



Drug-Related Hospital Visits How Big Is The Problem?

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Objectives

- To discuss the overall health care impact of drug-related hospitalization.
- To discuss factors associated with identifying patients at risk and drugs commonly associated with drug-related hospitalization.
- To discuss strategies pharmacists can utilize in your practice to minimize drug-related hospitalizations.

Zed PJ, Drug-related Hospital Visits: How Big is the Problem?, CSHP PPC, Feb 1, 2004

Conflict of Interest Declaration

- No financial interest (stocks/shares) in the sale of any drugs
- Not supported by any research funding from industry
- Not on any industry advisory boards
- Not a paid industry consultant
- Not supported by industry for any educational activities
- Not paid speaker honorarium by any company for any product pertaining to this presentation

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Definitions

■ Adverse Drug Reaction (ADR)

- *"Any noxious, unintended, and undesired effect of a drug, which occurs at doses used in humans for prophylaxis, diagnosis or therapy"*
WHO Definition

- Excludes: therapeutic failures, intentional/accidental poisonings, drug abuse, medication errors in administration (too much/little drug), drug interaction, noncompliance

■ Adverse Drug Event (ADE)

- *ADR in addition to medication errors (errors in prescribing, dispensing, patient adherence and monitoring)*

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Drug-Related Problems

Hepler & Strand Am J Hosp Pharm 1990;47:533-43

- Untreated Indication
- Improper Drug Selection
- Subtherapeutic Dosage
- Failure to Receive Drug
- Overdosage
- Adverse Drug Reaction
- Drug Interaction
- Drug without Indication



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Drug-Related Morbidity

Arch Intern Med 1995;155:1949-56; J Am Pharm Assoc 2001;41:192-9.

- Annually in the USA drug-related morbidity account for:
 - Costs: \$76 billion (1995) → \$177 billion (2000)
 - Hospital Costs: 62% (1995) → 70% (2000)
 - 17 million emergency department (ED) visits
 - 8.7 million hospital admissions
- Majority of literature focus on drug-related hospitalizations specifically related to adverse drug reactions (ADRs)
- Many patients present only to the ED/AC without requiring admission and for drug-related reasons other than ADRs

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Incidence of Adverse Drug Reactions in Hospitalized Patients

A Meta-analysis of Prospective Studies

Jason Lazarou, MSc; Bruce H. Pomeranz, MD, PhD; Paul N. Corey, PhD
JAMA. 1998;279:1200-1205

Objective.—To estimate the incidence of serious and fatal adverse drug reactions (ADR) in hospitalized patients.

Data Sources.—Four electronic databases were searched from 1966 to 1996.

Study Selection.—Of 153, we selected 39 prospective studies from US hospitals.

Data Extraction.—Data extracted independently by 2 investigators were analyzed by a random-effects model. To obtain the overall incidence of ADRs in hospitalized patients, we combined the incidence of ADRs occurring while in the hospital plus the incidence of ADRs causing admission to hospital. We excluded errors in drug administration, noncompliance, overdose, drug abuse, therapeutic failures, and possible ADRs. Serious ADRs were defined as those that required hospitalization, were permanently disabling, or resulted in death.

Data Synthesis.—The overall incidence of serious ADRs was 6.7% (95% confidence interval [CI], 5.2%-8.2%) and of fatal ADRs was 0.32% (95% CI, 0.23%-0.41%) of hospitalized patients. We estimated that in 1994 overall 2 216 000 (1 721 000-2 711 000) hospitalized patients had serious ADRs and 106 000

METHODS

Definitions
 One step we took to reduce severity was to exclude any drug not use the following specific Adverse Drug Reaction² according to the World Health Organization definition,³ this is any unintended, and undesired effect which occurs at doses used in prophylaxis, diagnosis, or therapy. This definition excludes therapeutic intentional and accidental poisoning, overdose, and drug abuse; does not include adverse errors in drug administration

Drug-Related Hospitalizations Meta-Analysis

Lazarou et al. *JAMA* 1998;279:1200-05.

N=39 studies (1966-1998)

Type of ADR	Hospitalization	Inpatient	TOTAL (95% CI)
All Severity	4.2%	10.9%	15.1% (12.0-18.1%)
Serious	4.7%	2.1%	6.7% (5.2-8.2%)
Fatal	0.13%	0.19%	0.32% (0.23-0.41%)

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Drug-Related Hospitalizations Meta-Analysis

Lazarou et al. *JAMA* 1998;279:1200-05

Estimated Number of Hospital Patients with ADRs (1994)

Type of ADR	Hospitalization	Inpatient	TOTAL
All Severity	1,547,000	3,607,000	4,986,000
Serious	1,547,000	702,000	2,216,000
Fatal	43,000	63,000	106,000

Estimated to be the 4-6th leading cause of death in the USA after CVD, Cancer and CVA

