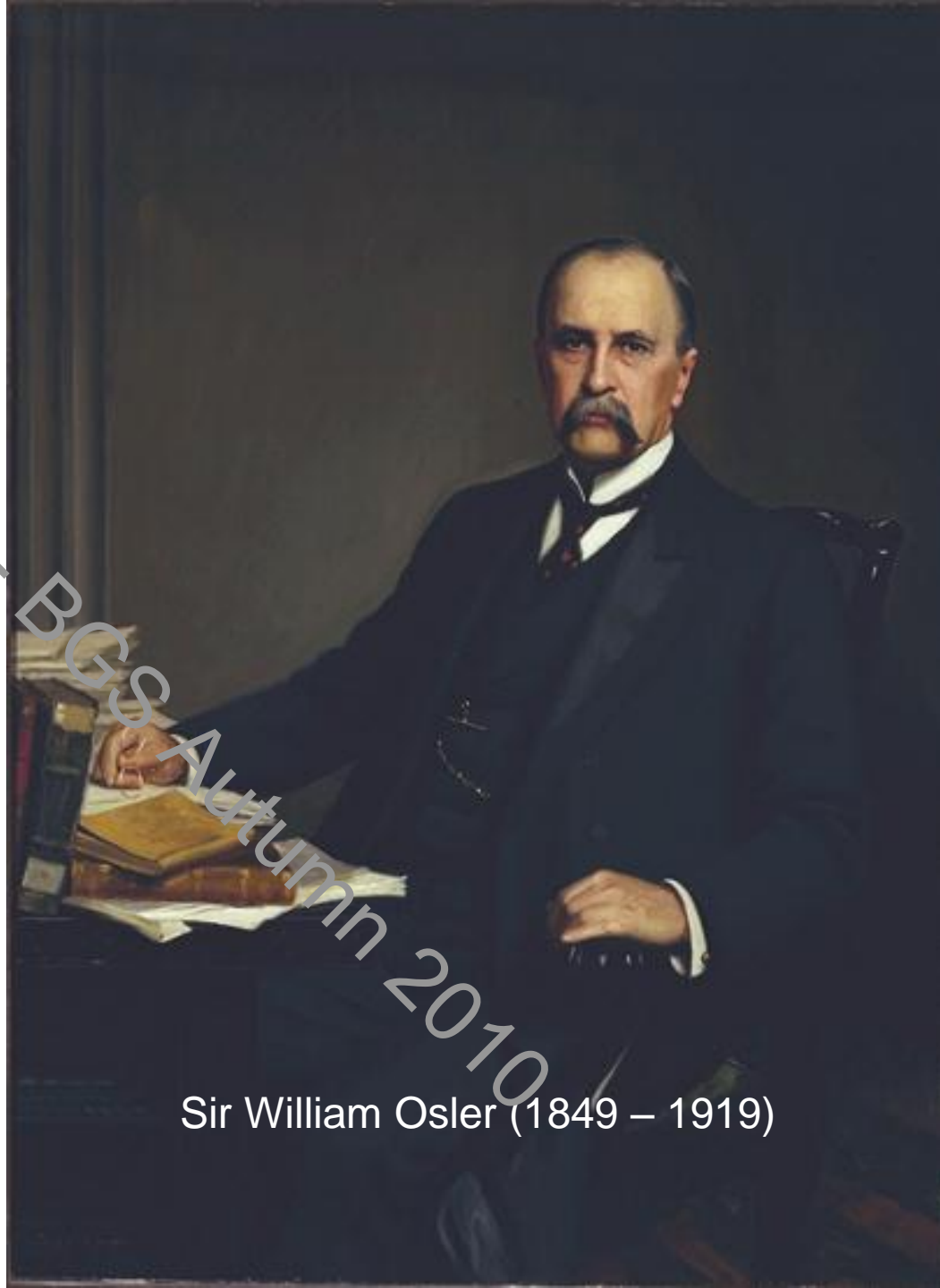
- that has the wrong indication
- that has no indication
- that has a high risk of Adverse Drug Event (ADE)
- that is unnecessarily expensive
- for too short or too long a time period

or

The failure to prescribe appropriate drug therapy for irrational or ageist reasons

“One of the first duties of the physician is to educate the masses *not* to take medicine.”

“Imperative drugging – the ordering of medicine in any and every malady (i.e. polypharmacy) - is no longer regarded as the chief function of the doctor.”



Sir William Osler (1849 – 1919)

**Beers' Criteria for  
Inappropriate  
Prescribing in  
Older People:  
1991, 1997, 2003**

**(A) Independent of Diagnosis  
(n = 48)**

**(B) Considering Diagnosis  
(n = 19)**

**Designed for use in any clinical  
setting**

**"Should be routine"**

**"Should improve outcomes"**



**Dr. Mark Beers: 1955 - 2009**

# Problems with Beers' Criteria - 1

Trimethobenzamide	Methocarbamol	Carisoprolol
Metaxalone	Cyclobenzaprine	Meprobamate
Halazepam	Reserpine	Chlorpropamide
Hydroxyzine	Hyoscyamine	Clidinium
Cyclandelate	Cyproheptadine	Tripelenamine
Guanedrel	Oxaprozin	Guanethidine
Mesoridazine	Isoxsurpine	Thiordiazine
Amphetamines	Clonidine	Ethacrynic acid
Dicyclomine	Phenylpropanolamine	Dessicated thyroid

>50% drugs  
**NOT  
AVAILABLE  
IN EUROPE**

- Are amitriptyline, amiodarone, nitrofurantoin, doxazosin and propranolol inappropriate?
- No drug-drug interactions
- No therapeutic duplication
- No under-prescribing
- Few prospective studies done using all criteria
- No RCTs using criteria as an intervention



# Problems with Beers' Criteria - 2

- Focused on US prescriber
- Unstructured
- Not used in routine clinical practice
- Lack of efficacy data in relation to:
  - (i) ADE prevention
  - (ii) Cost reduction
- Lack of significant association between Beers' Criteria drugs and risk of ADE's
- Do not include several important instances of IP

