Risk Factors For Drug-Related Problems Causing Emergency Department Visits In Older Adults

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Outline

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- Polypharmacy and Medication Inappropriateness

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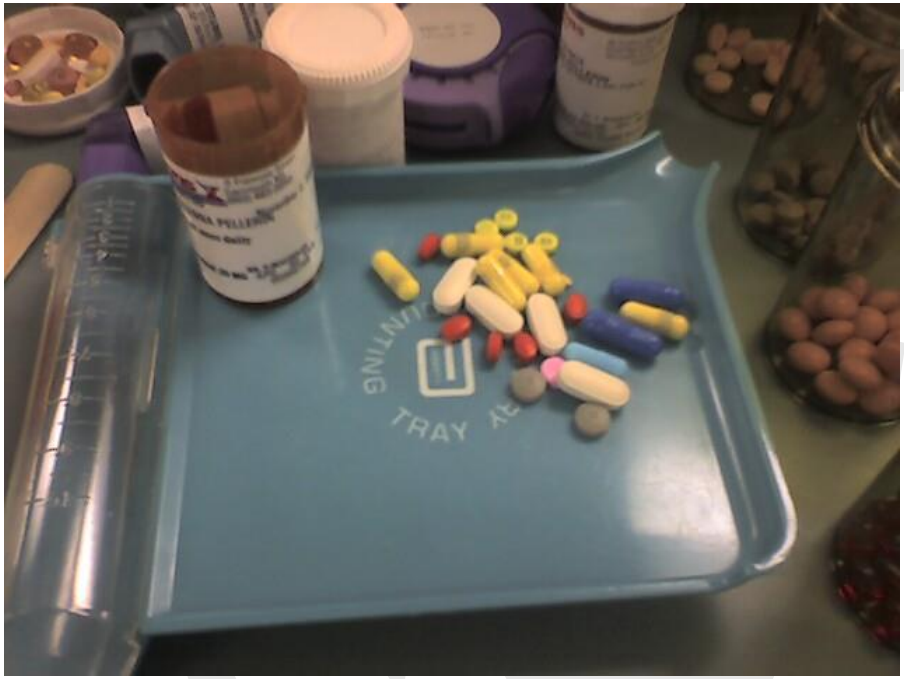
Polypharmacy and Medication Inappropriateness



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Literature Review

- 30.4% of hospital admissions in adults aged 75 years or older could be attributed to a drug-related problem

  (Chan, M., Nicklason, F., & Vial, J.H. (2001). Adverse drug events as a cause of hospital admission in the elderly. Internal Medicine Journal, 31(4), 199-205.)

- Of 718 adults over 50 years that were admitted to a medical ward in a four month period and were taking drugs on admission 23% were deemed to have a drug-related cause for admission

  (Grymonpre, R.E., Mittenko, P.A., Sitar, D.S., Aoki, F.Y., & Montgomery, P.R. (1988). Drug-associated hospital admissions in older medical patients. The Journal of the American Geriatrics Society. 36(12),1092-1098.)

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Literature Review: Risk Factors

Factors that have been shown to increase the incidence of an adverse drug event leading to contact with the healthcare system include:

(1) number of medications

(2) drug interactions

(3) specific medications such as digoxin, non-steroidal anti-inflammatory drugs, antiplatelet or anticoagulent drugs, diuretics, calcium channel antagonists, chemotherapeutic agents and antibacterial drugs

(4) older age

(5) increased number of comorbidities

(6) impaired cognition

(7) impaired renal function

(8) dependence for activities of daily living

(9) incontinence

(10) falls

(11) self-medication management

(12) lack of social support

(13) frailty

(14) malnutrition

(15) medication non-adherence

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Literature Review: Medication appropriateness

- Beer's List
  - 98.7% of veterans 65 years or older were taking at least one Beer's list medication and this predicted a subsequent adverse drug reaction

    (Lund, B.C., Carnahan, R.M., Egge, J.A., Chrischilles, E.A. & Kaboli, P.J. (2010). Inappropriate prescribing predicts adverse drug events in older adults. The Annals of Pharmacotherapy, 44(6), 957-963.)
  - 97.7% of 251 305 subjects 65 years of age or older who were likely taking a potentially inappropriate medication according to Beers list were at a significantly increased risk of unplanned hospitalization which increased as the subject was exposed to more potentially inappropriate medications

    (Price, S.D., Holman, C. D. J., Sanfilippo. F. M., & Emery J.D. (2014). Association between potentially inappropriate medication from the Beers criteria and the risk of unplanned hospitalization in elderly patients. Annals of Pharmacotherapy, 48(1),6-16.)