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Available at: <http://www.jr2.ox.ac.uk/bandolier/Extraforbandolier/ADRPM.pdf>

Bandolier *Extra*

Evidence-based health care

June 2002

Adverse drug reactions in hospital patients

A systematic review of the prospective and retrospective studies

Philip Wilton BPharm, Regional Pharmaceutical Advisor, SERO
 Mike Gill FRCP, Director of Public Health, SERO
 Jayne Edwards DPhil, Research Associate
 Andrew Moore DSc, Director of Research

N=69 studies, ~413,000 pts = 6.7% (95% CI 6.6-6.8%)

N=54 prospective studies, ~193,000 pts = 5.5%
 N=15 retrospective studies, ~220,000 pts = 7.7%

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Preventable Drug-Related Hospital Admissions

Almut G Winterstein, Brian C Sauer, Charles D Hepler, and Charles Poole

Ann Pharmacother 2002;36:1238-48.

OBJECTIVE: To estimate the prevalence of preventable drug-related hospital admissions (PDRA) and to explore if selected study characteristics affect prevalence estimates.

METHODS: Keyword search of MEDLINE (1966–December 1999), *International Pharmaceutical Abstracts* (1970–December 1999),

Median Preventability Rate
59% (IQR 50-73%)

was determined, because the numerous study results were highly heterogeneous (Cochran's Q = 27.0, P < .0001). A meta-analytic summary estimate was computed. Stratified analysis suggested an association between prevalence estimates and 3 study characteristics: exclusion of first admissions (readmission studies: average PDRA prevalence of 14.0%, estimated prevalence OR = 3.7); mean age of admissions >70 (OR = 2.1); and inclusion of "indirect" drug-related morbidity, such as omission errors or therapeutic failure (OR = 1.9). There was little evidence of other associations with prevalence estimates, such as selection of specific hospital units, exclusion/inclusion of planned admissions, country, and specified methods of PDRA case ascertainment.

CONCLUSIONS: Drug-related morbidity is a significant healthcare problem, and a great proportion is preventable. Study methods in prevalence reports vary and should be considered when interpreting findings or planning future research.

Drug-Related Emergency Department Visits

Retrospective Studies

- 9 studies (1992-2002) evaluating ~725,000 patients
- DRV: **0.19-10.6%** of all ED visits
- Hospitalization Rate: **11.9-30.9%**
- Cost: **\$247-\$333/EDV** & **\$2815-\$8888/adm** (\$US)
- Limitations
 - retrospective data collection
 - 8/9 studies conducted in USA, 1/9 in Canada
 - definition of drug-related visits heterogeneous but mostly ADR
 - exclusion of OTC, alternative medicines

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Drug-Related Emergency Department Visits

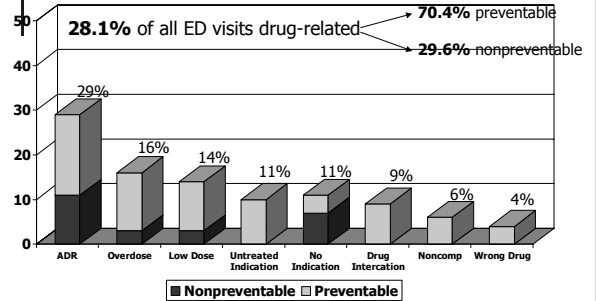
Prospective Studies

- 5 studies (1998-2003) evaluating ~12,000 patients
- DRV: **4.3-28.1%** of all ED visits
 - 2 US studies estimated DRV at 22% and 28.1%
- Hospitalization Rate: **8.6-27.3%**
- Preventability: **38-70%**
- Cost: **\$576/EDV** & **\$4834/adm** (\$US)

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Drug Related Emergency Department Visits

Tafreshi et al. Ann Pharmacother 1999;33:1252-7



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Incidence and Preventability of Adverse Drug Events Among Older Persons in the Ambulatory Setting

JAMA. 2003;289:1107-1116

Jerry H. Gurwitz, MD

Terry S. Field, DSc

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Lawrence Garber, MD

Michael Kelleher, MD

David W. Bates, MD, MSc

Context Adverse drug events, especially those that may be preventable, are among the most serious concerns about medication use in older persons cared for in the ambulatory clinical setting.

Objective To assess the incidence and preventability of adverse drug events among older persons in the ambulatory clinical setting.

Design, Setting, and Patients Cohort study of all Medicare enrollees (30 397 persons) years of observation) cared for by a multispecialty group practice during a 12-month study period (July 1, 1999, through June 30, 2000), in which possible drug-related incidents occurring in the ambulatory clinical setting were detected using multiple methods, including reports from health care providers; review of hospital discharge summaries; review of emergency department notes; computer-generated signals; a mailed free-text review of electronic clinic notes; and review of administrative incident reports concerning medication errors.

Main Outcome Measures Number of adverse drug events, severity of the events (classified as significant, serious, life-threatening, or fatal), and whether the events were preventable.