# No mention in Beers' Criteria of...

- (i) Loop diuretic for dependent ankle oedema only, i.e. no clinical signs of heart failure (no evidence of efficacy, compression hosiery usually more appropriate).
- (ii) Thiazide diuretic with a history of gout (may exacerbate gout).
- (iii) Aspirin to treat dizziness not clearly attributable to cerebrovascular disease (not indicated).
- (iv) Tricyclic anti-depressants with glaucoma (likely to exacerbate glaucoma).
- (v) Long-term (i.e. >1 month) neuroleptics as long-term hypnotics (risk of confusion, hypotension, extra-pyramidal side-effects, falls).
- (vi) Anti-cholinergics to treat extra-pyramidal side-effects of neuroleptic medications (risk of anti-cholinergic toxicity).
- (vii) Prochlorperazine (Stemetil) with Parkinsonism (risk of exacerbating Parkinsonism).
- (viii) Proton pump inhibitor for peptic ulcer disease at full therapeutic dosage for >8 weeks (dose reduction or earlier discontinuation indicated).
- (ix) Theophylline as monotherapy for COPD (safer, more effective alternative; risk of adverse effects due to narrow therapeutic index).
- (x) Non-steroidal anti-inflammatory drugs (NSAIDs) with moderate to severe hypertension (risk of exacerbation of hypertension).
- (xi) NSAID with heart failure (risk of exacerbation of heart failure).
- (xii) NSAID with chronic renal failure (risk of deterioration in renal function).
- (xiii) Alpha-blockers in males with frequent urinary incontinence, i.e. one or more episodes of incontinence daily (risk of urinary frequency and worsening of incontinence).
- (xiv) Beta-blockers in those with diabetes mellitus and frequent hypoglycaemic episodes, i.e.  $\geq 1$  episode per month (risk of masking hypoglycaemic symptoms).
- (xv) Oestrogens with a history of venous thromboembolism (increased risk of recurrence).
- (xvi) Neuroleptics and recurrent falls (may cause gait dyspraxia and Parkinsonism, leading to further falls).
- (xvii) Vasodilator drugs with persistent postural hypotension, i.e. recurrent  $>20$  mmHg drop in systolic blood pressure (risk of syncope, falls).
- (xviii) Long-term opiates, i.e. >3 months in those with chronic constipation without concurrent use of laxatives (risk of severe constipation).
- (xix) Any duplicate drug class prescription, e.g. two concurrent opiates, NSAIDs, loop diuretics, ACE inhibitors (optimisation of monotherapy within a single drug class should be observed prior to considering a new agent).

# New IP Criteria?

- Errors of prescribing commission
- Errors of prescribing omission
- Structured according to physiological systems (alá drug formularies)
- Recognize specific high risk groups particularly fallers, patients with dementia
- Reflect current prescribing practice
- Designed for application in all clinical settings

D O'Mahony - BGS Autumn 2010



# New Draft IP Criteria

- (A) Screening Tool of Older Persons' potentially inappropriate Prescriptions (acronym, **STOPP**): 68 draft criteria
- (B) Screening Tool to Alert doctors to Right (i.e. indicated, appropriate) Treatment (acronym, **START**): 22 draft criteria

# Validation of STOPP & START

- Consensus panel of 18 experts in Geriatric Pharmacotherapy in Ireland & UK
- Geriatric Medicine, Clinical Pharmacology, Old Age Psychiatry, Clinical Pharmacy, Primary Care
- Delphi process (2 rounds)
- Final agreed list of STOPP criteria (n=65), START criteria (n=22)
- Good inter-rater reliability (STOPP  $k = 0.75$ ; START  $k = 0.68$ )

# STOPP: Screening Tool of Older People's potentially inappropriate Prescriptions

The following drug prescriptions are potentially inappropriate in persons aged  $\geq 65$  years of age.

## Cardiovascular System

1. Digoxin at a long-term dose  $> 125\mu\text{g}/\text{day}$  with impaired renal function\*
2. Loop diuretic for dependent ankle oedema only i.e. no clinical signs of heart failure
3. Loop diuretic as first-line monotherapy for hypertension
4. Thiazide diuretic with a history of gout.
5. Non-cardioselective beta-blocker with Chronic Obstructive Pulmonary Disease (COPD).
6. Beta-blocker in combination with verapamil
7. Use of diltiazem or verapamil with NYHA Class III or IV heart failure
8. Calcium channel blockers with chronic constipation
9. Use of aspirin and warfarin in combination without histamine H2 receptor antagonist (except cimetidine because of interaction with warfarin) or PPI
10. Dipyridamole as monotherapy for cardiovascular secondary prevention
11. Aspirin with a past history of peptic ulcer disease without histamine H2 receptor antagonist or proton pump inhibitor
12. Aspirin at dose  $> 150\text{mg}$  day
13. Aspirin with no history of coronary, cerebral or peripheral vascular symptoms or occlusive event
14. Aspirin to treat dizziness not clearly attributable to cerebrovascular disease
15. Warfarin for first, uncomplicated deep venous thrombosis for  $> 6$  months
16. Warfarin for first uncomplicated pulmonary embolus for  $> 12$  months
17. Aspirin, clopidogrel, dipyridamole or warfarin with concurrent bleeding disorder  
\* *eGFR*  $< 50\text{ml}/\text{min}$ .

## Central Nervous System and Psychotropic Drugs

1. Tricyclic antidepressants (TCA's) with dementia
2. TCA's with glaucoma
3. TCA's with cardiac conductive abnormalities
4. TCA's with constipation
5. TCA's with an opiate or calcium channel blocker
6. TCA's with prostatism or prior history of urinary retention
7. Long-term (i.e.  $> 1$  month), long-acting benzodiazepines e.g. chlordiazepoxide, flurazepam, nitrazepam, chlorazepate and benzodiazepines with long-acting metabolites e.g. diazepam
8. Long-term (i.e.  $> 1$  month) neuroleptics as long-term hypnotics
9. Long-term neuroleptics in those with parkinsonism
10. Phenothiazines in patients with epilepsy
11. Anticholinergics to treat extra-pyramidal side-effects of neuroleptic medications
12. Selective serotonin re-uptake inhibitors (SSRI's) with a history of clinically significant hyponatraemia
13. Prolonged use ( $> 1$  week) of first generation antihistamines i.e. diphenhydramine, cyclizine, chlorpheniramine, promethazine

### **Gastrointestinal System**

1. Diphenoxylate, loperamide or codeine phosphate for treatment of diarrhoea of unknown cause
2. Diphenoxylate, loperamide or codeine phosphate for treatment of severe infective gastroenteritis i.e. bloody diarrhoea, high fever or severe systemic toxicity
3. Prochlorperazine (Stemetil) or metoclopramide with Parkinsonism
4. PPI for peptic ulcer disease at full therapeutic dosage for > 8 weeks
5. Anticholinergic antispasmodic drugs with chronic constipation

### **Respiratory System**

1. Theophylline as monotherapy for COPD
2. Systemic corticosteroids instead of inhaled corticosteroids for maintenance therapy in moderate-severe COPD
3. Nebulised ipratropium with glaucoma

### **Musculoskeletal System**

1. Non-steroidal anti-inflammatory drug (NSAID) with history of peptic ulcer disease or GI bleeding, unless with concurrent H2 receptor antagonist, PPI or misoprostol
2. NSAID with moderate-severe hypertension
3. NSAID with heart failure
4. Long-term use of NSAID (>3 months) for symptom relief of mild osteoarthritis
5. Warfarin and NSAID together
6. NSAID with chronic renal failure\*
7. Long-term corticosteroids (>3 months) as monotherapy for rheumatoid arthritis or osteoarthritis.
8. Long-term NSAID or colchicine for chronic treatment of gout where no contraindication to allopurinol