Literature Review: Medication appropriateness

- STOPP & START: 80 STOPP criteria and 34 START criteria*
  - In 302 frail inpatients 75 years or older, admitted for acute illness 210 events of potentially inappropriate medication were detected with STOPP and START
  - A prevalence of 47.7% were receiving a potentially inappropriate medication
  - Contributed to 27.1% of the subjects being admitted to hospital

    (Dalleur, O., Spinewine, A., Henrard, S., Losseau, C., Speybroeck, N., & Boland, B. (2012). Inappropriate prescribing and related hospital admissions in frail older persons according to the STOPP and START criteria. Drugs Aging, 29(10),829-837.)
- Medication Appropriateness Index
  - Correlates with risk of adverse drug events

    (Hanlon, J.T., Schmader, K.E., Samsa, G.P., Weinberger, M., Uttech, K.M., Lewis, I.K., … Feussner, J.R. (1992). A method for assessing drug therapy appropriateness. Journal of Clinical Epidemiology, 45(10), 1045-1051.)

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Literature Review: Medication appropriateness index

Answer the question for each drug and give the applicable score	Indicated	Marginally Indicated	Not Indicated	Weight
1. Is there an indication for the drug?	1	2	3	3
2. Is the medication effective for the condition?	1	2	3	3
3. Is the dosage correct?	1	2	3	2
4. Are the directions correct?	1	2	3	2
5. Are there clinically significant drug-drug interactions?	1	2	3	2
6. Are there clinically significant drug-disease/condition interactions?	1	2	3	1
7. Are the directions practical?	1	2	3	1
8. Is there necessary duplication with other drug(s)?	1	2	3	1
9. Is the duration of therapy acceptable?	1	2	3	1
10. Is this drug the least expensive alternative compared to others of equal utility?	1	2	3	1

Objective

- To examine medication appropriateness in relation to medical, social and economic factors as risk factors for drug-related emergency department visits

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Methods

- Comprehensive Geriatric Assessment (CGA) Excel database
- The data collection began in the summer of 2006 and contains entries until fall 2013
- All subjects in the database of 65 years of age or older were evaluated
- Over 900 entries were contained in the database
  - Not all entries were complete…

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Methods

- Due to problem with the database only data for 360 subjects was available
- Of these 159 could not be included in the study
  - 17 were too young (<65 years of age), 36 did not have an indentifiable corresponding medical record, 99 potential subjects had ID numbers that did not correspond to any patient, 6 were subsequent visits for previously included individuals and one subject had no medication information
- This left complete data for **201** subjects available for analysis
- Patient records were consulted to collect missing data

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Methods

- Risk Factor Variables and their Measurement
  - Sex
  - **Digoxin**
  - **Non-steroidal anti-inflammatory drugs**
  - **Antiplatelet or anticoagulent drugs**
  - **Diuretics**
  - **Calcium channel antagonists**
  - **Chemotherapeutic agents**
  - **Antibacterial agents**
  - Any psychoactive medication
  - Anticholinergics
  - Sedatives
  - *Antipsychotics*
  - *Antidepressants*
  - *Anti-epileptics*
  - *Lithium*
  - *Narcotics*
  - Age
  - Number of medications
  - Number of comorbidities
  - Impaired cognition by MMSE score
  - Impaired cognition by previous diagnosis
  - Dependence for activities of daily living
  - Presence of kidney dysfunction
  - Incontinence
  - History of falls
  - Social support
  - Self-medication management
  - Frailty
  - Medication appropriateness index score
  - Impaired hearing
  - Impaired vision
  - Baseline education
  - Living alone

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Hypotheses

- H_1: A high medication appropriateness index is a risk factor for drug-related emergency department visits in adults 65 years of age or older assessed by a geriatric internal medicine service.
- H_2: Social vulnerability as lack of social support is a risk factor for drug-related emergency department visits in adults 65 years of age or older assessed by a geriatric internal medicine service.
- H_3: Lower cognitive status is a risk factor for drug-related emergency department visits in adults 65 years of age or older assessed by a geriatric internal medicine service.
- H_4: Low educational level is a risk factor for drug-related emergency department visits in adults 65 years of age or older assessed by a geriatric internal medicine service.
- H_5: Frailty is a risk factor for drug-related emergency department visits in adults 65 years of age or older assessed by a geriatric internal medicine service.