Results There were 1523 identified adverse drug events, of which 27.6% (421) were considered preventable. The overall rate of adverse drug events was 50.1 per 1000 persons per year, with a rate of 13.8 preventable adverse drug events per 1000 person-years.

ALTHOUGH NUMEROUS STUDIES have evaluated the patterns and quality of prescription medication use among

ADE in Older Patients in Ambulatory Care

Gurwitz et al. JAMA 2003;289:1107-16

Rate and Severity of Adverse Drug Events

N=27,617 person-yrs

	Overall N=1523	Preventable N=421	Nonpreventable N=1102
Rate/1000 person-yrs (95% CI)	50.1 (47.6-52.6)	13.8 (12.5-16.2)	36.3 (34.1-38.4)
Category of Severity (%)			
Fatal	11 (0.7)	5 (1.2)	6 (0.5)
Life Threatening	136 (8.9)	72 (17.1)	64 (5.8)
Serious	431 (28.3)	167 (39.7)	264 (24.0)
Significant	945 (62.0)	177 (42.0)	768 (69.7%)

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ADE in Older Patients in Ambulatory Care

Gurwitz et al. JAMA 2003;289:1107-16

Frequency of Adverse Drug Events by Drug Class

Drug Class	%	Drug Class	%
Cardiovascular	26.0	Antineoplastics	1.7
Antibiotics	14.7	Gastrointestinal	1.3
Diuretics	13.3	Nutrients/Supplements	1.3
Nonopioid Analgesics	11.8	Antiplatelets	1.2
Anticoagulants	7.9	Respiratory	0.8
Hypoglycemics	6.8	Sedative/Hypnotics	0.6
Steroids	5.3	Antipsychotics	0.5
Opioids	4.9	Hormones	0.5
Antidepressants	3.2	Osteoporosis	0.5
Antiseizure	2.3	Muscle Relaxants	0.5
Antihyperlipidemics	2.0	Thyroid	0.5

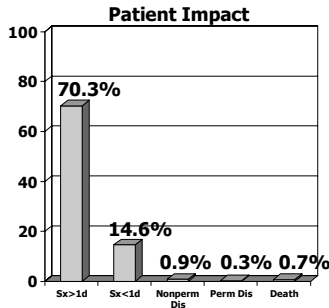
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ADE in Older Patients in Ambulatory Care

Gurwitz et al. JAMA 2003;289:1107-16

77.6% ADE Preventable

- Monitoring 60.8%
- Prescribing 58.4%
- Adherence 21.1%
- Dispensing <2.0%



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SPECIAL ARTICLE

PATIENT SAFETY

Adverse Drug Events in Ambulatory Care

Tejal K. Gandhi, M.D., M.P.H., Saul N. Weingart, M.D., Ph.D.,
 Joshua Borus, B.A., Andrew C. Seger, R.Ph., Josh Peterson, M.D.,
 Elisabeth Burdick, M.S., Diane L. Seger, R.Ph., Kirstin Shu, B.A.,
 Frank Federico, R.Ph., Lucian L. Leape, M.D., and David W. Bates, M.D.

N ENGL J MED 348:16 WWW.NEJM.ORG APRIL 17, 2003

Adverse Drug Events in Ambulatory Care

Gandhi et al. NEJM 2003;348:1556-64

Rate and Severity of Adverse Drug Events

N=661

	No.	Rate
ADR	162 (181 events)	25.0%
Severity		
Fatal/Life Threatening	0	0
Serious	24	13%
Significant	157	87%
Preventability		
Ameliorable/Preventable	71	39%

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The Incidence and Severity of Adverse Events Affecting Patients after Discharge from the Hospital

Alisa J. Forster, MD, FRCP, MSc; Harvey J. Murff, MD; Josh F. Peterson, MD; Tejal K. Gandhi, MD, MPH and David W. Bates, MD, MSc

Background: Studies of hospitalized patients identify safety as a significant problem, but few data are available regarding injuries occurring after discharge. Patients may be vulnerable during this transition period.

Objective: To describe the incidence, severity, preventability, and "ameliorability" of adverse events affecting patients after discharge from the hospital and to develop strategies for improving patient safety during this interval.

Design: Prospective cohort study.

Setting: A tertiary care academic hospital.

Patients: 400 consecutive patients discharged home from the general medical service.

Measurements: The three main outcomes were adverse events, defined as injuries occurring as a result of medical management; preventable adverse events, defined as adverse events judged to have been caused by an error; and ameliorable adverse events, defined as adverse events whose severity could have been decreased. Posthospital course was determined by performing a

medical record review and a structured telephone interview approximately 3 weeks after each patient's discharge. Outcomes were determined by independent physician reviews.

