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Do Guidelines Make A Difference?

How Can You Tell?



Overview

- An increasingly important question
- Experience with a handheld, computer-mediated guideline implementation for children's asthma exacerbations
- Surprising findings
- Lessons learned



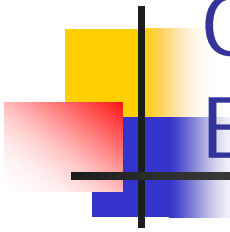
Guideline-based care has myriad positive effects

- 1993 - 55/59 studies showed improved care (Grimshaw and Russell, Lancet)
 - Patient-specific advice
 - Delivered at the point of care
- Subsequent ratification



Guidelines don't always work as expected--unanticipated side effects

- ATS guidelines for CAP led to 3x–10x higher antimicrobial costs without difference in patient outcomes (Gleason JAMA 1997)
- AHCPR back pain guidelines: increase use of Xrays by 238%- (Suarez-Almazor JAMA 1997)
- HIV care with alerts improved response to times for clinical events, but no change in admission rate, admissions for pneumocystis, survival (Safran Lancet 1995)



AAP's First E-B Guideline: Office Management of Asthma Exacerbations

- ↑ Physiologic measurements: PEFR & O₂ saturation
- ↑ Frequency & dosage of β_2 -agonists
- ↑ Use of systemic steroids
(Oxygen for moderate and severe exacerbations)



Objective

To evaluate effects on the *process* and *outcomes* of care brought about by a handheld, computer-based system that implements the AAP guideline on office management of asthma exacerbations



Primary Hypotheses

Use of the computer-based implementation will lead to **improved adherence** to the guidelines regarding:

- assessment of PEFR and oxygen saturation
- prescription of corticosteroid
- use of oxygen



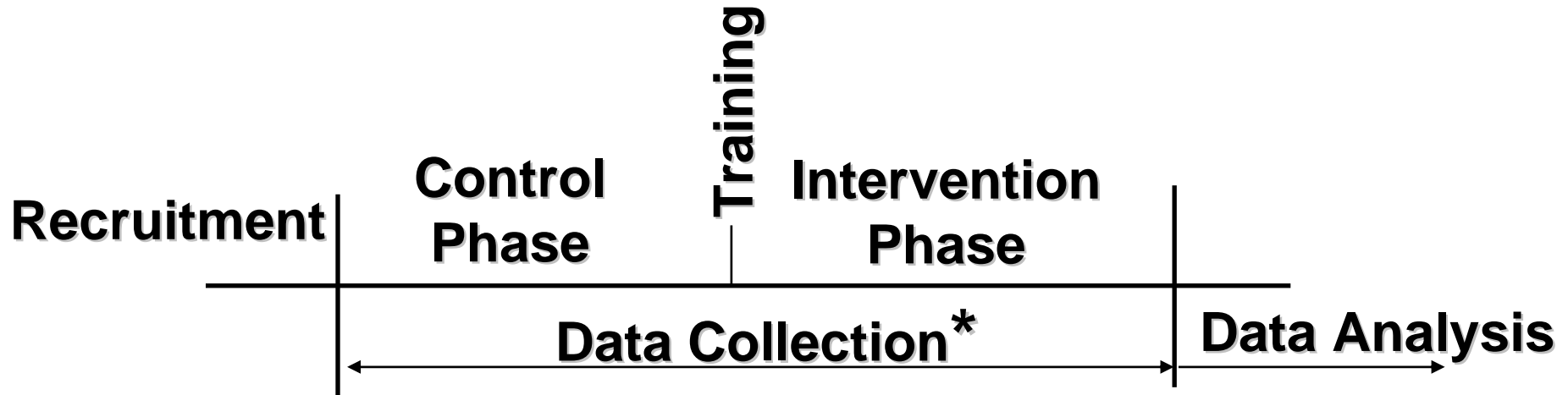
Secondary Hypotheses

Increased adherence to the guidelines will result in **improved patient outcomes** as measured by:

