



# Researching the use of Emergency Pharmacists in the ED

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  - Career development grant (via SAEM) [www.EMPSF.org](http://www.EMPSF.org)





# Objectives

1. Briefly review pre-existing evidence supporting clinical pharmacist roles
2. Report findings from the Emergency Pharmacist Research Project
3. Describe some lessons learned





# Previous literature

- ICU Pharmacists Impact Medication Safety
  - 99% of Pharm recommendations accepted by physicians in ICU
  - 66% decrease in Preventable ADEs in ICU

*Folli HL, Poole RL, Benitz WE, Russo JC. Pediatrics 1987; 79(5)*

*Gattis WH, Whellan DJ. Arch Internal Med, 1999. 159(16): p. 1939-1945.*

*Kane SL, Weber RJ, Dasta JF. Int Care Med 2003;29(5):691-8*

*Leape LL, Cullen DJ, Clapp MD, et al. JAMA 1999;282(3):267-70*





# Background

- University of Rochester Emergency Department
  - EPh Program Since 2000
  - Accredited EPh residency
  - Anecdotally we found
    - Medication adverse events reduced
    - Staff consult the EPh often
    - Staff seem to value EPh input



*Fairbanks RJ, Hays DP, Webster DF, Spillane LL, Clinical Pharmacy Service in an Emergency Department, American Journal of Health-System Pharmacy, 2004; 61(9): 934-937.*





# Role of the EPh

- Clinical consultation- primary role
- At the bedside
  - Critical patients, Trauma, Resuscitations
- Order screening- as able, high yield cases
- Education- patients, nurses, physicians
- Preparation of urgent medications
- **MDs & RNs seek pharmacist advice**





# Preliminary Data: Trauma Care

- Improved key measures
  - Time to:
    - Pain meds
    - RSI, paralytics, sedation
  - ADEs: 9/51 with, 0/153 without



*Hays D, Kelly-Pisciotti S, O'Brien T, Fairbanks RJ, et al. American Association for the Surgery of Trauma 2006 Annual Meeting, September 28-30, 2006; New Orleans, LA.*

*Kelly SJ, Hays D, et al. "Pharmacists Enhancing Patient Safety During Trauma Resuscitations." 2005 ASHP Best Practices Award*





# AHRQ PIPS Project: Program Objectives

- Optimize role for patient safety (2005)
- Study outcomes: P/ADE/Qual (2005-7)
- Study staff perceptions (2006)
- Study EM residency program use (2007)
- Time-Motion Study (2007)
- Study barriers to implementation (2007)
- Develop tools for other hospitals (2005-7)
  - [www.EmergencyPharmacist.org](http://www.EmergencyPharmacist.org)







# Optimized Role Results

- High visibility / easy access
  - On duty/off duty signs
  - Portable phone
  - Frequent walk-rounds
- Patient centered roles only
  - Minimal dispensing, no stocking
- Focus on ED patients
  - Admitted boarders → inpatient pharmacy





# Optimized Role Results

- Maintain surveillance of provider orders
  - mandatory review of pediatric orders
    - ex) patients <1 year or <10kg
- Respond to all critical (traumas, medical)
- Focus coverage on peak volume periods
- Minimize administrative responsibility
  - Committees, etc





# Time-Motion Results

- Rounding pattern noted (21% total time)
- EPh highly utilized (sought after)
  - 46% questions related to medication choice, dose, interactions, side effects, availability
- Communication: 45% tasks, 22% Time
  - Vast majority RN (14%) or MD (22%) tasks





# Survey: URMC ED Staff Perceptions

- #1 role: “being available for a consult”
- 96%- EPh is integral part of the team
- 100% - use EPh more than if not in ED
- 73%- Value EPh order screening
- 85%- EPh should check all high risk meds
- **99%- EPh improves quality of care**
  - **100% physicians agree**

*Fairbanks RJ, Hildebrand JM, Kolstee KE, Schneider SM, Shah MN. Medical and nursing staff value and utilize clinical pharmacists in the Emergency Department. Emergency Medicine Journal, Oct 2007; 24:716-719.*





# Impact Evaluation Study: 10,224 cases reviewed

- Hypothesis: EPh improves medication safety and quality of care
- Study Design:
  - Prospective enrollment
  - Random selection for chart review
    - critically ill, pediatric, geriatric
  - 2 groups: EPh absent vs. EPh Present
    - blinded, so unable to determine whether EPh was actually involved in the care of individual patients.