Results: Seventy-six patients had adverse events after discharge (19% [95% CI 15% to 23%]). Of these, 23 had preventable adverse events (6% [CI 4% to 9%]) and 24 had ameliorable adverse events (6% [CI 4% to 9%]). Three percent of injuries were serious laboratory abnormalities, 65% were symptoms, 30% were symptoms associated with a nonpermanent disability, and 3% were permanent disabilities. Adverse drug events were the most common type of adverse event (66% [CI 55% to 76%]), followed by procedure-related injuries (17% [CI 8% to 26%]). Of the 25 adverse events resulting in at least a nonpermanent disability, 12 were preventable (48% [CI 28% to 68%]) and 6 were ameliorable (24% [CI 7% to 41%]).

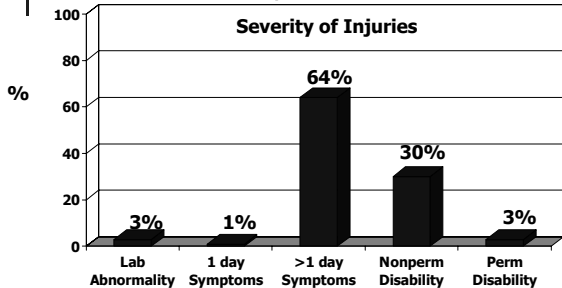
Conclusion: Adverse events occurred frequently in the pre-discharge period, and many could potentially have been prevented or ameliorated with simple strategies.

Ann Intern Med. 2003;138:161-167.

Adverse Drug Events After Hospital DC

Forster et al. Ann Intern Med 2003;138:161-7

76/400 = 19% experienced ADE within 3-weeks of hospital DC
 47/76 = 62% preventable/ameliorable

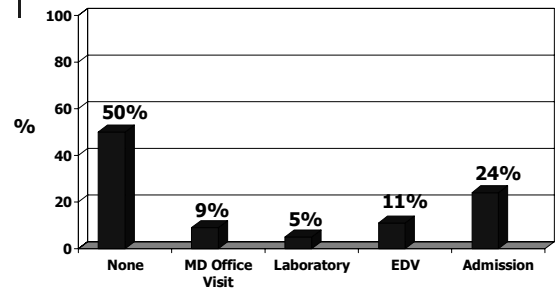


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Adverse Drug Events After Hospital DC

Forster et al. Ann Intern Med 2003;138:161-7

Health Services Utilization



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Drug Interactions at Hospital Discharge

Egger et al. Euro J Clin Pharmacol 2003;58:773-8

- Retrospective review of patients discharged from hospital
- N=500
- 60% had at least one potential drug interaction
- 747 potential drug interactions
- 54% were new at the time of discharge
- Severity:
 - 12% major
 - 70% moderate
 - 18% minor

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Drug Interactions in the Hospitalized Elderly

Juurlink et al. JAMA 2003;289:1652-8.

- Design:
 - 3 population-based, nested case-control studies
- Time Period:
 - January 1, 1994 - December 31, 2000, Ontario
- Data Source:
 - Ontario Drug Benefit Program
 - Canadian Institute for Health Information Discharge Abstract DB
- Patients:
 - >65 years of age, glyburide, digoxin, ACEI
- Exposure:
 - glyburide-cotrimoxazole, digoxin-clarithromycin, ACEI-K-sparing
 - glyburide-amoxicillin, digoxin-cefuroxime, ACEI-indapamide

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Drug Interactions in the Hospitalized Elderly

Juurlink et al. JAMA 2003;289:1652-8.

Hospitalization Within 1 Week of Drug Initiation

Drug Interaction	Case	Control	OR
Glyburide-Co-trimoxazole	3.9%	0.4%	6.6 (4.5-9.7)
Glyburide-Amoxicillin	1.1%	0.6%	
Digoxin-Clarithromycin	2.6%	0.2%	11.7 (7.5-18.2)
Digoxin-Cefuroxime	0.3%	0.1%	
ACEI-K-sparing Diuretic	8.2%	0.3%	20.3 (13.4-30.7)
ACEI-Indapamide	0.6%	0.4%	

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Who is at Risk?

- Elderly
 - tend to receive more medications
 - illnesses tend to be treated with "high-risk" medications
 - drug interactions occur due to polypharmacy
 - poor compliance
 - altered pharmacokinetics/pharmacodynamics
- Multiple Medications
 - 5% (1-2 meds) → 10-20% (>5 meds) → 50% (>10 meds)

J Am Geriatr Soc 1988;36:1092-8 & 1991;39:1093-9
- Particular Drug Classes

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Which Drug Classes?

- Antibiotics
- Anticoagulants
- Digoxin
- Diuretics
- Hypoglycemic Agents
- NSAIDS



60-70% of all ADE!!