### **Urogenital System**

1. Bladder antimuscarinic drugs with dementia
2. Antimuscarinic drugs with chronic glaucoma
3. Antimuscarinic drugs with chronic constipation
4. Antimuscarinic drugs with chronic prostatism
5. Alpha-blockers in males with frequent incontinence
6. Alpha-blockers with long-term urinary catheter

### **Endocrine System**

1. Glibenclamide or chlorpropamide with type 2 DM
2. Beta-blockers in those with DM and frequent hypoglycaemic episodes
3. Oestrogens with a history of breast cancer or venous thromboembolism
4. Oestrogens without progestogen in patients with intact uterus

#### **Drugs that adversely affect those prone to falls**

1. Benzodiazepines
2. Neuroleptic drugs
3. First generation antihistamines
4. Vasodilator drugs with persistent postural hypotension
5. Long-term opiates

#### **Analgesic Drugs**

1. Use of long-term powerful opiates e.g. morphine or fentanyl as first line therapy for mild-moderate pain
2. Regular opiates for >2 weeks in those with chronic constipation without concurrent laxative
3. Long-term opiates in those with dementia unless indicated for palliative care or management of moderate/severe chronic pain syndrome

#### **Duplicate Drug Classes**

1. Any duplicate drug class prescription e.g. concurrent opiates, NSAID's, SSRI's, loop diuretics, ACE inhibitors

**i.e. 65 rules relating to the most common and the most potentially dangerous instances of inappropriate prescribing in older people.**

# **START: Screening Tool to Alert doctors to Right i.e. appropriate, indicated Treatment.**

These medications should be considered for people  $\geq 65$  years of age with the following conditions, where no contraindication to prescription exists.

## **Cardiovascular System**

1. Warfarin in the presence of chronic atrial fibrillation
2. Aspirin in the presence of chronic atrial fibrillation, where warfarin is contraindicated, but not aspirin
3. Aspirin or clopidogrel with a history of atherosclerotic coronary, cerebral or peripheral vascular disease in patients with sinus rhythm
4. Antihypertensive therapy where systolic BP consistently  $>160$  mmHg
5. Statin therapy with a history of coronary, cerebral or peripheral vascular disease, where functional status remains independent for activities of daily living and life expectancy is  $> 5$  years
6. Angiotensin Converting Enzyme (ACE) inhibitor with chronic heart failure
7. ACE inhibitor following acute myocardial infarction
8. Beta-blocker with chronic stable angina

## **Respiratory System**

1. Regular inhaled beta 2 agonist or anticholinergic for mild to moderate asthma or COPD
2. Regular inhaled corticosteroid for moderate-severe asthma or COPD, where predicted FEV1  $<50\%$
3. Home continuous oxygen with documented chronic type 1 respiratory failure or type 2 respiratory failure

## **Central Nervous System**

1. L-DOPA in idiopathic Parkinson's disease with functional impairment and disability
2. Antidepressant with moderate-severe depressive symptoms

## **Gastrointestinal System**

1. Proton Pump Inhibitor with severe GORD or peptic stricture requiring dilatation
2. Fibre supplement for chronic, symptomatic diverticular disease with constipation

## **Musculoskeletal System**

1. Disease-modifying anti-rheumatic drug (DMARD) with active rheumatoid disease lasting  $> 12$  weeks
2. Bisphosphonates in patients taking maintenance corticosteroid therapy
3. Calcium/Vitamin D supplement in patients with osteoporosis (fragility fracture, dorsal kyphosis)

## **Endocrine System**

1. Metformin with type 2 diabetes +/- metabolic syndrome (in the absence of renal impairment\*)
2. ACE inhibitor or ARB in diabetes with nephropathy i.e. proteinuria or microalbuminuria +/- renal impairment\*
3. Antiplatelet therapy in diabetes mellitus with co-existing cardiovascular risk factors
4. Statin therapy in diabetes mellitus if co-existing major cardiovascular risk factors present

\* eGFR  $<50$ ml/min.

**i.e. 22 rules relating to common instances of prescribing omission**

## 6 European Centres:

- **Ireland (Cork)**
  - D O'Mahony
  - P Gallagher
- **Switzerland (Geneva)**
  - JP Michel
  - PO Lang
- **Belgium (Ostende)**
  - JP Baeyens
- **Spain (Madrid)**
  - A Cruz-Jentoft
- **Czech Rep (Prague)**
  - E Topinkova
  - P Madlova
- **Italy (Perugia)**
  - A Cherubini
  - B Gasperini



# Inter-rater reliability of STOPP and START criteria between 9 hospital physicians on 20 datasets with 181 medications in 6 different European countries.

Rater combination A B C D Ppos Pneg Kappa (95% CI)

## STOPP criteria

Rater 1 * rater 2	1,255	4	0	41	0.99	0.95	0.95 (0.91–0.99)
Rater 1 * rater 3	1,254	5	3	38	0.99	0.90	0.90 (0.83–0.97)
Rater 1 * rater 4	1,254	5	3	38	0.99	0.90	0.90 (0.83–0.99)
Rater 1 * rater 5	1,255	4	0	41	0.99	0.95	0.95 (0.91–0.99)
Rater 1 * rater 6	1,258	1	2	39	0.99	0.96	0.96 (0.92–1)
Rater 1 * rater 7	1,257	2	1	40	0.99	0.96	0.96 (0.92–1)
Rater 1 * rater 8	1,253	6	3	38	0.99	0.89	0.89 (0.82–0.96)
Rater 1 * rater 9	1,250	9	0	41	0.99	0.90	0.90 (0.83–0.96)
Median (IQR)					0.99	0.93	0.93 (0.90–0.96)

## START criteria

Rater 1 * rater 2	417	3	2	18	0.99	0.88	0.87 (0.76–0.98)
Rater 1 * rater 3	417	3	3	17	0.99	0.85	0.84 (0.72–0.97)
Rater 1 * rater 4	418	2	1	19	0.99	0.92	0.92 (0.84–1)
Rater 1 * rater 5	417	3	0	20	0.99	0.93	0.93 (0.84–1)
Rater 1 * rater 6	416	4	3	17	0.99	0.83	0.82 (0.69–0.95)
Rater 1 * rater 7	415	5	5	15	0.98	0.75	0.74 (0.58–0.89)
Rater 1 * rater 8	413	7	1	19	0.99	0.83	0.82 (0.69–0.94)
Rater 1 * rater 9	414	6	0	20	0.99	0.87	0.86 (0.75–0.97)
Median (IQR)					0.99	0.86	0.85 (0.82–0.91)

A, both raters agreed criterion not fulfilled; B, rater 1 scored criterion not fulfilled and rater 2 scored criterion as being fulfilled; C, rater 1 scored criterion as fulfilled and rater 2 scored criterion as not fulfilled; D, both raters scored criterion as being fulfilled; ppos, proportion of positive agreement; pneg, proportion of negative agreement; CI, confidence interval; IQR, interquartile range.