# Impact Evaluation Study

- Outcome Measures [\[definitions\]](#)
  - Adverse drug event (ADE), Potential ADE (PADE)
  - Quality measures: list developed
    - Specific to Emergency Medicine
    - Literature review & expert consensus
- Methods
  - HMPS methods (acknlgmt: David Bates, Diane Seger)
    - Data abstracted- nurse reviewers
    - Suspicion for ADE/PADE identified by RNs
    - Confirmed and classified by MDs

*Brennan, Leape, Laird et al. NEJM. 1991; 324(6).*





# Impact Evaluation: Results

## ■ Results

- Total enrollment: 10,224
  - Pediatrics (<19) 5098
    - (Peds Critical: 144)
  - Geriatrics (>64): 2873
    - (Geriatric Critical: 819)
  - Critical: 3245
    - 144 pediatric, 819 geriatric
    - One missing age





# Overall Event Rates: ALL Patients

- Overall [\[see details\]](#)
  - ADE 1.56% (159/10224)
  - PADE 1.58%

## *Compare:*

*1997 study of 13,000 ED patients, retrospective chart review  
1.7% ADE Rate [included outpatient causes]  
(PADEs were excluded)*

*Hafner et al, Ann Emerg Med. 2002;39(3):258-267*







# Overall Event Rates

- Pediatric (5099)
  - ADE 0.47% --- PADE 1.12%
- Critical Care (3245)
  - ADE 3.45% --- PADE 2.00%
- Critical Care (2873)
  - ADE 2.61% --- PADE 1.98%

*All are higher than inpatient published rates*

*[see details]*





# Impact Evaluation: EPh vs no EPh Results

*EPh = Pharmacist Present*

*No EPh = Not Present*

- Characteristics of Groups:
  - Similar sex, race, payor status
  - Mean age 38 EPh vs. 34 no EPh)