- missed school days
- missed caretaker work days
- immediate and delayed ED visits
- immediate and delayed hospitalizations



Prospective, Before & After Trial





Data Collection

- Severity of exacerbation (presentation and discharge)
- Procedures (e.g., PEFr, ox sat)
- Office treatments (e.g., nebulization)
- Medications
- Duration of visit
- Immediate disposition (home or ED/hospital)
- Fee



Randomly Selected Physician-Subjects

Connecticut pediatricians

- in active practice of primary care pediatrics
- within 20 mile radius of New Haven
- available equipment: O₂ and PEFR meter
- no academicians or subspecialists
- only one physician per practice



Patients

20 consecutive patients per physician

- age 5–18 years
- present to a non-hospital setting with an acute exacerbation of asthma

Intervention: AsthMonitor

Newton MessagePad

- Handheld -> use at point-of-care
- Pen-based -> more familiar

Custom software:

- Structured *documentation*
- *Recommendations*
- *Prescription-writing, calculation* of dosages and predicted PEFr



AsthMonitor II

Last Name **Kane**

First Name **Charles F.**

ID **1942**

Phone **555-1942**

◆ Age **12**

Wt. (kg) **40**

Ht. (cm) **100**

— Symptoms and Duration —

	None	<1d	1-3d	4-6d	1-2w	>2w
Cough	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Wheezing	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rapid Resp	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dyspnea	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fever	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vomiting	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Notes

+HX

PE

+Discharge



Notes

Patient was
shedding in the
snow when he
began to wheeze



Record



Names



Dates



Extras



Undo



Find



Assist

Charles F. Kane

PEFR	> 70% of predicted	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resp. Rate	30-50% above mean	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
O2Sat	96-100%	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Alertness	Normal	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dyspnea	Speaks phrases or partial sentences	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
Retraction	None to mild intercostal	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Color	Good	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
Chest Snds	End expiratory wheezing only	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
SubQ Air	None	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
P. prdxus	< 20mm Hg	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

Total
00:00

Continue

Next
00:00

 **Notes** **+HX** **+Discharge** 



Names



Dates



Extras



Undo







Find




Assist

Charles F. Kane

Condition: Moderate*

- Oxygen 6 L/min 
- Albuterol 
- Nebulizer **Select**
- MDI
- SubQ Epinephrine or Terbutaline 
- Steroids 

- Consider transfer to ER 
- Monitor patient

The albuterol treatment may be repeated every 20 minutes for up to 1 hour.

*Advice presumes that UNASSESSED signs/symptoms are mild or normal.

Record



Notes

+Hx

+Discharge



Names



Dates



Extras



Undo



Find



Assist

Charles F. Kane

555-1212

Age: **10** Ht: **60 in** Wt: **90 lb** Pred PEFr: **379**

Risk Factors: History of respiratory failure

History

Symptoms & Duration: Cough <1d and wheezing < 1 d

Attack status: Worsening

Precipitated by: Seasonal and weather change

Current medications: Albuterol (inhaler), cromolyn

Initial Evaluation **9/11/97** **11:30 AM**

PEFR: **210** 50-70% predicted

Resp Rate: **24** Normal to 30% > mean

Ox Sat: Not Assessed

Alertness: Normal

Dyspnea: Speaks complete sentences

Charles Kane

ID: 605443

Phone: 555-1212

9/29/97

Rx

Albuterol metered dose inhaler

2 puffs every 4 hrs prn cough or wheeze Refill 3 times

Prednisone Tablets 10 mg

Dispense 42 tablets. Take as directed

Richard N. Shiffman, MD

144 N. Main St.

Anytown, CT 06666

Implementation of Recommendations

*Measure PEFR
and oxygen
saturation:*
Prompts

Charles F. Kane

Condition: Moderate*

- Oxygen 6 L/min ⓘ
- Albuterol ⓘ
- Nebulizer
- MDI
- SubQ Epinephrine or Terbutaline ⓘ
- Steroids ⓘ

Select

- Consider transfer to ER ⓘ
- Monitor patient

The albuterol treatment may be repeated every 20 minutes for up to 1 hour.
*Advice presumes that UNASSESSED signs/symptoms are mild or normal.