Gallagher et al.,  
*Age Ageing* 2009

# Application of STOPP, START

- Define prevalence rates of IP in different clinical settings:
  - Primary Care (general practice)
  - Secondary Care (hospital)
  - Nursing Home/Continuing Care
- Compare IP rates in different countries
- Can STOPP predict ADE's?
- Can STOPP & START be used clinically to:
  - (i) improve medication appropriateness?
  - (ii) reduce ADE incidence?
  - (iii) reduce cost of pharmacotherapy?

# Prevalence rates of IP in Ireland (STOPP & START criteria)

- **Primary Care:**

- Potentially inappropriate medicines (STOPP): 21.4%
- Potential prescribing omissions (START): 22.7%

Ryan C et al., *Br J Clin Pharmacol* 2009

- **Secondary Care:**

- Potentially inappropriate medicines (STOPP): 34.5%
- Potential prescribing omissions (START): 57.9%

Gallagher P & O'Mahony D, *Age Ageing* 2008

Barry PJ et al., *Age Ageing* 2007

- **Nursing Home Care**

- Potentially inappropriate medicines (STOPP): 55% - 59.8%

Ryan C et al., *Ir J Med Sc* 2009

O'Sullivan D et al., *Eur Ger Med* 2010

# Prevalence rates of IP in Ireland (Beers' criteria, 2003 version)

- **Primary Care: 13% – 18%**

Ryan C et al., *Br J Clin Pharmacol* 2009

Ryan C et al., *J Clin Pharm Ther* 2009

- **Secondary Care: 25% – 32%**

Barry PJ et al., *J Clin Pharm Ther* 2006

Gallagher P et al., *Age Ageing* 2008

- **Nursing Home Care: 37% – 55%**

Byrne S et al., *Int J Pharm Pract* 2008

O'Sullivan D et al., *Eur Ger Med* 2010

# IP rates in different countries

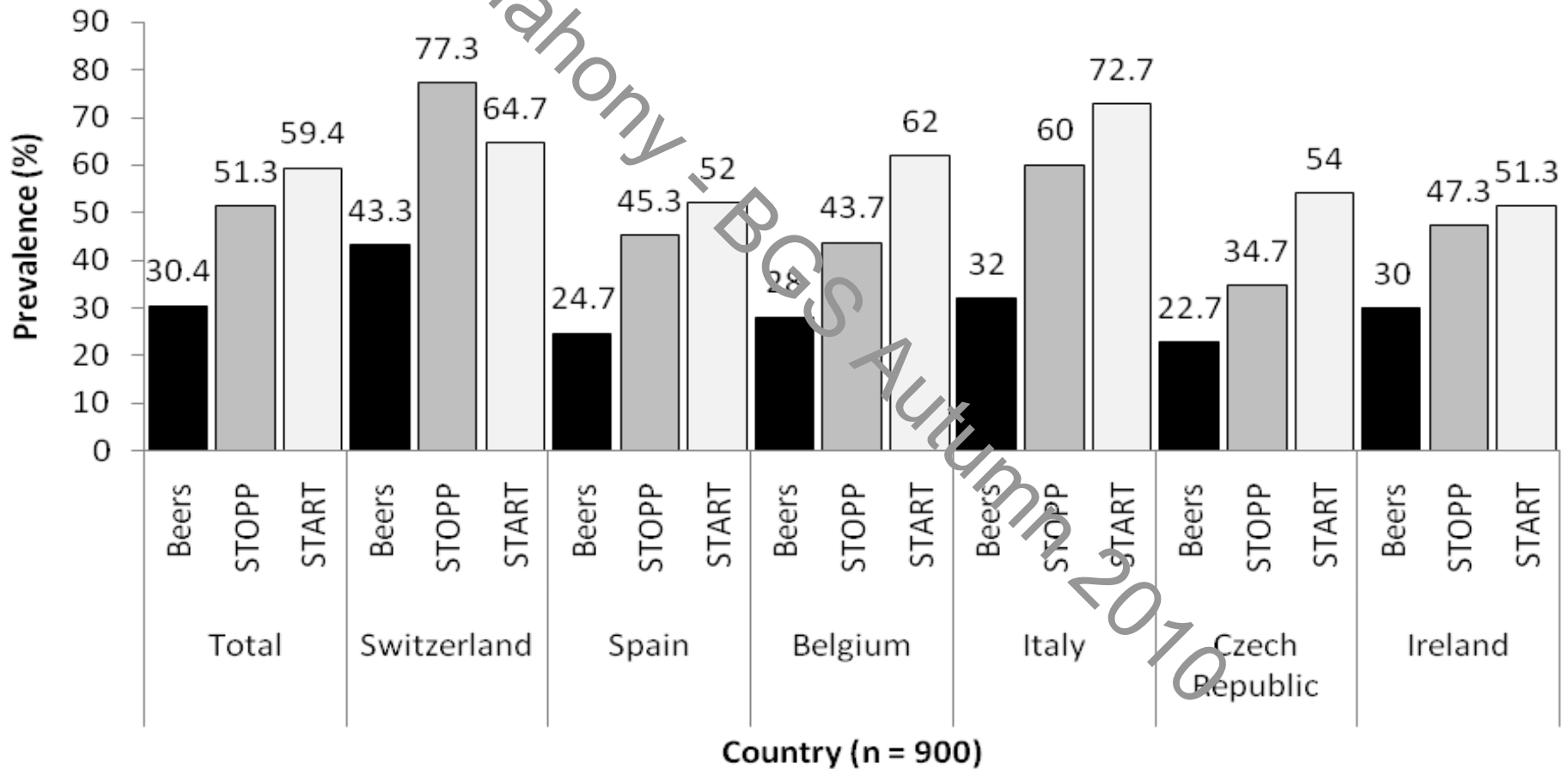
- 6 European centres:  
Cork      Madrid      Geneva      Ostende  
            Prague      -Perugia
- 150 consecutive cases in each centre
- STOPP, Beers' Criteria → PIM's
- START → PPO's
- Criteria applied by trained geriatricians