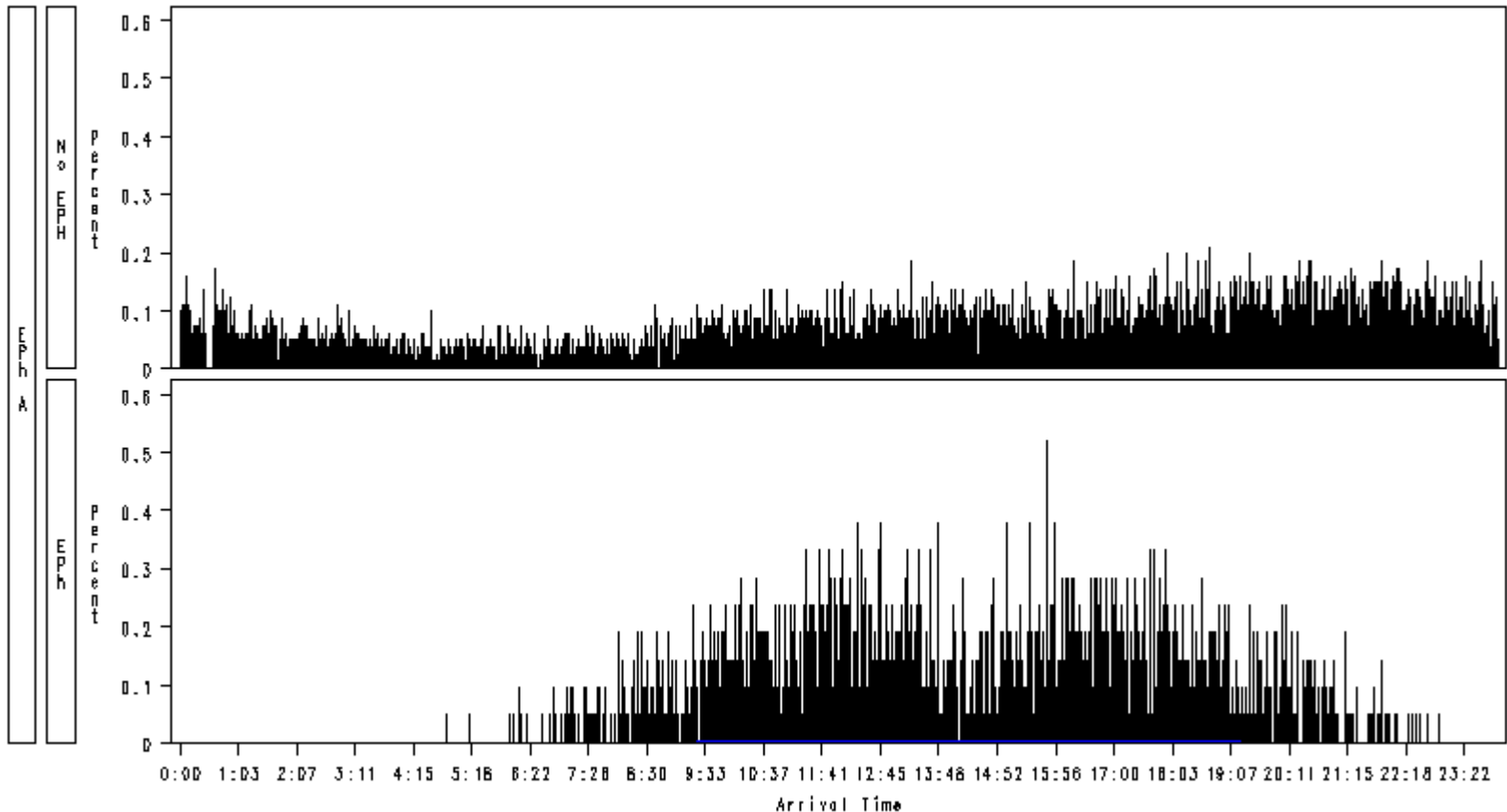




# Difference between groups: Time of arrival

ED Pharmacist as Safety Measure – Analysis by Visit (10/24/07)