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Methods

- The primary outcome measure is a drug-related healthcare system visit
- Drug-Related Problems
  - **(1) untreated indication**
  - **(2) improper drug**
  - **(3) sub-therapeutic dosage**
  - **(4) over-dosage**
  - **(5) adverse drug reaction**
  - **(6) drugs are used at appropriate doses and may include abnormal laboratory values**
  - **(7) drug interaction**
  - **(8) drug use without indication**

(Hepler, C.D., & Strand, L.M. (1990). Opportunities and responsibilities in pharmaceutical care. American Journal of Hospital Pharmacy, 47(3):533-543.)

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Methods

- Naranjo Score
- >9 definite drug-related event
- 5-8 probable drug-related event
- 1-4 possible drug-related event
- 0 doubtful drug-related event

(Naranjo, C.A., Busto, U., Sellers, E.M., Sandor, P., Ruiz, I., … Greenblatt, D.J. (1981). A method for estimating the probability of adverse drug reactions. Clinical Pharmacology & Therapeutics, 30(2), 239-245.)

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	Yes	No	Do not know	Score
I. Are there previous conclusive reports on this reaction?	1	0	0	
2. Did the adverse event appear after the suspected drug was administered?	2	-1	0	
3. Did the adverse reaction improve when the drug was discontinued or a specific antagonist was administered?	1	0	0	
4. Did the adverse reaction reappear when the drug was readministered?	2	-1	0	
5. Are there alternative causes (other than the drug) that could on their own have caused the reaction?	-1	2	0	
6. Did the reaction reappear when a placebo was given?	-1	1	0	
7. Was the drug detected in the blood (or other fluids) in concentrations known to be toxic?	1	0	0	
8. Was the reaction more severe when the dose was increased, or less severe when the dose was decreased?	1	0	0	
9. Did the patient have a similar reaction to the same or similar drugs in any previous exposure?	1	0	0	
10. Was the adverse event confirmed by any objective evidence?	1	0	0	

Results

Continuous Variable	Total number of subjects (N)	Mean (± standard deviation)	Minimum	Maximum
Age	201	81.1 ± 8.1	65	102
Number of Medications	201	9.0 ± 5.6	0	33
Number of Comorbidities	201	8.8 ± 3.3	2	18
MMSE Score	170	20.9 ± 8.7	0	30
Education in Years	174	10.2 ± 2.7	0	13
Medication Appropriateness Index	201	12.5 ± 13.0	0	76
Clinical Frailty Scale	198	5.6 ± 1.6	2	9

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Results

Categorical Variable	Total number of subjects (N)	Number of subjects (%)
Male Sex	201	94 (46.8%)
Digoxin	201	5 (2.5%)
NSAID	201	11 (5.5%)
Antiplatelet or Anticoagulent	201	109 (54.2%)
Diuretic	201	87 (43.3%)
Calcium Channel Blocker	201	55 (27.4%)
Chemotherapy	201	5 (2.5%)
Antibiotic	201	35 (17.4%)
Any Psychoactive Agent	201	107 (53.2%)
Antipsychotic	201	11 (5.5%)
Sedative	201	54 (26.9%)
Antidepressant	201	62 (30.8%)
Antiepileptic	201	13 (6.5%)
Lithium	201	1 (0.5%)
Narcotic	201	39 (19.4%)
Any Anticholinergic Medication	201	155 (77.1%)
Normal Hearing	192	133 (66.2%)
Normal Vision	181	116 (57.7%)
Baseline Cognition	182	
Normal Cognition		101 (50.2%)
Mild Cognitive Impairment		26 (12.9%)
Dementia		55 (27.4%)
Dependent for any ADL(s)	199	29 (14.4%)
Known Kidney Dysfunction	201	51 (25.4%)
Incontinence of either bowel or bladder	193	46 (22.9%)
Prior Fall(s)	183	73 (36.3%)
Social Support	187	
No Support		55 (27.4%)
Informal Support		74 (36.8%)
Formal Support		58 (28.9%)
Living Alone	197	60 (29.9%)
Self Medication Management	198	82 (40.8%)

