Child Health Improvement through Computer Automation: The CHICA Experiments

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Disclosure

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Case

• Term infant born 18 months ago in an Indiana Hospital
• TTN requiring 5 day stay in NICU
• Discharged without newborn screen
  – Hospital attempted to contact mother, but Mother’s phone number had changed
• Seen on multiple occasions by FP

Case Cont.

• Floppy; constantly sleeping
• Poor feeding
• Jaundice
• Profound failure to gain weight
• Missed developmental milestones
• Stools less than once weekly
• Nightly bradycardias on home monitor
• Mottled, umbilical hernia
• Macroglossia

 Wouldn’t it be Great If…

• When an infant or newborn presented to the clinician...

  [Checkboxes for Screen Normal, Screen Abnormal, Follow-up Scheduled, Screen not done/sampled, Repeat Screen Sent]
Problem is Widespread

• National Study of 1536 children in the US*
• 12 metropolitan areas (including Indy)
• 142 quality indicators
• Children received 46.5% of indicated care
  – 40.7% of preventive care
  – 37.8% of screening
  – 34.5% of adolescent preventive care


Pediatricians Are Overwhelmed with Preventive Care Guidelines

• Multiple guidelines from authoritative sources
  – AAP
  – CDC
  – USPSTF
  – HRSA
  – ACMG
  – Medicaid
  – HMO
• Average preventive care visit: **18.3 minutes**
• Pediatricians: No time for developmental assessments and psychosocial issues

Computer Decision Support Systems (CDSS) Can Help

• Critical review of 100 clinical trials of CDSS compared to usual care controls*
• Practitioner performance: 62/97 (64%) improved care
• Preventive care: 16/21 (76%) improved care
• Disease mgmt: 23/40 (62%) improved care


Child Health Improvement through Computer Automation (CHICA)

• Outpatient Decision Support System
• Integrate easily into the clinical workflow
• Deliver relevant, high priority, tailored reminders to providers at point of care
• Capture structured clinical data
• Provide a familiar, intuitive, easy to use, portable, inexpensive, flexible interface

Sample Screening Form (PSF)

CHICA Workflow

RMRS (EMR)

CHICA
Sample Screening Form (PSF)
- Spanish on back...

Background Calculations

Physician Preventive Care Reminders

Identifying Risk Factors

Prioritization
- Hundreds of questions and reminders possible
- Only 20 questions and 6 reminders printed
- Prioritization: Expected Value of Firing Rule

Risk × Severity × Effectiveness × Evidence
CHICA To Date

- Turned on November 10, 2004
- Operates in 4 inner city clinics
- Served over 36,000 patients
  - 200,000 visits
  - 2.5 M parent questions
  - 700,000 physician reminders

Experiments with CHICA

- Questions and reminders controlled by set of rules; can be changed
- CHICA can randomize patients such that some rules are used for some and not others
- Randomized controlled trials:
  - Maternal Depression
  - ADHD Management
  - Asthma Case Finding
  - Developmental Screening
  - Parent Smoking Cessation
  - Autism Screening

Maternal Postpartum Depression

- Affects 7-13% of mothers
- Documented consequences to child
- Often goes unrecognized
- Pediatricians may be best opportunity to intervene?
  - See mothers often at WCC

Edinburgh 3

1st / 2nd Arms: Surveillance Questions

- Parents often get depressed. In the past month, have you often felt down, depressed or hopeless?
- In the past month, have you had little interest or pleasure in doing things?

1st / 2nd Arms: Specific Reminder

- In the past 7 days, have you felt scared or panicky for no good reason?
- In the past 7 days, have you been anxious or worried for no good reason?
- In the past 7 days, have you blamed yourself unnecessarily when things went wrong?

**ATTENTION**- If a parent identified symptoms of depressed mood on 08/30/2005, symptoms of sadness, anhedonia, sleep disturbance or appetite disturbance may indicate depression:

- May have depression
- Referred
- Counseled & gave handout
- Not depressed
- Mom not present
2nd Arm: (+) Just-in-Time Handout
- Printed based upon risk
- Anticipatory guidance / Support Services

RCT
Remind MD to screen for maternal depression (Control)

Screen parent in waiting room: alert MD if + (PSF Only)

Screen parent in waiting room: alert MD if +; give MD handouts (PSF + JIT)

