Results of the Emergency Pharmacist Outcomes Study

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Objectives

1. Briefly review pre-existing evidence supporting an emergency pharmacist role.

2. Report findings from the Emergency Pharmacist Research Studies.

Previous literature

- **Inpatient Pharmacists reduce adverse drug event rates**
  - 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
  - Nurses, physicians
  - Physical presence
  - Portable phones
- Critical patients, Traumas, Resuscitations
- Order screening- as able, high yield
- Education- patients, nurses, physicians
  - Very well received among providers
- Key Difference:

The MDs & RNs come to the Pharmacist

Study Objectives

- Add second EPh position (2005)
- Optimize role for patient safety (2005)
- Study outcomes: P/ADE/Qual (2005-7)
- Study staff perceptions (2006)
- Study EM residency program use (2007)
- Study barriers to implementation (2007)
- Develop tools for other hospitals (2005-7)

Optimized Role Study

- **Objective**
  - Optimize Role *for patient safety*
- **Methods**
  - Qualitative: interviews (purposive sampling)
    - Emergency physicians, residents, nurses, inpatient providers, pharmacists, patients
    - How can we maximize the patient safety role...
    - Field notes transcribed, coded, sorted
    - Analysis for emerging themes
  - Redundancy → 43 Interviews

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 critically ill (traumas, codes)
- Focus coverage on peak volume periods
- Minimize administrative responsibility
  - Committees, etc

Survey Study: Roles in other programs

- **EM (MD) Residency Programs:**
  - 74% of 135 programs responded
  - 30% had some pharmacy service available in ED
    - Of these, average 8 hours/day
    - 6% had 24/7 coverage
  - Compare to 14% previous data
    - Thomasset 2005

Szczesiul JM, Hildebrand JM, Clark L, Hays DP, Kolstee KE, Shah MN, Fairbanks RJ Use of Clinical Pharmacists in Academic EDs is Limited (abstract). <u>Academic Emergency Medicine</u>, May 2007; 14(5).

EM Residency Survey

- Of those with ED pharmacy services:
  - 49% provide drug or toxicology information
  - 33% screen for drug interactions
  - 30% advise on cost effectiveness
  - 29% dispense medications
  - 19% perform patient counseling
- Of programs performing med rec (51%):
  - Only 12% use pharmacist

ED Staff Value the Clinical Pharmacist

- **Survey: Referral Center ED (93k)**
- **92 Staff Randomly selected**
  - 82% response rate (33 MD, 42 RN)
  - Mean 7 years experience in ED
  - 41% worked at least part in peds
- **93% consulted EPh in recent shift**
  - 40% "at least once per shift"

ED Staff Value the Clinical Pharmacist

Do we need a dedicated, physically present emergency pharmacist??

- "being available for a consult" was #1 choice for "most important part of role"
  - "I make more use of a pharmacist when they are located in the ED as opposed to when I have to call the pharmacy"
    - 100% of physicians "agree"
    - 88% of nurses "agree" (only 2% disagree)

ED Staff Value the Clinical Pharmacist

- 96%- EPh is integral part of the team
- 73%- Value EPh order screening
- 85%- EPh should check all high risk meds
- **99%- EPh improves quality of care**
  - **100% of Physicians "agree"**
  - 1 nurse answered "neutral" (no negatives)

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.

EPh Time-Motion Study

Methods

- Summer 2007

- Medical students shadowed EPh's

- Standard time-motion methods
  - Start and end time for each task
  - Nature of task
  - Details of communication (who, what)

EPh Time-Motion Study

Results

- Rounding pattern noted

- EPh highly utilized (sought after)

- Communication: 45% tasks, 22% Time

Joint Commission Patient Safety Goal #2:
Improve the effectiveness of communication among caregivers

Time-Motion Study: What does the EPh Do?