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Drug Classes Associated Hospital Visits

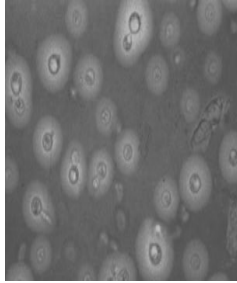
- Antibiotics
 - most likely to be non-preventable
 - ADR: GI, allergic reactions
 - compliance, wrong antibiotic, drug interactions
 - antimicrobial resistance



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Community-Acquired Infections

- Meningitis
- Otitis Media
- Sinusitis
- Pharyngitis
- Bronchitis
- Pneumonia
- Endocarditis
- Intra-abdominal
- Genitourinary
- Skin and Soft Tissue



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"Spiraling Empiricism"

"The imprecision of clinical practice establishes context; the litigious nature of our society unnerves; the absence of toxicity permits; and the sum of these encourages the incontinent, extemporaneous use of antimicrobial agents

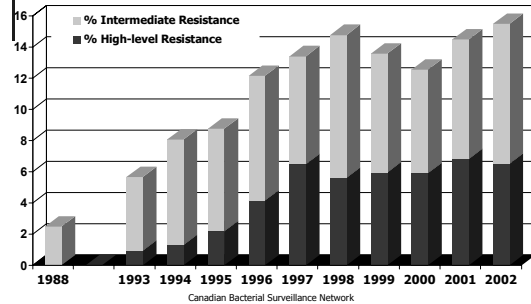
Jerome Kim 1989



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Penicillin-Resistant *S. pneumoniae*

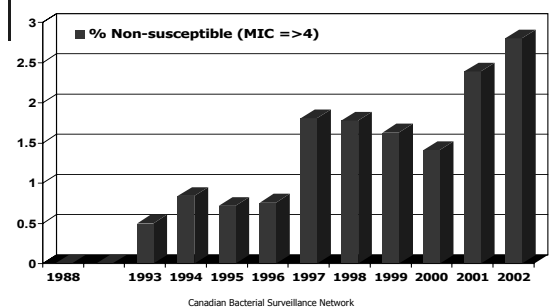
Canadian Isolates 1988, 1993-2002



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Ciprofloxacin-Resistant *S. pneumoniae*

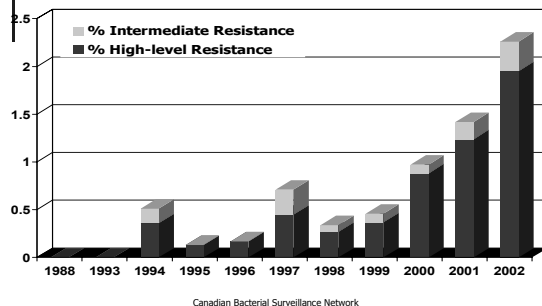
Canadian Isolates 1988, 1993-2002



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Levofloxacin-Resistant *S. pneumoniae*

Canadian Isolates 1995-2002



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Brief Report

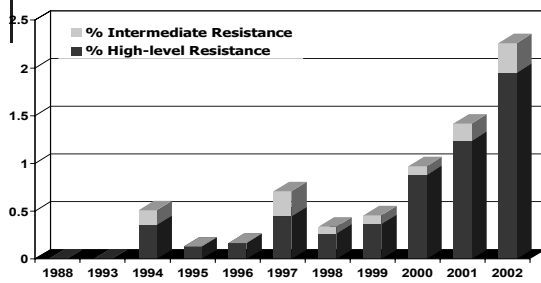
N Engl J Med, Vol. 346, No. 10 · March 7, 2002 ·

RESISTANCE TO LEVOFLOXACIN AND FAILURE OF TREATMENT OF PNEUMOCOCCAL PNEUMONIA

ROSS DAVIDSON, PH.D., RODRIGO CAVALCANTI, M.D.,
 JAMES L. BRUNTON, M.D., DARRIN J. BAST, PH.D.,
 JOYCE C.S. DE AZAVEDO, PH.D., PAMELA KIBSEY, M.D.,
 CHRISTINE FLEMING, M.L.T., AND DONALD E. LOW, M.D.

Levofloxacin-Resistant *S. pneumoniae*

Canadian Isolates 1995-2002



Canadian Bacterial Surveillance Network

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Appropriate Use of Antibiotics

Appropriate use of antibiotics can be defined as "the cost-effective use of antimicrobials which maximizes clinical therapeutic effect, while minimizing both drug-related toxicity and development of antimicrobial resistance."

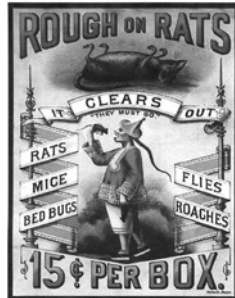
WHO 2000



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Drug Classes Associated Hospital Visits

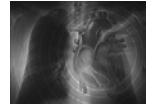
- Anticoagulants
 - very common
 - one of the most dangerous
 - INR too high or too low
 - anticipate drug interactions!
 - MONITOR, MONITOR, MONITOR!



