Children’s Adherence to Asthma Self-management

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Child Asthma Statistics

- 6.8 million children (9%) have been diagnosed with asthma (CDC, 2007)
- 4 million children (6%) had an asthma attack in the previous 12 months (CDC, 2006)
- Asthma is the 3rd leading cause of hospitalization (CDC, 2006)
- Asthma is the leading cause of missed school days
  - 14.7 million absences due to asthma annually (CDC, 2006)
- Asthma can be life-threatening if not properly managed (ALA, 2005)
Figure 1. Percent of current asthma prevalence: United States, 2005

- Female: 8.8%
- Male: 6.4%
- Mexican: 5.0%
- Puerto Rican: 6.2%
- Total Hispanic: 17.0%
- Non-Hispanic black: 9.4%
- Non-Hispanic white: 7.6%
- Asian: 4.9%
- American Indian/Alaska native: 9.2%
- Black: 9.5%
- White: 7.4%

- 18 years and over: 7.2%
- 0-17 years: 8.9%
- Total: 7.7%

Sources:
- National Health Interview Survey, National Center for Health Statistics, CDC.
- Age adjusted to 2000 U.S. standard population.

http://www.cdc.gov/nchs/products/pubs/pubd/hestats/ashtma03-05/ashtma03-05.htm
Figure 2. Percent of asthma attack prevalence:
United States, 2005

- Female: 5.0%
- Male: 3.4%
- Mexican: 2.8%
- Puerto Rican: 10.0%
- Total Hispanic: 3.5%
- Non-Hispanic black: 4.4%
- Non-Hispanic white: 4.2%
- Asian: 3.1%
- American Indian/Alaska native: 5.8%
- Black: 4.6%
- White: 4.1%

18 years and over:
- Female: 3.9%
- Male: 5.2%

Total: 4.2%

1 Age adjusted to 2000 U.S. standard population.
SOURCE: National Health Interview Survey, National Center for Health Statistics, CDC.
Figure 7. Number of asthma deaths per 100,000 population: United States, 2003

- Female
- Male
- Mexican
- Puerto Rican
- Total Hispanic
- Non-Hispanic black
- Non-Hispanic white
- Asian
- American Indian/Alaska native
- Black
- White
- 18 years and over
- 0-17 years
- Total

Deaths per 100,000 population

1 Age adjusted to 2000 U.S. standard population.

SOURCE: Mortality Component of the National Vital Statistics System, National Center for Health Statistics, CDC.
Race and Asthma

- Poverty and environmental exposure place nonwhites at greater risk for asthma
- Higher prevalence and higher mortality rate among minorities
5,000 Asthma Deaths/Year

Asthma Severity

% of Patient Deaths

0 5 10 15 20 25 30 35 40

Severe 36%  Moderate 31%  Mild 33%

## Reasons for Increased Asthma Morbidity

- Inadequate asthma management and education
- Non-adherence to treatment
- Limited access to care, particularly for those most at risk
- Increased air pollution
- More time spent indoors
- Increased virulence of viruses coupled with increased exposure
Educational Methods

- Health care provider based:
  - verbal instruction: triggers, signs, daily self-monitoring, meds
  - written guidelines & treatment plan (based on peak flow zones), MDI use, emergency treatment (Action Plan)
  - frequent review: avoid bad habits and confusion
  - adherence strategies
Nonadherence to Recommended Treatment

- Fewer than half of patients adhere to recommended asthma regimen (Burkhart & Dunbar-Jacob, 2002)

- Estimates of costs of poor adherence to pharmacological regimen are as high as $100 billion annually

- Over half of hospital admissions, drug related visits to E.D., and asthma E.D. visits have been found to be related to nonadherence
What Does Adherence Include?

- Filling the prescription
- Taking the proper dosage of medication at the correct intervals (2/3 underuse ICS)
- Using the medication properly (e.g., spacer)
- Taking the full course of medication
- Adhering to measures to prevent and control asthma symptoms (e.g., avoidance of triggers; PEFR monitoring)
Why Don’t Patients Adhere?