Activity (total n=1302)	# of Events	% of total # events	% within subgroup	% of total time	Total min
General Tasks					
Order Screening	19	1%	3%	1%	23
Screening Medication Arrivals	22	2%	3%	1%	22
Chart review	24	2%	3%	1%	50
Researching Information	32	2%	5%	3%	89
Trauma/Code	48	4%	7%	20%	726
Email	70	5%	10%	5%	180
Preparing drug/med	77	6%	11%	4%	127
Medication Management	83	6%	12%	5%	183
Other	94	7%	13%	8%	295
Rounding	145	11%	21%	21%	757

Time-Motion Study: Who does the EPh talk to?

Activity (total n=1302)	# of Events	% of total # events	% within group	% of total time	Total min
Communication Tasks					
Speaking with patient	3	0%	1%	0%	2
Speaking with Pharmacist	41	3%	7%	3%	102
Other	81	6%	14%	7%	237
Speaking with nurse	183	14%	31%	3%	112
Speaking with provider (physicians, PA, NP)	280	22%	48%	10%	345

Time-Motion Study: What questions to EPh?

Activity	# of Events	% within subgroup	Total minutes	% of time
Drug/med compatibility	12	2%	11	1%
Side effects	19	3%	22	3%
Discussion pertaining to research	24	4%	55	7%
Question about mode of administration	26	4%	27	3%
Drug/med availability	56	9%	38	5%
Education/teaching	60	10%	276	33%
Drug/med choice	87	14%	109	13%
Dosage question	91	14%	90	11%
Other	256	41%	208	25%
subtotals	**631**	**100%**	**837**	**100%**

Impact Evaluation Study

- Hypothesis: EPh improves medication safety and quality of care
- Study Design:
  - Prospective enrollment
  - Random selection for chart review
    - 85% of all critically ill
    - 20% of all pediatric (<19yo)
    - 25% of all geriatric (>64yo)
  - 2 groups: EPh absent vs. EPh Present

Definitions

- ## 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

Impact Evaluation Study

- **Outcome Measures**
  - ADE, PADE
  - Quality measures: list developed
    - Specific to Emergency Medicine
    - Literature review & expert consensus
- **Methods**
  - HMPS methods (thanks to 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 Study

- Limitations
  - One Emergency Department
  - Contamination between 2 groups
    - Staff memory/education
    - Patients who's stay extends between 2 groups
  - Underpowered for quality measures
    - Baseline ADE rate too low to detect changes?

Impact Evaluation: Results

- **Results**
  - Total enrollment: 10,224
    - Pediatrics (<19) 5098
      - (Peds Critical: 144)
    - Geriatrics (>64): 2873
      - (Geriatric Critical: 819)
    - Critical: 3245
      - (2252 are not pediatric or geriatric)
      - One missing age

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

ADE Medication	% of ADEs	PADE Medication	% of PADEs
Morphine	16.9%	Hydromorphone	8.1%
Propofol	11.5%	Acetamininophen	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%
Ciprofloxicin	2.3%	Labetalol	3.0%

Overall Event Rates: ALL Patients

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

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

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

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

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

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

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

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%

Characteristics of Groups:

EPh vs no EPh

EPh = Pharmacist Present
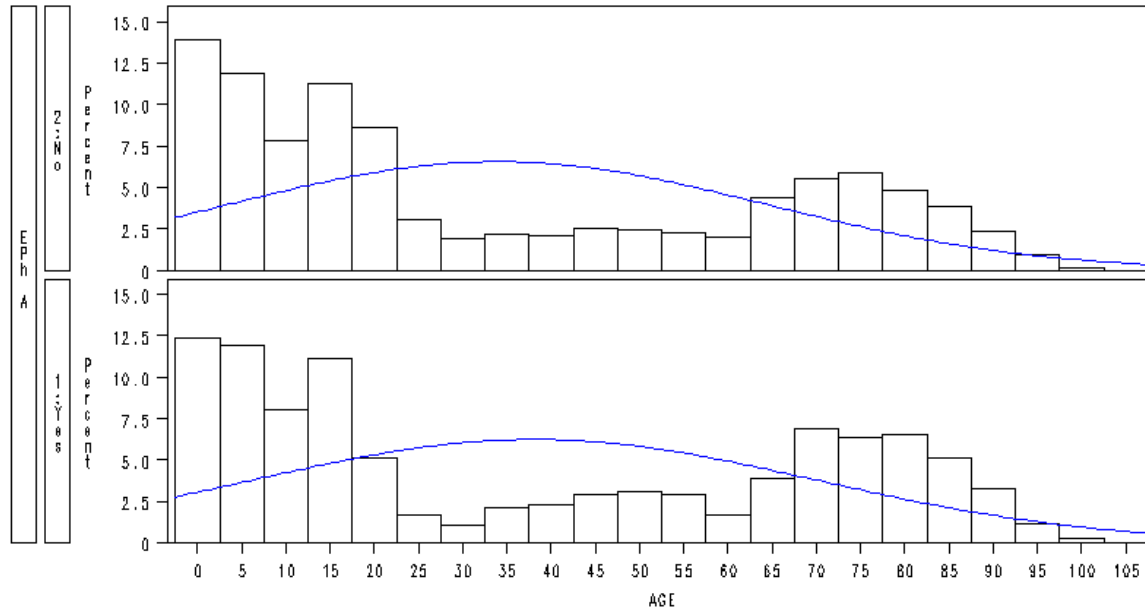*No EPh = Not Present*

Age is slightly different

Mean age (95%CI)

No EPh: 34 (33-35)

EPh: 38 (37-39)

ED Pharmacist as Safety Measure — Analysis by Visit (10/15/07)
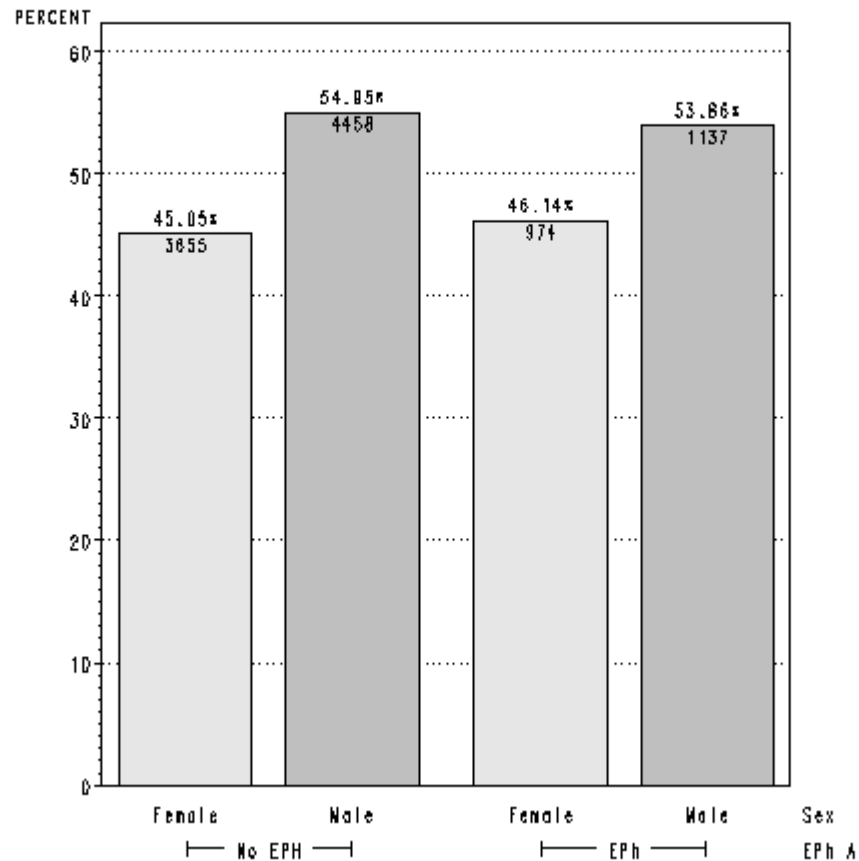
EPh A (Coverage for 1st 3hrs of Stay)