Examining Arrival Time by EPH-A Grouping



CONFIDENTIAL STUDY RESULTS – DESTROY IF FOUND UNSECURED

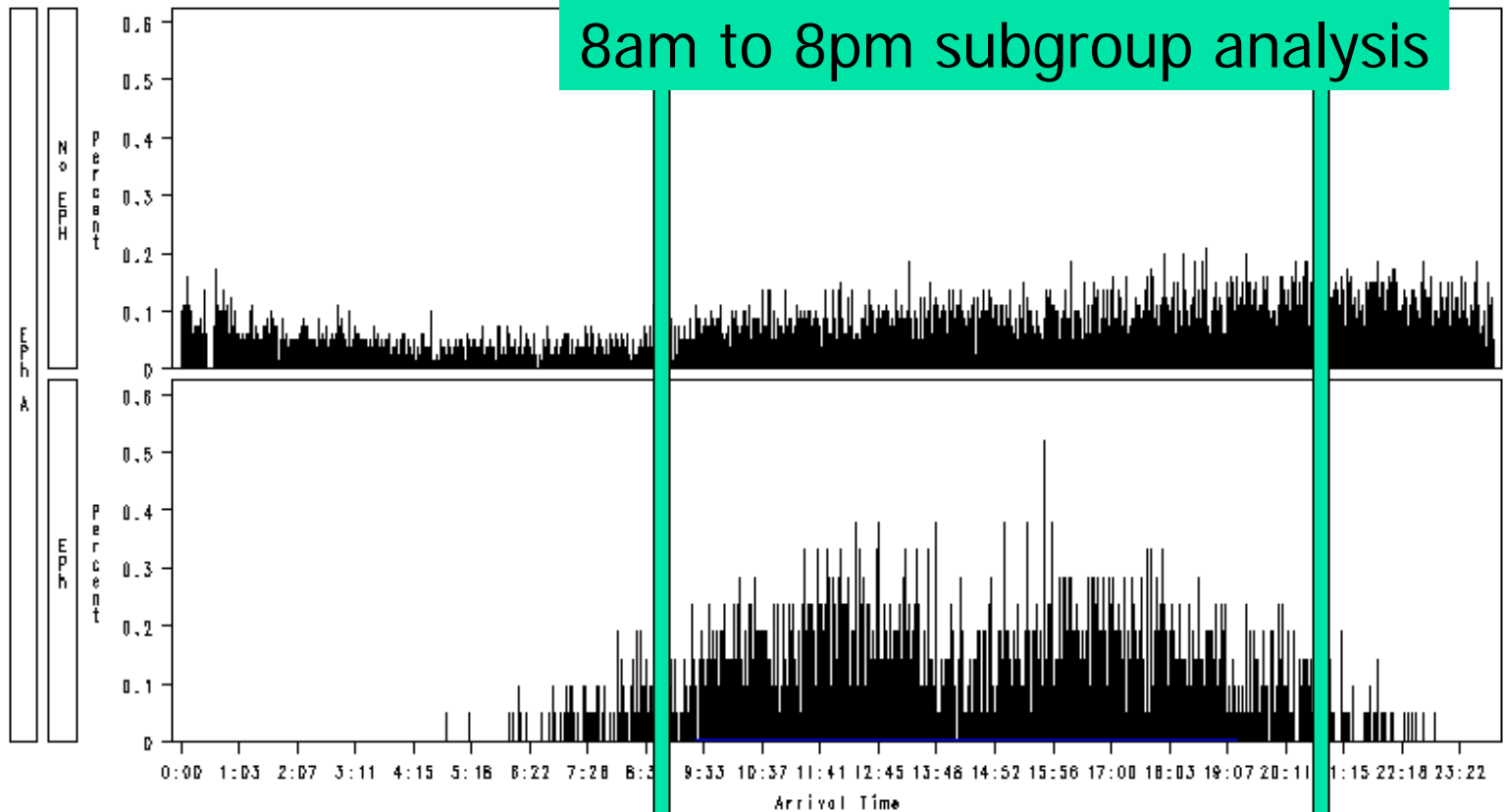




# Time of arrival

ED Pharmacist as Safety Measure – Analysis by Visit (10/24/07)

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CONFIDENTIAL STUDY RESULTS – DESTROY IF FOUND UNSECURED





# Pharmacist Present –vs– Pharmacist Not Present

Overall	EPH (2111)		No EPH (8113)		p <i>t-test</i>
	<u>Events</u>	<u>Rate</u>	<u>Events</u>	<u>Rate</u>	
<b>ADE Events</b>	<b>35</b>	<b>1.66%</b>	<b>124</b>	<b>1.53%</b>	<b>0.699</b>
ADE - Preventable	21	0.99%	76	0.94%	0.821
ADE - Non-Preventable	14	0.66%	48	0.59%	0.730
<b>PADE Events</b>	<b>46</b>	<b>2.18%</b>	<b>116</b>	<b>1.43%</b>	<b>0.036</b>
PADE - Non-Intercepted	39	1.85%	89	1.10%	<b>0.021</b>
PADE - Intercepted	7	0.33%	27	0.33%	0.993
<b>Medication Errors</b>	<b>21</b>	<b>0.99%</b>	<b>69</b>	<b>0.85%</b>	<b>0.548</b>