# Prescription Drug Use in 6 centres

	<b>Total</b>	<b>Geneva</b>	<b>Madrid</b>	<b>Ostende</b>	<b>Perugia</b>	<b>Prague</b>	<b>Cork</b>
	<i>n</i> = 900	<i>n</i> = 150	<i>n</i> = 150	<i>n</i> = 150	<i>n</i> = 150	<i>n</i> = 150	<i>n</i> = 150
<b>Median (IQR) number of daily prescription drugs</b>	<b>6 (4 – 9)</b>	<b>7 (5 – 10)</b>	<b>6 (4 – 9)</b>	<b>7 (4 – 10)</b>	<b>5 (3 – 7)</b>	<b>6 (4 – 8)</b>	<b>7 (4 – 9)</b>
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
<b>0 medications</b>	<b>23 (3)</b>	<b>8 (5)</b>	<b>1 (1)</b>	<b>7 (5)</b>	<b>3 (2)</b>	<b>0 (0)</b>	<b>4 (3)</b>
<b>1-5 medications</b>	<b>351 (39)</b>	<b>41 (28)</b>	<b>55 (36)</b>	<b>54 (36)</b>	<b>75 (50)</b>	<b>71 (47)</b>	<b>55 (37)</b>
<b>6-10 medications</b>	<b>400 (44)</b>	<b>69 (46)</b>	<b>70 (47)</b>	<b>60 (40)</b>	<b>66 (44)</b>	<b>66 (44)</b>	<b>69 (46)</b>
<b>&gt; 10 medications</b>	<b>126 (14)</b>	<b>32 (21)</b>	<b>24 (16)</b>	<b>29 (19)</b>	<b>6 (4)</b>	<b>13 (9)</b>	<b>22 (14)</b>

# Rates of PIM's & PPO's in 6 European Centres

European Centres

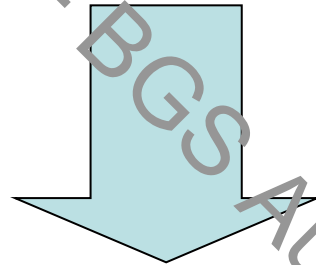


# Inappropriate Prescribing & Adverse Drug Events (ADE's)-1

- Approx. 3% of all deaths in Sweden (Wester et al., 2008)
- Median age in men 81, in women 83
- Hospital admissions for ADEs rising since 1980; 5-6% of all acute admissions (Leendertse et al., 2008)
- 5<sup>th</sup> leading cause of death in USA
- Nosocomial incidence of ADEs approx. 7% (Lazarou et al., 1998)
- Case fatality rate approx. 0.3%
- Costly i.e. > \$200 billion in USA per annum

# Inappropriate Prescribing & Adverse Drug Events (ADE's)-2

- Laroche et al. (2007): 2018 pts
- Onder et al. (2005): 5152 pts



PIMs *not* significantly associated with ADEs in older hospitalised pts, *using Beers' Criteria*

Laroche et al., *Br J Clin Pharmacol* 2007  
Onder et al., *Eur J Clin Pharmacol* 2005

# **ADE's in older people on admission to hospital: Cork University Hospital data 2006-7**

- 715 consecutive patients with acute illness
- Single 3 month period
- Age  $\geq$  65 years
- Retrospective assessment of ADE incidence
- STOPP criteria PIMs  $\rightarrow$  causal/contributory to acute admission in 11.5%
- Beers' criteria PIMs  $\rightarrow$  causal/contributory to acute admission in 6%

# ADE's in older people on admission to hospital: Cork University Hospital data 2008-9



# ADEs on arrival to hospital

- 600 consecutive pts aged  $\geq 65 \rightarrow$  CUH
- Acute unselected illness, requiring admission
- 40% male; median age 77
- 34% taking  $\leq 5$  meds,
- 46% taking 6-10 meds;
- 20% taking  $> 10$  meds
- 329 ADEs identified in 158 pts (26.3%)
- WHO definition of ADE's
- WHO-UMC causality criteria



**Gold standard ADE definition & relationship to index hospital admission:  
Expert consensus panel**

# ADEs & Acute Hospital Admission

- 36/329 ADEs (10.9%) the ***prime cause of hospital admission*** in ADE-affected patients i.e. **6% of total** cohort of 600 patients
- 183/329 ADEs (55.6%) ***significantly contributed to hospital admission*** in ADE-affected patients i.e. **14.7% of total** cohort of 600 patients
- 110/329 (33.5%) ADEs ***not causal or contributory to admission***

# PIMs and avoidable ADEs: STOPP criteria vs Beers' criteria

- 170/329 ADEs (51.7%) were listed in STOPP;  
66/329 ADEs (20.1%) were listed in Beers' criteria
- 94/150 (62.7%) definitely/possibly avoidable ADEs listed in STOPP  
34/150 (22.7%) definitely/possibly avoidable ADEs listed in Beers' criteria

**i.e. STOPP detected definitely/possibly avoidable ADEs 2.8 times more frequently than Beers' criteria**

After adjusting for age, sex, baseline ADL status, number of prescription drugs

.....

- **Probability of ADEs increased significantly by STOPP criteria PIM prescription (OR = 1.83; 95% CI 1.49 – 2.24;  $p < 0.001$ )**
- **Probability of ADEs not increased significantly by Beers' criteria PIM prescription (OR = 1.28; 95% CI 0.95 – 1.73;  $p = 0.107$ )**

# Common *avoidable* ADEs that caused or contributed to hospital admission

Adverse Drug Event	n	STOPP PIMs	Beers PIMs
Injurious falls and benzodiazepines	24	24	22
Metabolic / electrolyte disturbance and diuretics	15	1	0
Injurious falls and opiates	11	11	1
Symptomatic orthostatic hypotension and ACEIs or ARBs	8	7	0
Injurious falls and sedative hypnotics	7	0	0
Acute kidney injury and diuretics/nephrotoxic drugs	7	4	0
Major constipation and opiates	7	6	0
Gastritis / Peptic Ulcer Disease and NSAIDs	7	6	1
Injurious falls and antipsychotics	5	5	0
Symptomatic orthostatic hypotension and diuretics	4	4	0
Symptomatic orthostatic hypotension and alpha blockers	4	4	1
Symptomatic bradycardia and beta blockers	4	0	0
Symptomatic orthostatic hypotension and beta blockers	3	3	0
<b>ADEs (of total = 150)</b>	<b>106</b>	<b>75</b>	<b>25</b>