CONFIDENTIAL STUDY RESULTS — DESTROY IF FOUND UNSECURED

Sex is the same

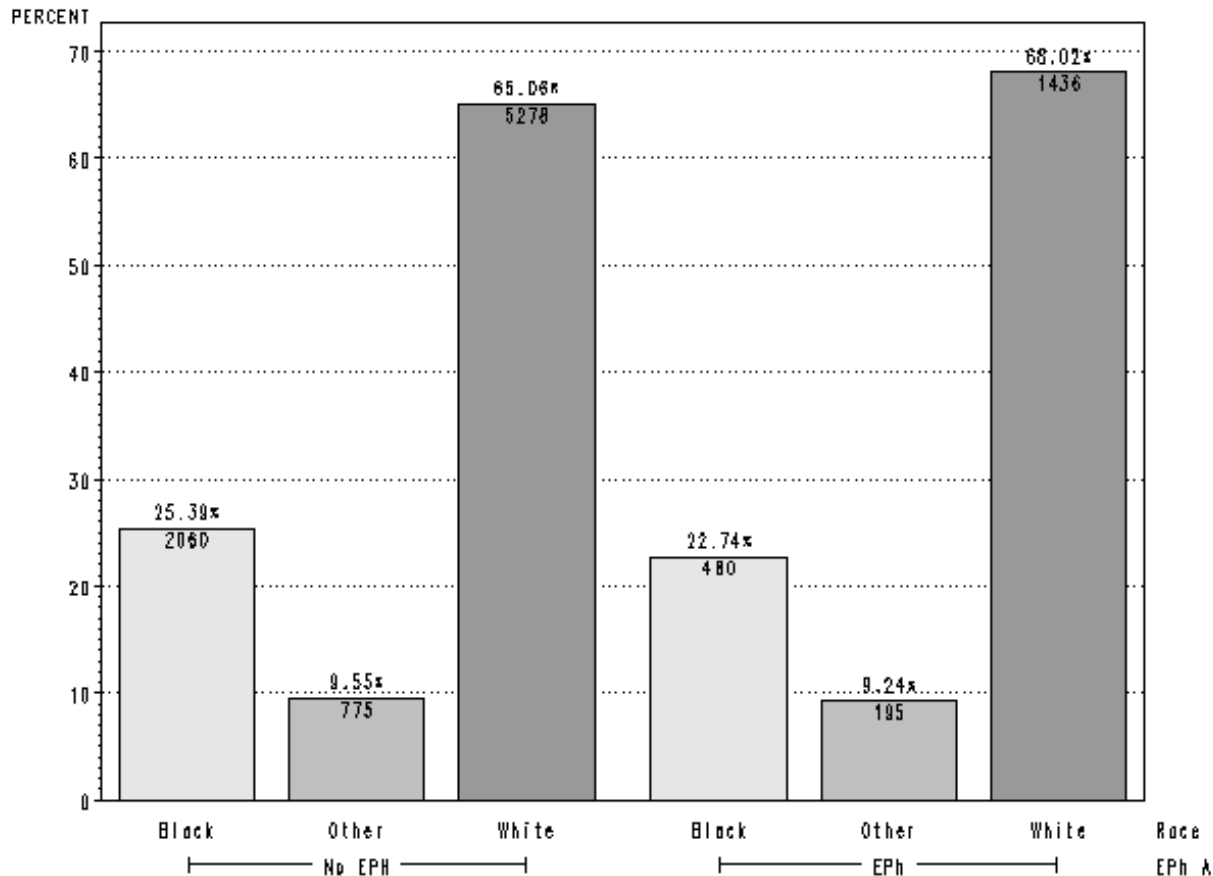
ED Pharmacist as Safety Measure — Analysis by Visit (10/24/07)