Balanced Coverage (8a-8p)	EPH (1922)		No EPH (4447)		p <i>t-test</i>
	<u>Events</u>	<u>Rate</u>	<u>Events</u>	<u>Rate</u>	
<b>ADE Events</b>	<b>30</b>	<b>1.56%</b>	<b>62</b>	<b>1.39%</b>	<b>0.646</b>
ADE - Preventable	18	0.94%	38	0.85%	0.772
ADE - Non-Preventable	12	0.62%	24	0.54%	0.704
<b>PADE Events</b>	<b>43</b>	<b>2.24%</b>	<b>58</b>	<b>1.30%</b>	<b>0.018</b>
PADE - Non-Intercepted	36	1.87%	45	1.01%	<b>0.016</b>
PADE - Intercepted	7	0.36%	13	0.29%	0.652
<b>Medication Errors</b>	<b>16</b>	<b>0.83%</b>	<b>33</b>	<b>0.74%</b>	<b>0.710</b>





# Pharmacist Present –vs– Pharmacist Not Present

Pediatric	EPH (992)		No EPH (4107)		p <i>t-test</i>
	<i>Events</i>	<i>Rate</i>	<i>Events</i>	<i>Rate</i>	
<b>ADE Events</b>	<b>5</b>	<b>0.50%</b>	<b>19</b>	<b>0.46%</b>	<b>0.864</b>
ADE - Preventable	1	0.10%	7	0.17%	0.561
ADE - Non-Preventable	4	0.40%	12	0.29%	0.611
<b>PADE Events</b>	<b>16</b>	<b>1.61%</b>	<b>41</b>	<b>1.00%</b>	<b>0.159</b>
PADE - Non-Intercepted	12	1.21%	32	0.78%	0.253
PADE - Intercepted	4	0.40%	9	0.22%	0.396
<b>Medication Errors</b>	<b>7</b>	<b>0.71%</b>	<b>18</b>	<b>0.44%</b>	<b>0.349</b>

Geriatric	EPH (691)		No EPH (2182)		p <i>t-test</i>
	<i>Events</i>	<i>Rate</i>	<i>Events</i>	<i>Rate</i>	
<b>ADE Events</b>	<b>18</b>	<b>2.60%</b>	<b>57</b>	<b>2.61%</b>	<b>0.992</b>
ADE - Preventable	14	2.03%	36	1.65%	0.573
ADE - Non-Preventable	4	0.58%	21	0.96%	0.282
<b>PADE Events</b>	<b>19</b>	<b>2.75%</b>	<b>38</b>	<b>1.74%</b>	<b>0.164</b>
PADE - Non-Intercepted	16	2.32%	33	1.51%	0.230
PADE - Intercepted	3	0.43%	5	0.23%	0.449
<b>Medication Errors</b>	<b>9</b>	<b>1.30%</b>	<b>28</b>	<b>1.28%</b>	<b>0.970</b>





# Pharmacist Present –vs– Pharmacist Not Present

Critical	EPH (660)		No EPH (2585)		p <i>t-test</i>
	<u>Events</u>	<u>Rate</u>	<u>Events</u>	<u>Rate</u>	
<b>ADE Events</b>	<b>29</b>	<b>4.39%</b>	<b>83</b>	<b>3.21%</b>	<b>0.211</b>
ADE - Preventable	17	2.58%	61	2.36%	0.776
ADE - Non-Preventable	12	1.82%	22	0.85%	0.102
<b>PADE Events</b>	<b>17</b>	<b>2.58%</b>	<b>48</b>	<b>1.86%</b>	<b>0.318</b>
PADE - Non-Intercepted	15	2.27%	32	1.24%	0.119
PADE - Intercepted	2	0.30%	16	0.62%	0.241
<b>Medication Errors</b>	<b>15</b>	<b>2.27%</b>	<b>35</b>	<b>1.35%</b>	<b>0.143</b>