# Can STOPP & START criteria help optimise prescribing in older people?

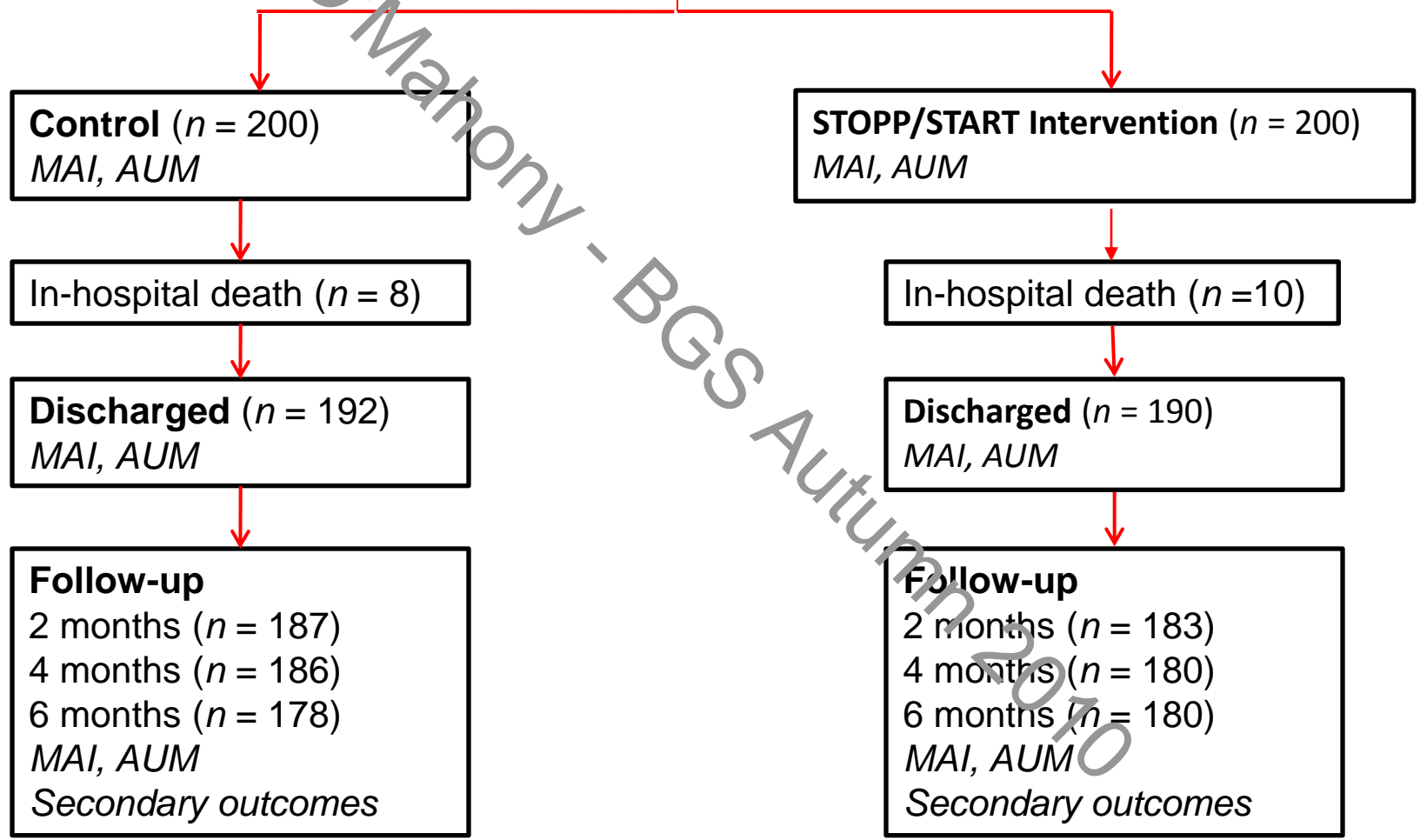
- Improve medication appropriateness?
- Reduce incidence of ADEs?
- Reduce drug costs?

# Single-centre RCT: Does application of STOPP & START rules improve medication appropriateness?

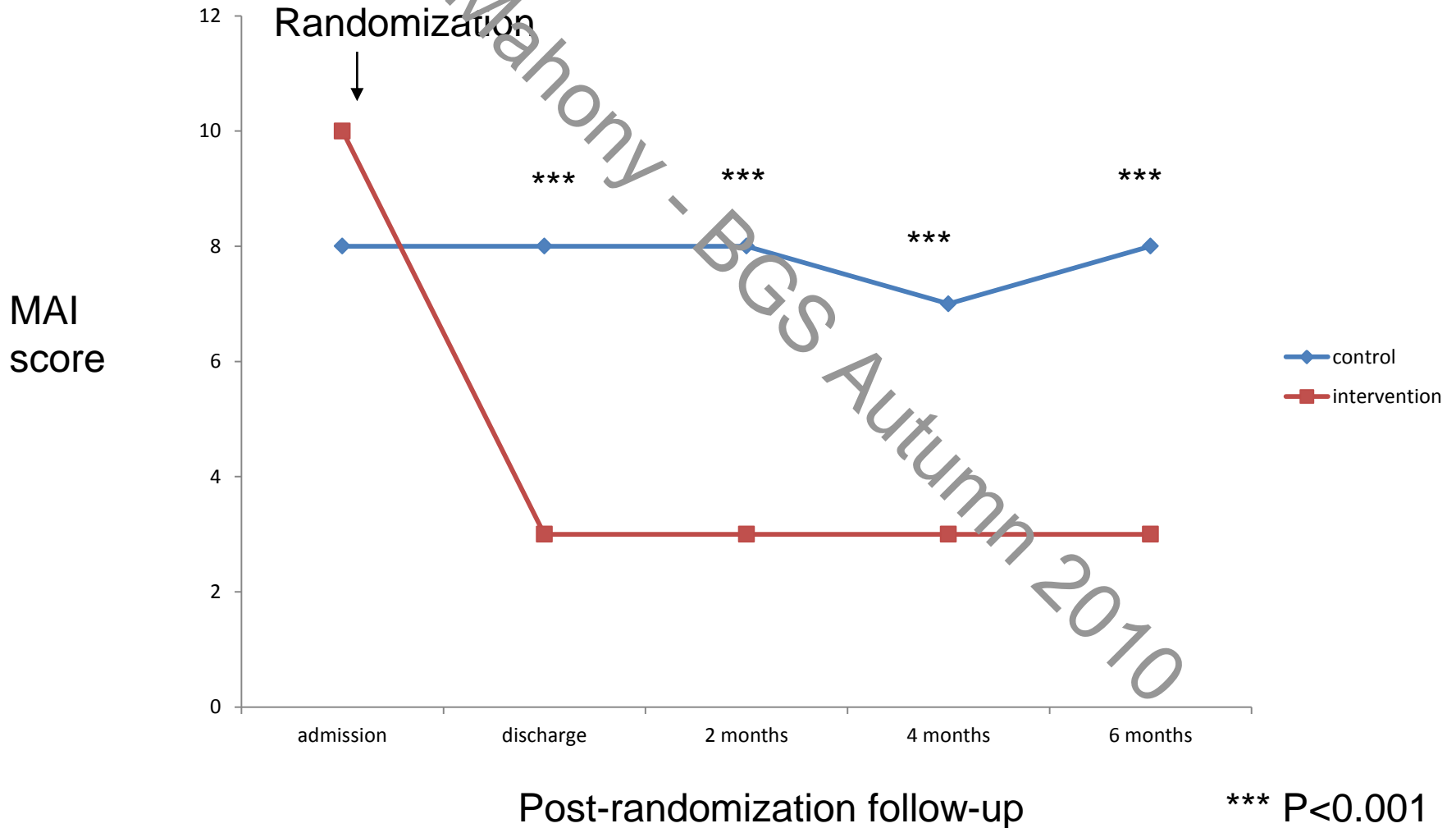
MAI: Medication Appropriateness Index  
AUM: Assessment of Underutilization of Medication