Race is Similar

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

Distribution of Race by EPH_A Status

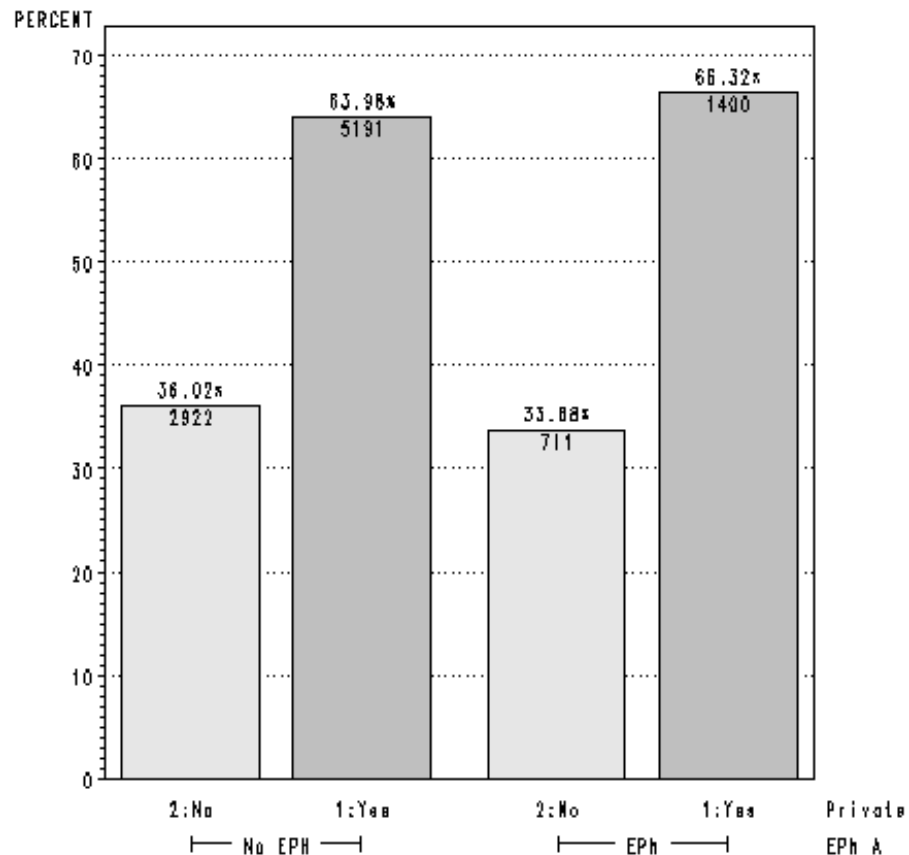CONFIDENTIAL STUDY RESULTS — DESTROY IF FOUND UNSECURED