Record [X]

[Notes] [+HX] [+Discharge] [X]

Charles F. Kane

PEFR	> 70% of predicted	● ○ ○
Resp. Rate	30-50% above mean	○ ● ○
O2Sat	96-100%	● ○ ○
Alertness	Normal	● ○ ○
Dyspnea	Speaks phrases or partial sentences	○ ● ○
Retraction	None to mild intercostal	● ○ ○
Color	Good	● ○ ○
Chest Snds	End expiratory wheezing only	● ○ ○
SubQ Air	None	● ○ ○
P. prdxus	< 20mm Hg	● ○ ○

Total 00:00 **Continue** **Next** 00:00

[Notes] [+HX] [+Discharge] [X]

*Increase appropriate use of
steroids and B₂ agonists:*

Dynamically generated
recommendations based on
documented findings

Results: Study Profile

Pediatrician listings within geographic boundary (N=237)

Random Selection

Ineligible (n=44), Declined (n= 8)

**Recruited Physicians
(n=11)**

Control Phase Dropouts (n=2)

Completed Control Phase by enrolling 10 patients (n=9)

Intervention Phase Activity - 74 patients enrolled

Adherence: Change in Mean Adherence Rates



P = .32

.007

.055

.14

Adherence: Frequency per Visit



x

t-test

P=0.001

P=0.017

P=0.026



Adherence: Oxygen Recommendations

	Used	Recommended
■ Control Phase	0	20
■ Intervention Phase	3	30



Effects: Immediate

- Visits lasted longer during Intervention phase
 - 56% > 30 minutes during Control
 - 85% > 30 minutes during Intervention
- Fees were higher during Intervention phase
 - \$103 Control
 - \$146 Intervention
- D/C Home: No difference
 - 98% Control
 - 99% Intervention

Outcomes: In First Week

	Control	Intervention	<i>P</i>
	%	%	
<hr/>			
Missed School	44	48	.76
(Avg Missed School Days)	1.29	1.04	NS
Missed Work	24	23	.92
(Avg Missed Work Days)	.56	.46	NS
Office Revisit	30	26	.61
ED visit	6	0	.11
Hospitalization	5	0	.18



Summary of Results

Use of AsthMonitor was associated with:

- Improved adherence
- Resistance to use of oxygen
- Prolonged visits
- Higher fees
- No improvement in measured intermediate term outcomes



Improved Adherence & Unimproved Outcomes

- Evidence-base
- Number of physicians was small
- Baseline adherence was high
- Unfamiliarity with device
- Secular trends



Conclusions

- Implementation of guideline recommendations with handheld computers can be effective in influencing physicians' behavior
- Physicians are selective about which recommendations they follow
- Improved guideline adherence may have unanticipated effects on outcomes





Firsts

- AAP's first evidence-based guideline
- First capable PDA
- First guideline retired by the AAP
- First and only PDA retired by Apple Computer
- First evaluation of health effects of CDSS for us



Additional lessons

- Process measurements may not tell the whole story
- Measurement of outcomes is difficult but important
- Hard-coding guideline recommendations for one-time use is wasteful



Exacerbations Were More Severe During the Intervention Phase

- Control: 22% moderate / severe
- Intervention: 40% moderate / severe

Chi square 8.27, $P = 0.013$



Effect of the Intervention

with Presenting Severity
Controlled as Covariate (ANCOVA)

	<i>F</i>	<i>df</i>	<i>P</i>
# PEFR	8.6	1,158	<0.01
# Ox Sat	8.5	1,159	<0.01
# Nebs	12.3	1,153	<0.001