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Methods: Binary Logistic Regression

- Hypothesis 2: social vulnerability as described by lack of social support is a risk factor for drug-related emergency department visits in adults 65 years of age or older as assessed by a geriatric internal medicine service was supported

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	AGE	.018	.026	.514	1	.473	1.019
	SEX(1)	.733	.421	3.030	1	.082	2.081
	NSAID(1)	-1.110	.737	2.268	1	.132	.330
	NARCOTIC(1)	**-1.024**	**.486**	**4.435**	**1**	**.035**	**.359**
	ANTICHOLINERGIC(1)	**-1.218**	**.600**	**4.125**	**1**	**.042**	**.296**
	SUPPORTS			**8.622**	**2**	**.013**	
	SUPPORTS(1)	1.575	.576	7.480	1	.006	4.832
	SUPPORTS(2)	1.421	.542	6.870	1	.009	4.140
	Constant	-2.245	2.170	1.071	1	.301	.106

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Methods: Binary Logisitic Regression by Naranjo Score

- Hypothesis 1: a high medication appropriateness index is a risk factor for drug-related emergency department visits in adults 65 years of age or older assessed by a geriatric internal medicine service was supported

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	SEX(1)	-.088	.833	.011	1	.916	.916
	AGE	-.002	.054	.002	1	.967	.998
	MAI	**.057**	**.021**	**7.406**	**1**	**.007**	**1.058**
	Constant	-4.148	4.391	.893	1	.345	.016

Findings

- This study showed that
  1. narcotic drug use
  2. any anticholinergic drug use
  3. lack of social supports
  4. increased MAI
  - increase the risk of drug-related hospital visits
- These results support hypotheses 1 and 2

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Discussion: Drug Use

Narcotic Use

- Narcotic use increased the risk of a drug-related emergency department visit
- Previously demonstrated by Merle, et al. (2005)
  - Showed that morphine derivatives increase the incidence of clinically meaningful drug-interactions that lead to hospital visits
- Pharmacologic effects of narcotics
  - Cause drowsiness
  - Precipiate delirium
- In Nova Scotia we monitor narcotic prescriptions but do not review for appropriateness
- No incentive for family physicians minimize narcotic use as a goal of care

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Anticholinergic Drug Use

- Anticholinergic drugs as a group were implicated as a risk factor for drug-related hospital visit
- Pharmacologic effects of anticholinergic drugs
  - Hallucinations
  - Confusion
  - Urinary retention
  - Constipation
    - Precipiate delirium

Discussion

- Lack of social supports increases the risk of drug-related emergency department visits
- Previously demonstrated by Vliet, et al. (2006)
  - Social supports decrease pressure on the healthcare sytem by reducing drug-related emergency department visists
  - Therefore hypothesis 2 was supported
- Education had no relationship to the risk of drug-related emergency department visits
  - Therefore hypothesis 4 was not supported
- Impaired cognition had no relationship to the risk of drug-related emergency department visits
  - Therefore hypothesis 3 was not supported
- Frailty had no relationship to the risk of drug-related emergency department visits
  - Therefore hypothesis 5 was not supported

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Discussion: Limitations

- Retrospective
  - Changes in practice over time
- Missing data
  - For the 201 subjects included in the analysis there was still unavailable data
- Small study size
  - Only initial entries were included for each subject
- Unable to include medication non-adherence
- Limited in its generalizablitiy
- The data collected was recorded by a variety of clinicians
  - Medications were not consistently recorded on the CGA form
  - How drugs are prescribed may not be how they were taken
- Only emergency department records were consulted so if subsequent information came to light that the visit was likely drug-related this would not be captured
- Clinical frailty scale versus frailty index
- Did not include cholinesterase inhibitors as a potential drug risk factor
- Chronic kidney disease was only included if it was listed as a known medical condition
- The maximum number of years of education was considered to be 13

Discussion: Biases

- Completed by one reviewer
- Patients seen by geriatric internal medicine may be more complicated, more likely to have polypharmacy and may be inherently more likely to have drug-related problems

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Conclusions

- This study showed narcotic use, any anticholinergic use, lack of social supports and increased MAI increased the risk of drug-related emergency department visits for seniors
- Highlights importance of social supports
- A high medication appropriateness index is a risk factor for drug-related emergency department visits

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