Insurance Status is Similar

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

Distribution of Ins_Insured by EPH_A Status

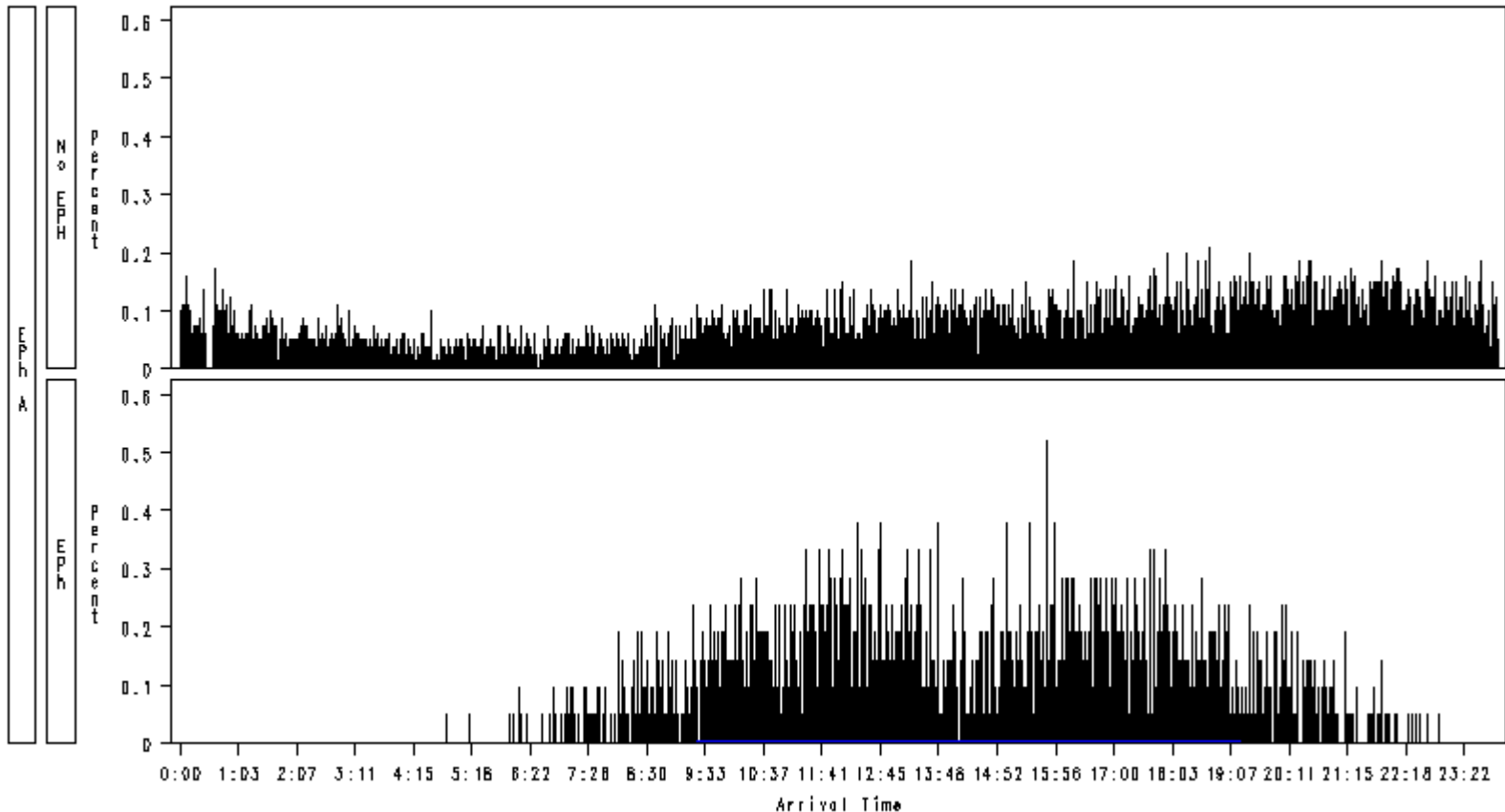# Difference between groups: Time of arrival