Patients admitted Dec 2007 – Nov 2008  
Randomly assigned ( $n = 400$ )

Patient population aged > 65, admitted with acute illness under care of non-geriatric physicians

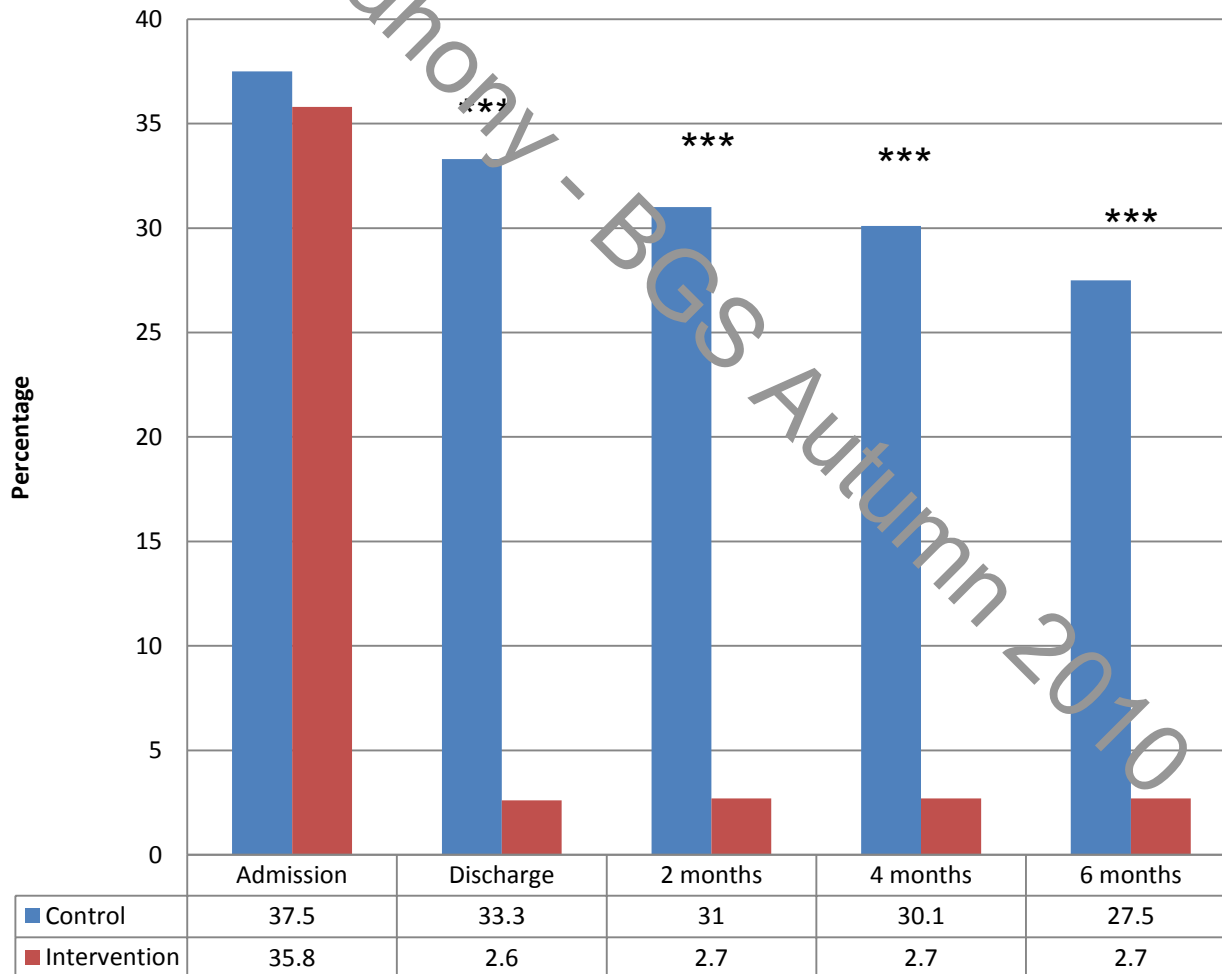


# Effect of STOPP on Medication Appropriateness



# Effect of START on Omission of Appropriate Medications

Percentage of patients with at least one prescribing omission (AUM)



\*\*\* P < 0.001

# STOPP PIM's: Implications for drug budget in older people

Cahir et al., Br J Clin Pharmacol 2010

- Restrospective study: 338801 persons aged  $\geq 70$  years in Ireland during 2007
- HSE Primary Care Reimbursement Service pharmacy claims reimbursement database (uses ATC drug classification)
- 30 out of 65 STOPP criteria  $\rightarrow$  PIM prevalence rate of 36%
- Main PIM's were:
  - PPI's at full dose  $> 8$  weeks
  - NSAID's for  $> 3/12$
  - Long half-life BZD's  $> 4/12$
  - Duplicate drug classes
- **Polypharmacy** was the main risk factor for PIM's
- Total expenditure on STOPP PIM's = €45.6 Million = 9% of total expenditure on drugs for persons aged  $\geq 70$  years in Ireland during 2007)

# STOPP/START to prevent ADE's?

New RCT: Nov 2010-Oct 2011

Older patients  
hospitalized with  
acute illness

Normal pharmaceutical care

Rigorous application of STOPP & START

Pharmaceutical care process intervention  
(Spinewine paradigm)

## 1° outcomes:

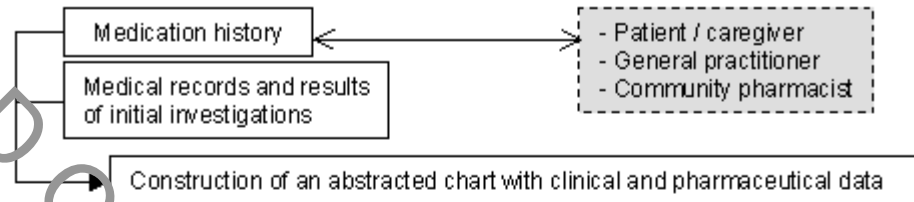
- ADE incidence
- ADE risk (Gerontonet score)