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Drug Classes Associated Hospital Visits

- Diuretics
 - furosemide, thiazides, spironolactone
 - ADR: fluid & electrolyte disturbances
- Beta-Blockers/Calcium Channel Blockers
- Digoxin
 - usually mild toxicity (CNS, GI) but potentially dangerous (CV)
 - elderly and/or renal dysfunction are at greatest risk factors
 - no need to push dose in CHF.....<1.0 nmol/L



JACC 2002;39:946-53

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Drug Classes Associated Hospital Visits

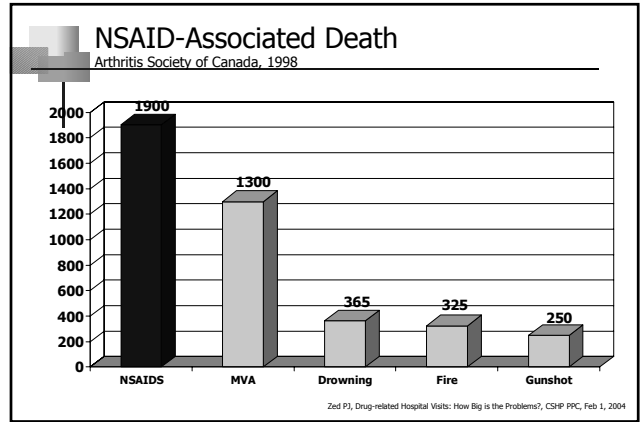
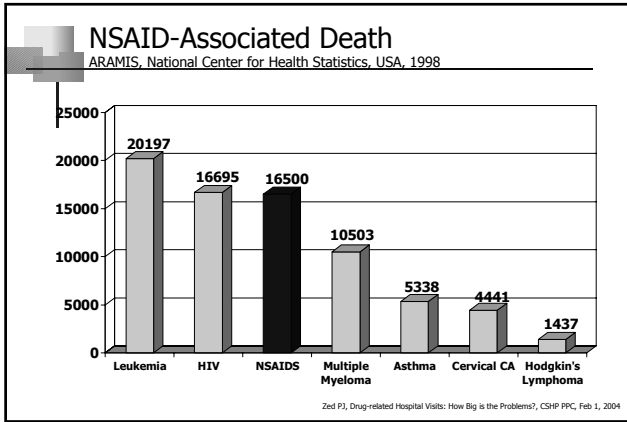
- Hypoglycemics
 - insulin/oral hypoglycemics
 - non-BG ADR:
 - glitazones (CV)
 - metformin (lactic acidosis)



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Health Canada / Santé Canada | Health Products and Food Branch / Direction générale des produits de santé et des aliments

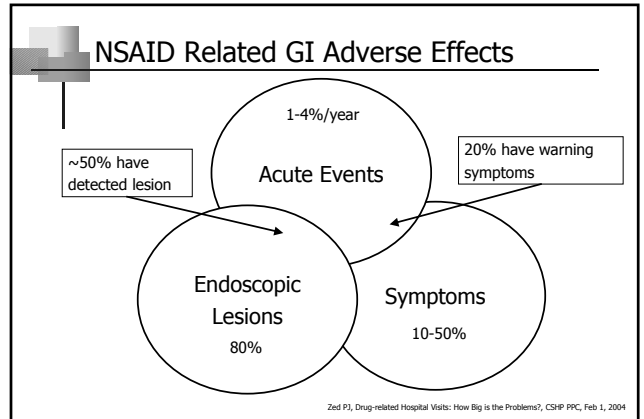
As outlined in the original AVANDIA® Product Monograph under the 'Warnings' section, physicians should be aware that thiazolidinediones can cause fluid retention, which can exacerbate or lead to congestive heart failure. Patients at risk for heart failure (particularly those on insulin) should be monitored for signs and symptoms of heart failure. AVANDIA® should be discontinued if any deterioration in cardiac status occurs. In addition, AVANDIA® is not indicated in patients with New York Heart Association (NYHA) Class III and IV cardiac status. For further emphasis, this important information regarding NYHA Class III & IV patients has been moved from the 'Precautions' section to the 'Warnings' section of the Product Monograph. In postmarketing experience with AVANDIA®, adverse events potentially related to volume expansion (e.g. congestive heart failure, pulmonary edema and pleural effusions) have been reported. It is important to also note that thiazolidinediones, including AVANDIA®, are contraindicated in patients with acute heart failure. This contraindication is new to the Product Monograph.



Drug Classes Associated Hospital Visits

- NSAIDS
 - seen daily in ED....many studies identified as most common ADR
 - ADR: GI, renal dysfunction, worsening CHF, allergic reaction
 - avoid if possible, be aware of high-risk patients, minimize risk
 - COX-2 inhibitors?