# Results: Quality Measures

- Trend towards improvement, not statistically significant:
  - AMI time to cath lab
  - Contraindicated antibiotic administration
  - Time to OR
  - Time to first antibiotics in C.A. Pneumonia
  - Time to first analgesic in fracture
- Limitation: Study powered for ADEs







# Lessons Learned & Limitations

- One Emergency Department
- Contamination between 2 groups
  - Staff memory/education
  - Patients who's stay extends between 2 groups
  - Patients in "EPh present" group never interacted
  - Proactive medication selection
    - Conners and Hays. Ann Emerg Med. 2007 Oct;50(4):414-8
- EPh- increase ADEs awareness/charting?
- Underpowered for quality measures
  - Baseline ADE rate too low to detect changes?





# Bottom Line

- Pharmacists have been shown to improve quality and safety
  - Shown in other areas of hospital
- Staff perceive this in ED as well
  - ALL of the staff in an EPh ED agree
  - More EDs are implementing
- More research is necessary before conclusions can be drawn





# What's next?

- Future Research
  - Further Evaluation of the EPh database
  - Evaluation in smaller, non-academic EDs
  - Head-to-head: central screening vs. EPh
  - The use of telemedicine: Remote EPh?
  - Study effect and consequences of 100% order screening





# Final Quote

" I will never forget being in the scanner with an intubated pediatric trauma, running around trying to keep the patient properly sedated and cared for when Dan Hays walks into the scanner with an infusion pump on a portable IV pole. 2 channels were attached, both programmed with my sedation meds, meds hung, tubing primed, and all I had to do was hook it up to the patient and press "Start." No med calculations, no worries about properly diluting, no worries about compatibilities, no worries at all! That is a feeling that I am sure many nurses have felt when Dan was on their shift. Thanks Dan for all that you do, and thanks for making my job (especially that day) so much more enjoyable!"

*- Kathryn Augustino, RN, URMC Pediatric Emergency Department*





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[www.MedicalHumanFactors.com](http://www.MedicalHumanFactors.com)

[www.EmergencyPharmacist.org](http://www.EmergencyPharmacist.org)





# Appendices: Supplemental Slides





# Definitions

[\[return\]](#)

## ■ Adverse Drug Event (ADE)

- A preventable or non-preventable injury resulting from medical intervention related to a drug.

*Bates, Cullen, Laird et al. JAMA. 1995;274(1)*

## ■ Potential ADE (PADE)

- An incident that could have but didn't cause injury due to intervention, chance, or special circumstances

## ■ Problem Drug Order

- drug order which would have minimal potential for injury if carried out





# 10 Most Commonly Given Medication Doses (n=21,378)

Medication	count	% of total
Morphine	2386	11.2%
Albuterol	1554	7.3%
Ibuprofen	1454	6.8%
Propofol	806	3.8%
Midazolam	757	3.5%
Acetaminophen	730	3.4%
Tetanus diphtheria vaccine	688	3.2%
Fentanyl	687	3.2%
Hydromorphone	678	3.2%
Nitroglycerin	588	2.8%







# Most common medications with events

[\[return\]](#)

ADE Medication	% of ADEs	PADE Medication	% of PADEs
Morphine	16.9%	Hydromorphone	8.1%
Propofol	11.5%	Acetaminophen	7.4%
Midazolam	7.7%	Morphine	5.2%
Hydromorphone	7.7%	Phenytoin	5.2%
Nitroglycerin	7.7%	Promethazine	5.2%
Phenytoin	4.6%	Cefazolin	4.4%
Fentanyl	4.6%	Fentanyl	3.7%
Metroprolol	3.8%	Aspirin	3.7%
Pip/Tazo	3.8%	Ibuprofen	3.7%
Lorazepam	3.8%	Hydrocodone/APAP	3.0%
Hydrocodone/APAP	2.3%	Prochlorperazine	3.0%
Ciprofloxacin	2.3%	Labetalol	3.0%