## 2° outcomes:

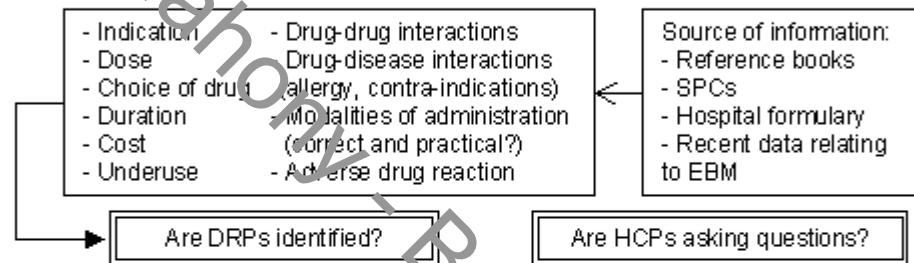
- Drug costs
- Composite healthcare costs
- Mortality

# Pharmaceutical care process (as applied by clinical pharmacists)

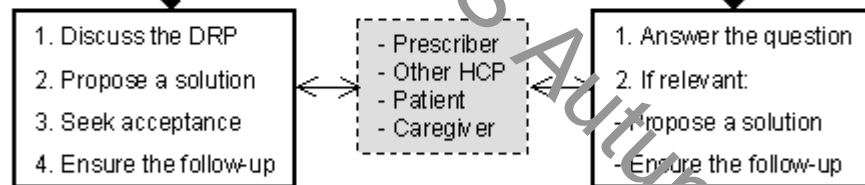
## Step 1: Gathering relevant information on the patient



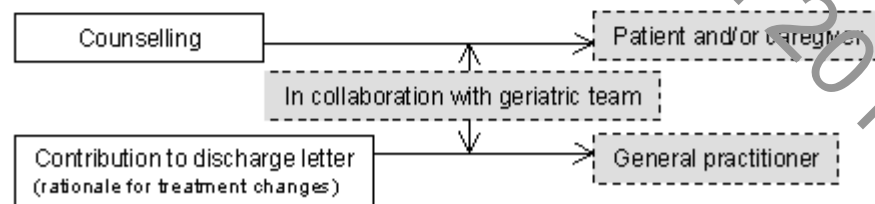
## Step 2 - 2a: Systematic analysis of medicines prescribed during hospital stay



## Step 2b: Interventions to optimise prescribing



## Step 3: Information at discharge



Abbreviations: DRP: drug-related problem; EBM: evidence-based medicine; HCP: health care professional; SPC: summary of product characteristics.

Grey dotted boxes represent persons with whom the clinical pharmacist collaborated.

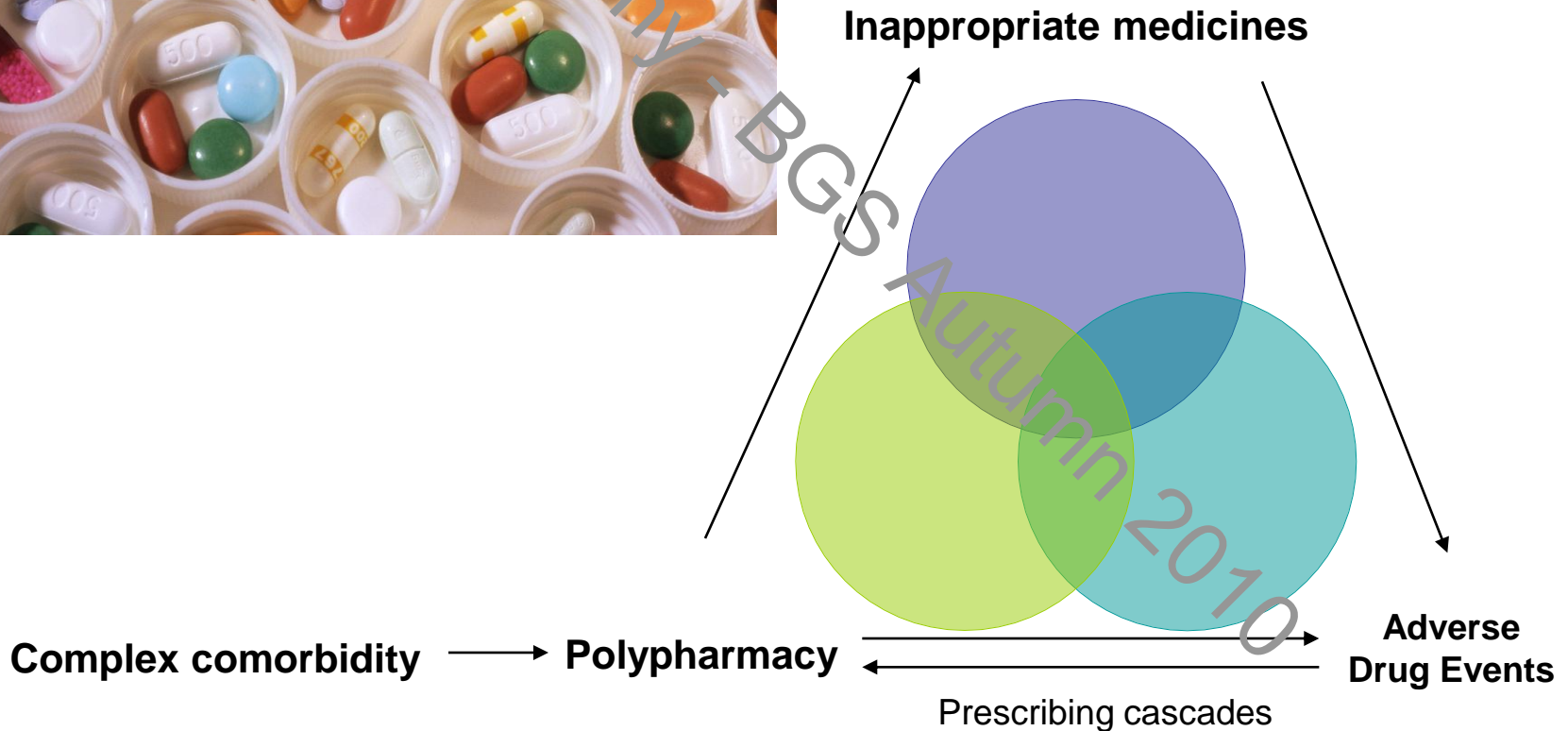
From Spinewine et al., unpublished

# Summary

- Potentially inappropriate prescribing errors are highly prevalent in primary care, hospital care and nursing homes according to Beers' Criteria and STOPP/START Criteria
- High prevalence of PIM's and PPO's in acutely ill older people in European hospitals according to STOPP/START criteria
- STOPP Criteria capture ADE's approx. 3 times more readily than Beers' Criteria; ADE's are significantly associated with STOPP Criteria drugs, but *not* with Beers' Criteria drugs.
- Rigorous application of STOPP & START improves medication appropriateness



**Polypharmacy is the core problem i.e. inappropriate over-prescribing in response to complex comorbidity**





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