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ORIGINAL INVESTIGATION

Consumption of NSAIDs and the Development of Congestive Heart Failure in Elderly Patients

History of Heart Disease	Use of NSAID	26.3 (5.8-119.1)
	No NSAID	2.5 (1.4-4.3)
No Heart Disease	Use of NSAID	1.6 (0.7-3.7)
	No NSAID	1.0 (Reference)

Honourable Mention!

- CNS Depressants
- Opioids
- Antiepileptic Drugs
- Complementary and Alternative Medicines

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How Can Drug-Related Visits be Prevented?

Minimize the Risk!

- Be aware of high-risk patients/drugs
- Individualize the dose
- Avoid duplication of therapy
- If you don't need it, don't start it...if it is not working stop it!
- MONITOR, MONITOR, MONITOR!
- Anticipate drug interactions
- Patient counseling
- Compliance tools
- New ≠ Better....and **ALWAYS** means.....
.....we don't know yet about ADRs & drug interactions!



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Patient Compliance



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Tools to Improve Patient Compliance

Haynes et al. JAMA 2002;288:2880-83

- Short Term Treatments
 - patient counseling about importance of compliance
 - written instructions
 - reminder packaging (e.g. calendar, blister packs, dosette)



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Tools to Improve Patient Compliance

Haynes et al. JAMA 2002;288:2880-83

- Long Term Treatments (Combinations)
 - instruction and instructional materials
 - simplification of the regimen (less frequent dosing, SR products)
 - counseling about the regimen
 - support group sessions
 - reminder for medications and appointments
 - cueing medications to daily events
 - reinforcement and rewards
 - self-monitoring with regular physician reviews and reinforcement
 - involving family members/significant others

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Drug Withdrawn from the Canadian Market



Drug	Reason
Cisapride	arrhythmia
Troglitazone	hepatotoxicity
Trovafloxacin	hepatotoxicity
Grepafloxacin	arrhythmia
Fenfluramine	valvular heart disease
Dexfenfluramine	valvular heart disease
Phenylpropanolamine	hemorrhagic stroke
Terfenadine	arrhythmia
Cerivastatin	rhabdomyolysis
Remoxipride	aplastic anemia
Pemoline	hepatotoxicity
Nefazadone	hepatotoxicity

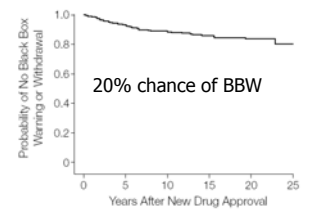
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Black Box Warnings and Drug Withdrawals

Lasser KE et al. JAMA 2002;287:2215-2220.

- 548 new chemical entities approved in US 1975-1999
- 56 (10.2%) acquired a new black box warning or WD
- 45 (8.2%) acquired one or more black box warnings
- 16 (2.9%) were withdrawn

Figure. Kaplan-Meier Estimate of New Drug Survival Without a New Black Box Warning or Withdrawal (Physicians' Desk Reference Changes)



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Post-Marketing Surveillance

Friedman et al. JAMA 1999;281:1728-34

	No. Exposed During Testing	No. Exposed Prior to Withdrawal
Terfenadine	5000	7,500,000
Fenfluramine	340	6,900,000
Dexfenfluramine	1200	2,300,000

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Medication Errors....The Preventable Errors!



Prescribing Transcribing Dispensing Administration Monitoring
1 **2** **3** **4** **5**

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Factors Associated with Errors in Prescribing

Lesar et al. JAMA 1997;277:312-17

- 2103 medication errors (3.99/1000 orders)
- 696 errors created potential for adverse outcome

Error	N	%
Overdosing	291	41.8
Underdosing	115	16.5
Prescribing Allergic Medication	90	12.9
Inappropriate Dosage form	81	11.6
Wrong Drug	35	5.0
Duplicate Therapy	35	5.0
Wrong Route	23	3.3
Other	26	3.7

Drug Class	N	%
Antibiotics	276	39.7
Cardiovascular	122	17.5
Gastrointestinal	51	7.3
Nonnarcotic Analgesics	46	6.6
Narcotics	25	3.6
Hormones	24	3.4
Minerals/Lytes	21	3.0
Xanthines	20	2.9

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Factor	N	%
Pathophysiological Factor (e.g. age, RF)	97	13.9
Allergy	84	12.1
Incorrect Dosing Calculation	77	11.1
Atypical Dosing Frequency	75	10.8
Need to Specify Dosage Form	43	6.2
Generic Names	36	5.2
Duplication	36	5.2

Drug Class	N	%
Drug Factors	209	30
Patient Factors	203	29
Calculations/Expression	122	17.5
Nomenclature	93	13.4
Dosage Form	22	3.2
Administrative	18	2.6