Results: Case Detection

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confirmed Depressed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>1.2%</td>
</tr>
<tr>
<td>PSF_JIT</td>
<td>28</td>
<td>2.4%</td>
</tr>
<tr>
<td>PSF_Only</td>
<td>28</td>
<td>2.4%</td>
</tr>
<tr>
<td>Screened positive for depressed mood</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>14</td>
<td>1.2%</td>
</tr>
<tr>
<td>PSF_JIT</td>
<td>101</td>
<td>8.7%</td>
</tr>
<tr>
<td>PSF_Only</td>
<td>103</td>
<td>8.8%</td>
</tr>
<tr>
<td>Screened positive for anhedonia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>5</td>
<td>0.4%</td>
</tr>
<tr>
<td>PSF_JIT</td>
<td>61</td>
<td>5.2%</td>
</tr>
<tr>
<td>PSF_Only</td>
<td>59</td>
<td>5.3%</td>
</tr>
</tbody>
</table>

Results: Timing of Diagnosis

Asthma Quality of Care
- NHLBI guidelines, widely accepted standard of asthma care
  - Severity classification: intermittent <> persistent
  - Controllers (inhaled steroids) for persistent
  - At least two visits per year
  - Use of a spacer
  - Asthma action plan
- Multiple studies show adherence is poor
  - Classification 77%
  - Controllers 35%
Severity ?’s

- Does John have coughing, wheezing, breathing difficulties or a tight chest during the daytime 3 or more nights a week?

- Does John have coughing, wheezing, breathing difficulties or a tight chest during the daytime 3 or more nights a week?

- Does John's activity level remain the same? Does John's activity level change?

- John's medical record shows no symptoms that suggest persistent asthma. (see attached ASTHMA ACTION PLAN) Should his asthma be downgraded to intermittent?

- Yes, it’s intermittent
- No, it’s persistent
- Controller prescribed
- No asthma

CHICA Also Assesses

- Adherence to daily controllers when prescribed
- Use of a spacer
- Alerts physician if either is a problem

Asthma Case Finding

- Randomized 2098 children 3-11 years
- No previous history of asthma

Screen for symptoms in waiting room; Alert MD if positive

Usual care

Results

New Cases of Asthma Diagnosed

- Over 21 months 2005-07
- Control: 54/1017 (5.3%)
- Intervn: 87/1081 (8.1%)

P<0.02

- Absolute increase of 2.8% (53% relative)

Environmental tobacco smoke (ETS): Important Cause of Morbidity

- Increases risk and severity
  - Respiratory infections
  - Asthma & wheezing illnesses
  - Sudden infant death syndrome (SIDS)
  - Neurocognitive and behavioral problems
- Children more likely to smoke
- Health care expenditures 19% higher

Pediatricians Can Help Parents Quit

- Parents responsive to advice from peds
- Open to cessation advice from peds
- “Teachable moment”
- Brief, repeated cessation messages effective
  - Pediatric visits 8-10 times first two years ...but...
- 2/3 of pediatricians do not provide cessation advice
CHICA's Algorithm: Trans-theoretical model (Stages of Change)

Child with unknown ETS exposure

Smoker in home?

Is smoker motivated to quit?

Stop

Provide smoking cessation advice

Provide motivation to quit.

Yes

No

Has smoker quit?

Next visit

Yes

No

Yes

No

Nov 12, 2008 The CHICA Smoking Cessation System

• Intervention: Smoking Cessation Module
• Control: CHICA without the module

Randomization by household
– Address or maternal phone #
– Automatically by the CHICA system

RCT:

25%

33%

67%

Snapshot: Stages of Change in the Intervention Group
### Quit Rates (unadjusted)

<table>
<thead>
<tr>
<th>Quit</th>
<th>Smoking</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>61 (29%)</td>
<td>118</td>
</tr>
<tr>
<td>Control</td>
<td>23 (11%)</td>
<td>182</td>
</tr>
</tbody>
</table>

- Assumes those with no follow-up data have not quit
- Confounded by follow up rates that were double in intervention group

### ADHD

- AAP Guidelines: DSM Dx, Timely F/U
- Checks for ICD Dx of ADHD
- PSF: Surveillance for:
  - Inability to concentrate
  - Easy distractibility
- PWS: Alerts MD to Dx or symptoms
  - Asks for confirmation of Dx (if appropriate)
  - Provides Vanderbilt forms
- Sets target goals, F/U Schedules

### Evaluation of CHICA ADHD

- CHICA “auto-scores”
- Reports sub-scores:
  - Inattention
  - Overactivity
  - Depr/anxiety
  - ODD

### CHICA Improved Diagnostic Criteria

- CHICA Clinics were...
  - 8 times more likely to use a structured diagnostic assessment (Vanderbilt)
  - More likely to document symptoms of both inattention and hyperactivity
  - More likely to document symptoms both at home and at school
Autism Screening