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

Examining Arrival Time by EPH_A Grouping

Time of arrival

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

Examining Arrival Time by EPH_A Grouping

8am to 8pm subgroup analysis

Arrival Time

CONFIDENTIAL STUDY RESULTS – DESTROY IF FOUND UNSECURED
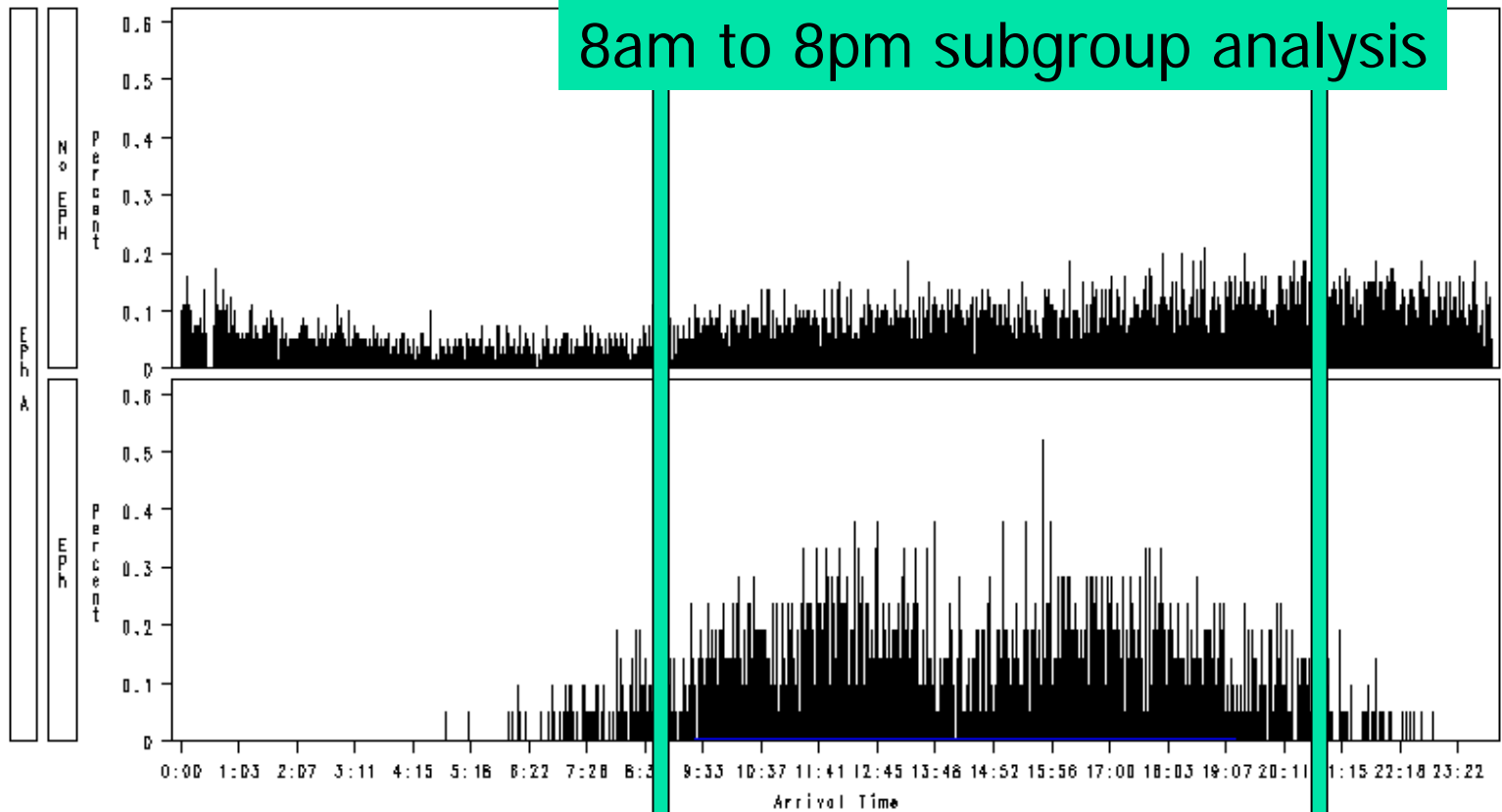
Quality Measures

Note– general issue with quality measures:

Study was powered for ADE/PADE measures and most quality measure analyses are underpowered.

Can be used to stimulate further focused study

Acute MI– EPh Saves Time

- **Time to Cath Lab: EPh saves 12 minutes**
  - Measured from time of first EKG
    - To avoid confound from delayed EKG
  - 152 patients, 11 Excluded
    - 2 straight to CABG
    - 6 1st EKG after Cath lab (EMS?)
    - 3 more than 4 hours (2 no EPh, 1 EPh)

EPh	Count	Range	Mean	P value
No EPh	94 (67%)	2-182	57	(t-test)
EPh Present	47 (33%)	5-115	45	<0.00001

PCN allergy violations

- **IF PCN allergy listed AND patient gets:**
  - Amox, Amox/Clav, cefazolin, Pip/Tazo, PCN
- **Trend towards improvement**, CIs overlap