# Overall Event Rates: ALL Patients [\[return\]](#)

<u>Overall</u>	<b>Total</b>		
	<u>Events</u>	<u>Visits</u>	<u>Rate</u>
<b>ADE Events</b>	<b>159</b>	<b>10224</b>	<b>1.56%</b>
ADE - Preventable	97	10224	0.95%
ADE - Non-Preventable	62	10224	0.61%
<b>PADE Events</b>	<b>162</b>	<b>10224</b>	<b>1.58%</b>
PADE - Non-Intercepted	128	10224	1.25%
PADE - Intercepted	34	10224	0.33%
<b>Medication Errors</b>	<b>90</b>	<b>10224</b>	<b>0.88%</b>

### ***Compare:***

*1997 study of 13,000 ED patients, retrospective chart review*

*1.7% ADE Rate [included outpatient causes]*

*(PADEs were excluded)*

*Hafner et al, Ann Emerg Med. 2002;39(3):258-267*





# Overall Event Rates: Pediatric Patients

<u>Pediatric</u>	<b>Total</b>		
	<u>Events</u>	<u>Visits</u>	<u>Rate</u>
<b>ADE Events</b>	<b>24</b>	<b>5099</b>	<b>0.47%</b>
ADE - Preventable	8	5099	0.16%
ADE - Non-Preventable	16	5099	0.31%
<b>PADE Events</b>	<b>57</b>	<b>5099</b>	<b>1.12%</b>
PADE - Non-Intercepted	44	5099	0.86%
PADE - Intercepted	13	5099	0.25%
<b>Medication Errors</b>	<b>25</b>	<b>5099</b>	<b>0.49%</b>

***Compare:***

Of 10,778 medication orders for inpatient pediatrics:

0.24% ADEs

1.1% PADEs

*Kaushal et al, JAMA. 2001; 285(16):2114-2120*





# Overall Event Rates: Critical Care ED Patients

<u><i>Critical</i></u>	<b>Total</b>		
	<u><i>Events</i></u>	<u><i>Visits</i></u>	<u><i>Rate</i></u>
<b>ADE Events</b>	<b>112</b>	<b>3245</b>	<b>3.45%</b>
ADE - Preventable	78	3245	2.40%
ADE - Non-Preventable	34	3245	1.05%
<b>PADE Events</b>	<b>65</b>	<b>3245</b>	<b>2.00%</b>
PADE - Non-Intercepted	47	3245	1.45%
PADE - Intercepted	18	3245	0.55%
<b>Medication Errors</b>	<b>50</b>	<b>3245</b>	<b>1.54%</b>

***Compare:***

ICU Inpatients PADE Rate (per patient day)

1.04% before pharmacist

0.35% after pharmacist

*Leape et al, JAMA. 1999;282(3):267-270*





# Overall Event Rates: Geriatric Patients [\[return\]](#)

<u>Geriatric</u>	<b>Total</b>		
	<u>Events</u>	<u>Visits</u>	<u>Rate</u>
<b>ADE Events</b>	<b>75</b>	<b>2873</b>	<b>2.61%</b>
ADE - Preventable	50	2873	1.74%
ADE - Non-Preventable	25	2873	0.87%
<b>PADE Events</b>	<b>57</b>	<b>2873</b>	<b>1.98%</b>
PADE - Non-Intercepted	49	2873	1.71%
PADE - Intercepted	8	2873	0.28%
<b>Medication Errors</b>	<b>37</b>	<b>2873</b>	<b>1.29%</b>

**Compare:** HMPS (Leape 1991): Drug related adverse event rates  
 Rate per 100 discharges, by age, for entire hospital  
 Of 71 Adverse Events (not just ADEs) 70.4% were deemed "due to negligence."

Age	0-15	16-44	45-64	>65
ADE Rate	0.24%	0.39%	1.12%	1.15%