- AAP Guidelines: Standardized screens at 18 & 24 mos, refer if +screen or >2 risks
- PSF screens for risks
  - Parent concern, family Hx of autism
- Prints MCHAT at 18 & 24 mos

November 2010 to July 2012

857 patients had MCHAT printed
567 MCHATs scanned (66%)
171 concerning MCHAT (30%)
98 (57%) not addressed
Physician addressed (43%) 73

396 (70%) normal
290 (33%) not screened

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50 normal
13 referrals
2 referral to audiology
8 marked as positive but not referred

Implications

- The Good News: 23/857 (3%) of kids were identified with possible ASD before age 3y
  - Compared to none before age 5 without CHICA
- The Bad News: We may have missed as many as 93 more
CHICA as a Data Repository

- 35,000 children screened for risks at every visit...
- What can we say about the prevalence of risks in our population?

<table>
<thead>
<tr>
<th>Screening Question (age group asked)</th>
<th>Number Asked</th>
<th>Response Rate</th>
<th>% Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not breastfed (0 do – 6 mo)</td>
<td>5987</td>
<td>90%</td>
<td>45.8%</td>
</tr>
<tr>
<td>Does not wear a bike helmet (2 yo – 12 yo)</td>
<td>17599</td>
<td>88.6%</td>
<td>39.5%</td>
</tr>
<tr>
<td>Uses a walker (6 mo – 12 mo)</td>
<td>6837</td>
<td>89.7%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Has ever slept on stomach (0 mo - 7mo)</td>
<td>8704</td>
<td>89.6%</td>
<td>29.0%</td>
</tr>
<tr>
<td>Hot water heater not &lt;120°F (0 yo - 3yo)</td>
<td>12900</td>
<td>87.8%</td>
<td>22.4%</td>
</tr>
<tr>
<td>Car seat faces forward (0 do – 2 yo)</td>
<td>8306</td>
<td>89.4%</td>
<td>17.3%</td>
</tr>
<tr>
<td>Baby asleep with bottle (5 mo – 18 mo)</td>
<td>469</td>
<td>93.5%</td>
<td>15.9%</td>
</tr>
<tr>
<td>Smoke detector batteries not tested monthly (0 yo – 21 yo)</td>
<td>14337</td>
<td>87.8%</td>
<td>12.6%</td>
</tr>
<tr>
<td>Maternal Depression Sx (PHQ or E3) (0 do – 15 mo)</td>
<td>23296</td>
<td>90.4%</td>
<td>4.1%</td>
</tr>
<tr>
<td>No working smoke detector (0 yo - 21 yo)</td>
<td>19716</td>
<td>87.3%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Domestic violence (0 do – 12 yo)</td>
<td>40508</td>
<td>88.1%</td>
<td>1.5%</td>
</tr>
<tr>
<td>Partner or another adult threatened or hurt children (0 do - 12 yo)</td>
<td>23311</td>
<td>88.3%</td>
<td>0.6%</td>
</tr>
<tr>
<td>ADHD Symptoms (5 yo – 13 yo)</td>
<td>14524</td>
<td>93.0%</td>
<td>21.3%</td>
</tr>
<tr>
<td>Concerns about child's development (24 mo – 36 mos)</td>
<td>475</td>
<td>95.3%</td>
<td>15.4%</td>
</tr>
<tr>
<td>Failed DDST at 90th %tile (2 mo – 64 mos)</td>
<td>38603</td>
<td>89.1%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Firearms in home (1 yo – 12 yo)</td>
<td>12721</td>
<td>88.4%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Lead risk (CDC questions) (10 mo – 36 mo)</td>
<td>1097</td>
<td>88.8%</td>
<td>5.4%</td>
</tr>
<tr>
<td>TB exposure risk (11 yo – 12 yo)</td>
<td>53893</td>
<td>88.2%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Non-adherence to asthma controller (3 yr - 11 yr)</td>
<td>468</td>
<td>91.2%</td>
<td>21.5%</td>
</tr>
<tr>
<td>Not using birth control if had intercourse (12 yo - 21 y0)</td>
<td>232</td>
<td>91.3%</td>
<td>26.0%</td>
</tr>
<tr>
<td>No condom use (among sexually active) (12 yo - 21 y0)</td>
<td>239</td>
<td>91.6%</td>
<td>28.3%</td>
</tr>
<tr>
<td>Ever had sexual intercourse (12 yo - 21 y0)</td>
<td>4766</td>
<td>86.4%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Depression Screening based on GAPS (12 y0 - 21 y0)</td>
<td>12235</td>
<td>87.5%</td>
<td>8.8%</td>
</tr>
</tbody>
</table>
Thank You!

Children’s Health Services Research

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