**Forgetting**
- use reminders, rewards, reinforcement

**Complicated regimens**
- consider frequency and ease of regimen; tailoring

**Adverse effects** (real or imagined)
- e.g., steroid phobia; s/e of meds
- dispell myths

**Poor health care provider communication**
- e.g., regarding precise regimen

**Psychosocial factors** (e.g., family dysfunction)
Whose responsibility is adherence to recommended asthma treatment?
Adherence Strategies

- Ask about adherence…. anticipate nonadherence
  - What problems do you expect to have with the treatment?
  - What questions/concerns do you have about the treatment?

- Specific Adherence Strategies:
  - Patient Education + Behavioral Skills:
    - Self-monitoring
    - Tailoring
    - Simplify the regimen
    - Provide reminders
    - Enhance coping
    - Behavioral contracting

- Social support
- Patient-provider interaction
Nonadherence to Recommended Treatment

- About half of patients adhere to recommended regimen
  

- PEF monitoring is recommended as part of asthma self-management for persistent asthma
  
  (NAEPP, 2007)
Design and Sample
(NIH-funded study)

- **Design**: Randomized, controlled, two-group clinical trial

- **Sample**: $N = 77$ children with persistent asthma (7-11 years of age)

- **Length of Study**: 16 weeks

## Children Included in Sample

**Inclusion Criteria**
- Take daily asthma medications or has daily asthma symptoms
- English speaking
- Diagnosed with asthma at least 6 months
- Parent or guardian willing to participate

**Exclusion Criteria**
- Sibling of participant
- Other chronic conditions
- Current use of PEF meter on a daily basis
Sample

• 77 children, ages 7-11 years, were recruited from pediatric practices in Kentucky
• Children were predominantly:
  • Male (58%)
  • Caucasian (79%)
  • From two-parent families (73%)
• Mean age was 9 years ($SD = 1.4$)
• 52% ($n = 40$) reported their asthma symptoms were under good control
• 12% ($n = 9$) previous PFM use
Adherence Measures

- Electronic PEF monitor
- Self-report -- Asthma Diary
Adherence Measure

- AccuTrax Personal Diary Spirometer
  (PDS Instrumentation, Louisville, CO)

- Computerized hand-held monitor which internally records the date, time, and PEF value
**NUMBER OF ATTACKS**

<table>
<thead>
<tr>
<th># of daytime asthma attacks</th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td># of times awakened by</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>asthma last night</td>
<td></td>
<td></td>
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</tbody>
</table>

**PEFR:** (before asthma meds are taken)

<table>
<thead>
<tr>
<th>Morning (AM)</th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Evening (4 PM or after)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**ASTHMA MEDS:**

1.  

2.  

3.  

4.  

5.
Purpose

Evaluate the effect of an intervention combining asthma education and a behavioral strategy to promote adherence to daily peak flow monitoring for 7- through 11-year-old children with persistent asthma.
Theoretical Framework

### Procedure

- Both groups received instruction on PFM

- Only the intervention group received
  - NAEPP –recommended asthma education
  - Contingency Management (behavioral reinforcement)
    - Self-monitoring
    - Contingency contract
    - Reinforcing (includes rewards)
    - Tailoring (PFM and lifestyle)
    - Cueing (Post-it reminders)
## Procedure

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Intervention</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teach PFM</td>
<td>Teach PFM</td>
</tr>
</tbody>
</table>
| 4     | *** Randomized ***
Action Plan
* NAEPP asthma education
  • Self–monitoring | *** Randomized ***
  [Action Plan by telephone] |
| 6     | * Review asthma education
  • Contingency contract
  • Reinforcing
  • Tailoring
  • Cueing |                                                  |
| 8     | * Review asthma education
Download PEF data | Download PEF data                                  |
| 16    | * Review asthma education
Download PEF data | Download PEF data
Provide asthma education, if desired |
ACTION PLAN: Symptoms vs. PFM

- **Green Zone** (80 - 100% of personal best) Signals good control. Take usual daily long-term-control medicines.

- **Yellow Zone** (50 - 79% of personal best) Signals caution: asthma is getting worse. Add quick-relief medicines. Might need to increase other asthma medicines.