Note: Two patients experienced ADEs when EPh not present. None when EPh was present

EPh	ADEs	Allergy Violations	Index ABX Orders	% Violations	95% CI
no EPh	2	32	681	4.70%	3.24-6.57
EPh Present	0	4	179	2.23%	0.61-5.62

Time to OR

- **All cases where arrival to OR < 1 hour were included**
  - assumed >1 hour to OR not emergency case
  - Trend towards improvement

excluding cases >1 hour to OR (minutes)				
EPh	**n**	**mean**	**SD**	**p**
No EPh	5	34	16	
EPh	46	21	9	0.156

all cases that went directly to the OR (min)				
EPh	**n**	**mean**	**SD**	**p**
No EPh	188	258	279	
EPh	46	224	197	0.340

Pneumonia- abx given?

- ED Diagnosis of PNA: 195 cases

1) More pts get at least one abx w/EPh

- Not Statistically Significant
- Moxi, azith, ceftriaxone, pip/tazo

Received any abx	total pna cases	EPH_A	% received abx	p value (chi sq)
104	151	no EPh	68.9%	
32	44	EPh	72.7%	0.62

Pneumonia- time to 1st abx

2) Trend: More pts get abx w/EPh
- Non significant (p=0.752)

EPH_A	1st ABX	n	% ok
No EPh (n=151)	No (>4hrs)	68	
	Yes (good)	83	55.0%
EPh (n=44)	No (>4hrs)	21	
	Yes (good)	23	52.3%

Pain Management in Fractures

Was there a difference in the time interval from arrival in the ED to delivery of the first opioid?

Trend towards faster with EPh, Non-significant

Time to first dose of Opioid in Fracture patients			
	# of cases	mean interval (min)	p (t-test)
with EPh	46	70	
no EPh	220	78	0.554

ACLS Algorithms

- **In Cardiac Arrest cases:**
  - C/C = CA –or– ED_Diag = CA
- **Did they always receive epi within a 6m frequency as is c/w ACLS?**
- **Non-significant difference**

EPH_A	Arrests	Epi Right	Epi >6m	freq right	p (chi sq)
No EPh	123	108	15	87.8%	
EPh	29	26	3	89.7%	0.781

Pharmacist Present –vs– Pharmacist Not Present

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

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

Pharmacist Present –vs– Pharmacist Not Present

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

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

Pharmacist Present –vs– Pharmacist Not Present

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

Why is the ADE/PADE effect not measured?

- Contamination
  - Presence of EPh continues to have a significant effect when EPh is not in the ED
  - Education:
    - Explain that pip/tazo isn't good with PCN allergy one day, resident remembers the next
    - Tell an attending that PO azithromycin has same efficacy as IV. Attending then teaches to residents, etc
  - Proactive medication selection
    - Conners and Hays. Ann Emerg Med. 2007 Oct;50(4):414-8

Why is the ADE/PADE effect not measured?

- **EPh may increase awareness of ADEs**
  - Ex) patient on propofol in trauma bay, all staff are with new trauma patient. EPh notes low BP, tells nurse who documents the BP and intervenes (thus picked up by study abstractors).
    - if no EPh, low BP not seen, so not noted in chart.
    - Time motion study supports EPh's presence in TB

Bottom Line

- We know EPh improves quality and safety
  - Shown in other areas of hospital
  - Quality measures reflect this in Ed
  - ALL of the staff in an EPh ED agree
  - More EDs are implementing
- Chart Review has limited ability to find ADE/PADE events

Helping new programs

- **Resources Available: Toolkit**
  - Convincing others of the need
    - List of References
    - Key manuscripts and abstracts
    - Summary PowerPoint presentations
  - Designing a new program
    - Job description
    - Role and responsibilities
    - Key manuscripts and abstracts

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?

Summary

- The need

- Optimized role

- The evidence

- Increasing participation

- Resources available

  - www.EmergencyPharmacist.org

---*QUESTIONS?*---

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www.EmergencyPharmacist.org