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Case: Prescribing Error

- **ID:** 74 yo M brought to ED by EHS at 2330h on Jan 13-04
- **CC:** decreased LOC, drowsy, slurred speech
- **HPI:** Patient had been in the ED 2 days prior secondary to a fall (rib #) and was DC on morphine. Developed slurred speech, hallucinations, disorientation this PM.
- **PMH:**
 - BPD
 - Hypothyroidism
 - Rib #
- **MPTA:** (as per patient/PNet)
 - Lithium 300 mg PO BID
 - Olanzapine 5 mg PO daily
 - Phenylnzine 30 mg PO AM/15 mg PO PM
 - Levothyroxine 50 mcg PO daily
 - Zopiclone 15 mg PO HS PRN sleep
 - Morphine 10-20 mg PO Q4h PRN rib pain

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Case: Prescribing Error

- In ED patient received:
 - CT Head: Normal
 - Meperidine 75 mg IM (0645h)
- At 0702h patient became agitated, diaphoretic, hyperthermic, hypotensive and increasingly rigid....seizure?
- **VS:** BP 63/30, HR 58, RR 18, T 37.7, O2 sat 96%
- Pt intubated using RSI
 - etomidate 20 mg, succinylcholine 120 mg
 - lorazepam 2 mg IV, phenytoin 1000 mg
 - consult ICU
- **Paged while on route to the hospital....?**

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Case: Dispensing Error

- **ID:** 44 yo F brought to ED by EHS at 1235h on May 21-03
- **CC:** drowsy
- **HPI:** Patient reports becoming increasingly drowsy throughout the morning and following a late morning dental appointment had become drowsy and at times had difficulty staying awake.
- **PMH:**
 - Asthma
 - NIDDM
 - Depression
 - Schizophrenia
- **MPTA:** (as per patient/PNet)
 - Glyburide 10 mg PO BID (LF: Apr 30)
 - Metformin 1000 mg PO BID (LF: Apr 30)
 - Paroxetine 30 mg PO daily (LF: May 20)
 - Lithium 1200 mg PO HS (LF May 20)
 - Clozapine 200 mg PO HS (LF May 20)

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Case: Dispensing Error

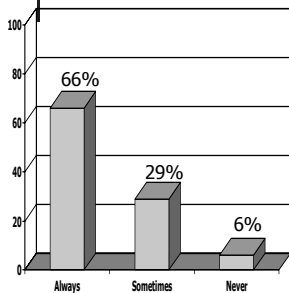
- EHS also reports patient received:
 - Last PM
 - Clonazepam 4 mg
 - Lorazepam 1 mg
 - This AM:
 - Clonazepam 4 mg
 - Gabapentin 600 mg
 - Fluoxetine 40 mg
 - Omeprazole 20 mg
- **VS:** BP 138/85, HR 79, RR 12, T 36.6 C, O2 sat 99%
- **PE:** excessive drowsy but otherwise NC
- **BG:** 9.3 mmol/L, all other bloodwork pending
- **What may be happening with this patient?**

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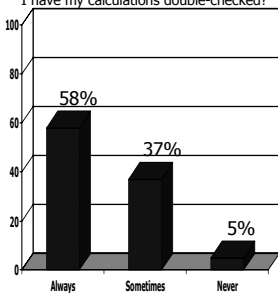
Medication Errors: Nurses Survey

Cohen et al. Nursing 2003;33:36-46

Do I repeat a verbal order back to the prescriber?



When administering "high-risk" medications I have my calculations double-checked?

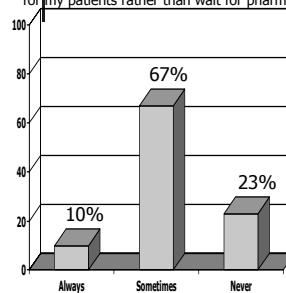


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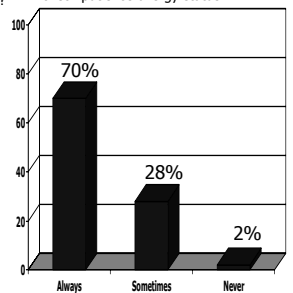
Medication Errors: Nurses Survey

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I "borrow" medications from other patients for my patients rather than wait for pharmacy?



Before administering medications I check patient's allergy status?

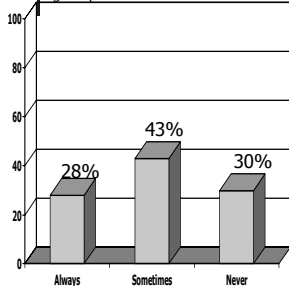


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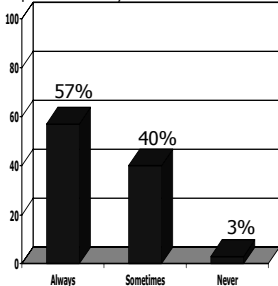
Medication Errors: Nurses Survey

Cohen et al. Nursing 2003;33-46

I remove medications from unit dose before entering the patient's room?



Before administering medications I check patient's identity on ID bracelet?



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