- **Red Zone** (below 50% of personal best) Signals medical alert! Add or increase quick-relief medicines; CALL HC Provider NOW.
Parent Supervision
Critical Part of the Intervention
Results

• At the end of baseline (Week 4), there was no difference in adherence to twice a day PEF monitoring between the intervention and control groups ($Mdn = 43\%$).

• At Week 16 (post-implementation), intervention group adherence ($Mdn = 71\%$) for daily electronically monitored PEF was higher than that of the control group ($Mdn = 57\%; U = 3.8, p = .05$).
Results

**Figure.** Median adherence over time, by group ($N = 77$).
Conclusions

- Intervention group children receiving the nurse-administered asthma education and contingency management protocol demonstrated higher adherence to PEF monitoring post-intervention compared with the control group children not receiving the intervention.

Clinical Implications

- The research was significant in the evaluation of effective interventions for promoting children’s adherence to recommended asthma self-management at home.

- Improvement in children’s adherence to recommended asthma self-management may be clinically significant in reducing asthma morbidity and mortality.
“I have **asthma**, but I don’t want to miss out.”
Results

- Among all participants, significant clinical findings included a decline from baseline to Week 16 in the incidence of at least one:
  - asthma episode ($p = .0002$)
  - physician or clinic visit ($p = .0002$)
  - missed school day ($p = .002$)
  - ED visit ($p = .03$)

- No difference in hospitalization
  [1 child (1%) had a hospitalization at baseline and 1 child (1%) at Week 16]
Incidence of at least one asthma episode in prior 2 months*

*\( p \)-value for \( \chi^2 \) test for Time factor = .0002;
16 weeks significantly lower than other time points.
Figure 2. Incidence of at least one asthma episode during Weeks 9-16, by level of adherence

*Note. For the comparison of adherence groups, $\chi^2 = 4.3; p = .04$
Percent of children with at least one physician/clinic visit, missed school day, and ED visit*

*p-values for Time factor in GEE models are .0002 (clinic visits), .002 (school), and .03 (ED visits)
Conclusions

- Closer self-monitoring of asthma symptoms with a PEF meter may have increased children’s awareness of their disease status leading to early intervention to avert asthma episodes that resulted in fewer missed school days and acute care visits for asthma.

Clinical Implications

- This study suggests that PFM in conjunction with a specific Asthma Action Plan results in better health outcomes than symptom management alone.

- Only 12% (n = 9) of the children reported PEF meter use prior to the study; none of the children were currently using a PEF meter on a regular basis when enrolled in the study.
# Results: Accuracy of Children’s Self-Reports \( (N = 42) \)

<table>
<thead>
<tr>
<th></th>
<th>Week 2</th>
<th>Week 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate PEF values</td>
<td>34%</td>
<td>24%</td>
</tr>
<tr>
<td>Phantom PEF values</td>
<td>54%</td>
<td>66%</td>
</tr>
<tr>
<td>Inflated PEF values</td>
<td>17%</td>
<td>29%</td>
</tr>
<tr>
<td>Deflated PEF values</td>
<td>12%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Parent-Child Partnership in Asthma Self-management
Pre- and Post-intervention assessment adherence to accurate MDI technique 

\( (N = 36) \)

Results

- 92% ($n = 33$) of the children used their MDI incorrectly (fair to poor) during the pre-test.

- Children made significant improvement in their MDI technique after receiving the intervention ($p < .0001$).

- Even after receiving instruction on MDI administration, 19% ($n = 7$) of the children still used their inhalers incorrectly.
Figure 1. Pre- and Post-intervention Assessment of Children’s MDI Administration Technique ($N = 36$).
Results

- The most common pre-intervention MDI technique mistakes were:
  - Failing to hold breath for 10 seconds (56%)
  - Not waiting 1 minute between inhalations (50%)
  - Inadequately shaking the medication (42%)
  - Not inhaling fully (42%)
  - Not using a spacer (22%)
Figure 2. Types of Errors in Pre- and Post-intervention MDI Administration Technique (N = 36).
Discussion

- Education greatly increased the number of children with good technique (8% before teaching vs. 81% after teaching)

- One out of every five children used their inhaler incorrectly despite education on proper technique

- Parents may not recognize that their child’s MDI technique is incorrect
  (Winkelstein et al., 2000)
## Implications for Practice & Research

- It is critical that clinicians reinforce accurate medication administration technique at every visit.

- New delivery devices require that clinicians learn new medication administration techniques:
  - MDI with HFA and breath-actuated
  - Dry powder inhalers
Conclusions

- Teaching should be reinforced at each health encounter since a single instruction session is not sufficient (Kamps, Brand, & Roorda, 2002)

- Even after education and training, 50% of patients with poor technique will return to their old technique or develop new errors with the passage of time (McFadden, 1995)
Conclusions

- The Practical Guide for the Diagnosis and Management of Asthma (NHLBI, 1998, p.25) recommends:
  - **Tell** the patient the steps and **give written** handouts
  - **Demonstrate** accurate technique
  - **Ask the patient to demonstrate** accurate technique
  - **Provide feedback** to patients about what they did right and what they need to improve
## Asthma Report Form

Open-ended questions on the Asthma Report Form are:

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Today ______ (date) I had trouble breathing while I was ________________</td>
<td></td>
</tr>
<tr>
<td>(What were you doing?)</td>
<td></td>
</tr>
<tr>
<td>These were the signs of asthma I had _____________ (How did you feel?)</td>
<td></td>
</tr>
<tr>
<td>To help my asthma get better I ___________________ (What did you do to help your breathing?)</td>
<td></td>
</tr>
</tbody>
</table>
Findings

Of the 42 children completing the study:

- 71% (n = 30) experienced at least one asthma episode during the time period
- 206 asthma episodes were reported in the Asthma Diary
- Of the 30 children with episodes:
  - 73% (n = 22) reported < 5 episodes
  - 17% (n = 5) reported > 15 episodes
Children’s responses to the question: “What were you doing?” (n = 179 responses)

- Physical Activity
- Sedentary Activity
- Sleeping
- Exposure to Triggers
- Noted a Decrease in PEFR
- Emotional Situation

Children's Activities
Children’s responses to the question: “How did you feel?” \((n = 194\) responses)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>(n)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough</td>
<td>47</td>
<td>24</td>
</tr>
<tr>
<td>Cough &amp; SOB</td>
<td>41</td>
<td>21</td>
</tr>
<tr>
<td>Cough &amp; tightness</td>
<td>26</td>
<td>13</td>
</tr>
<tr>
<td>Cough, SOB, wheeze</td>
<td>17</td>
<td>9</td>
</tr>
<tr>
<td>Cough &amp; wheeze</td>
<td>15</td>
<td>8</td>
</tr>
<tr>
<td>Other combinations</td>
<td>40</td>
<td>21</td>
</tr>
<tr>
<td>Symptoms of URI</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>
Children’s responses to the question: “What did you do to help your breathing?”

(n = 198 responses)
Conclusions

- Physical activity often precipitates asthma episodes

- Cough is an early sign of an asthma episode

- Children use inhaled bronchodilators to alleviate their asthma symptoms

SUMMARY

- Asthma is a significant public health problem

- In every situation in which patients are required to administer their own treatment, nonadherence is likely

- Practitioner protocols needed for disease-specific adherence that can be tailored to the specific needs of patients

- Assessment and reinforcement of adherence to recommended treatment regimen needed at each point of contact
To know one life has breathed easier because you have lived, that is to have succeeded.

~ Ralph Waldo Emerson
Patient Education Programs

- National
  - American Lung Association
  - National Heart, Lung & Blood Institute
  - AAAAI

- Regional/Local
ASTHMA WEB RESOURCES

- American Lung Association  www.lungusa.org
- American Academy of Allergy, Asthma & Immunology  www.aaaaai.org
- National Heart, Lung and Blood Institute  www.nhlbi.nih.gov
- National Jewish Medical and Research Center  www.njc.org
  - 1-800-222-LUNG
DISCUSSION & QUESTIONS

Thank you!