Quality Improvement Efforts in Oral Healthcare
Chronic Disease Prevention and Management of ECC

2015 Dental Quality Alliance Conference
May 1, 2015
Chicago, IL

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Disclosures

I will be presenting work and results that have received grant funding support from:

DentaQuest Institute
DentaQuest Foundation
Health Resources Services Administration
Learning Objectives

• Understand the role of and how to use quality improvement and data measurement in clinical practice
  – Through an example of a quality improvement initiative which aimed to test and implement a Chronic Disease Management (CDM) approach to addressing ECC
    • Understand Chronic Disease Management (CDM)
    • What is it and why it works
Early Childhood Caries

But aren’t they just baby teeth?

PROBLEM STATEMENT

• Hospital-based safety dental clinics care for a disproportionate number of children with ECC
• Many of these children are treated surgically
• Months-long backlogs for operating room care
• High rate of decay after treatment
• High cost of operating room treatment
• **Caries is a highly preventable disease**
The Caries Balance

Pathologic Factors
- Acid-producing bacteria
- Frequent eating/drinking of fermentable carbohydrates
- Sub-normal saliva flow and function

Protective Factors
- Salivary flow and components
- Fluoride-remineralization
- Antibacterials
- Sealants

Demineralization/Caries

Remineralization/No Caries

Current State

Dentistry, with its surgical tradition, commonly approaches dental caries... as an acute **surgical** problem requiring restoration and repair rather than as a chronic **medical** disease process requiring individually-tailored management of etiologic factors, Chronic Disease Management ("CDM").
Why “CDM” for ECC is needed

<table>
<thead>
<tr>
<th>Less Costly</th>
<th>Predentate Dentate, not infected</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dentate, infected Dentate, caries active Decalcification/WSL No Cavitation CAVITATION</td>
</tr>
<tr>
<td>Most Costly</td>
<td>Pulpal infection Pain Alveolar/facial infection</td>
</tr>
<tr>
<td></td>
<td>Prevention</td>
</tr>
<tr>
<td></td>
<td>Suppression, Medical Management</td>
</tr>
<tr>
<td></td>
<td>Surgical Management</td>
</tr>
</tbody>
</table>
Opportunity for Improvement

What we know DESIRED

- Focused prevention
- Assess and manage risk
- Support behavior change
- Repair defects

THE GAP

- Applying evidence
- Changing processes
- Training workforce
- Educating parents
- Using information technology
- Aligning payment

What we do ACTUAL

- Prevention essentially the same for everyone
- Little focus on self-management
- 6-month recall visits
- Restore teeth
Quality Improvement

• A formal approach of analyzing what we currently do in practice

• It is the testing, implementation, and adoption of new changes and ideas that lead to measurable improvements in health outcomes
Improve Oral Health of Children 1-5
- O1 Reduce % of pts with new cavitation by 50%
- O2 Reduce % of pts complaining of pain by 30%
- O3 Reduce % of pts referred to OR or for sedation by 50%

P1 – Practice QI infrastructure supports population management

P2 - Reliable delivery of risk-based preventive & restorative care

P3 – Engaged patients/families adequately manage their care

S1 System supports reporting QI measures

S2 Practice staff has necessary QI skills and culture

S3 Practice systems support more frequent recalls

S4 Patients are screened for caries risk

S5 Standard method for charting caries progression

S6 Patients are recalled at risk-appropriate intervals

S7 Treatment is conservative, based on a risk-based treatment plan

S8 Care is customized based on individual risk factors and needs

S9 Evidence-based behavior change techniques to educate and motivate families about ECC

Changes
- Dummy codes; reports
- Registry
- Recall visits – alternative scheduling schemes
- Non-office patient contact & coaching
- Self management goals
- Motivational interviewing

M2 (O1a)
M3 (O1)
M4 (O2)
M5 (O3)
M1 (S4)
M6 (S6)
M7 (S8)

Revised 10/3/2013
Model for Improvement

What are we trying to accomplish?

How will we know that a change is an improvement?

What change can we make that will result in improvement?

Aim

Measures

Change

PDSA Testing Cycle

Act  Plan  Study  Do
ECC Phase I (Demonstration Project)*

Aim Statement

Over an 18 month period, caries will be managed and caries progression will be reduced in all children under 60 months of age who present with high risk for ECC.

Goals

Reduce the percent of patients

- With new cavitation
- Who are referred to the operating room
- With pain

*At Boston Children’s Hospital and St. Joseph’s Hospital; and funded by DentaQuest Institute
ECC Collaborative Clinical Protocol*

**Initial or recall visit**
- Review medical history and dental history
- Perform CRA
- Perform Clinical exam and Caries charting by tooth surface and activity
- Take radiographs if indicated and possible
- Assess cooperation
- Apply Topical fluoride (Fluoride varnish)

**Inclusion Criteria**
- At least one tooth with decay (cavitation and/or demineralization)
- Or a history of tooth decay

**Effective Engagement and Communication**
- Explain caries process and causes of ECC
- Establish SM goals [diet, oral hygiene, fluoride toothpaste (sodium fluoride or stannous fluoride), other remineralizing modalities]

**Disease Management Follow-up Visits**
- Perform CRA
- Perform Clinical exam and Caries charting
- Take radiographs if indicated and possible
- Re-define or re-emphasize SM goals
- Assess cooperation
- Apply Topical fluoride (Fluoride varnish)

**Restorative/Surgical Treatment**
- Restorative treatment as indicated or desired
- ITR and/or sealants as indicated or desired
- GA/OR or sedation as indicated

**For Children at High Risk**
Next DM visit in 1-3 months

**For Children at Medium Risk**
Next DM visit in 3-6 months

**For Children at Low Risk**
Next DM visit in 6-12 months

ECC = early childhood caries
DM = disease management
ITR = interim therapeutic restoration
CRA = caries risk assessment
GA/OR = general anesthesia/operating room
SMGs = self management goals

*Funded by DentaQuest Institute

Boston Children's Hospital
Until every child is well
## ECC Collaborative Risk-based CDM protocol

<table>
<thead>
<tr>
<th>Existing Risk Category</th>
<th>New Clinical Findings</th>
<th>Fluoride Varnish Interval</th>
<th>Self-Management Goals</th>
<th>Restorative Treatment</th>
<th>DM Return Interval</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>• No disease indicators of caries; or • Completely remineralized (arrested) carious lesions</td>
<td>6-12 months</td>
<td>• Twice daily brushing with F toothpaste† • Stannous fluoride‡ on cavitated lesions</td>
<td></td>
<td>6-12 Months</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>• No disease indicators,* but has risk factors**; and/or inadequate protective factors*** • Disease indicators present with some remineralization</td>
<td>3-6 months</td>
<td>• Twice or more daily brushing with F toothpaste • Stannous fluoride on cavitated lesions • Dietary changes</td>
<td>• Sealants • ITR • Conventional Restorative</td>
<td>3-6 Months</td>
<td>• Xylitol gum or candies or wipes • Calcium phosphate paste</td>
</tr>
<tr>
<td>High</td>
<td>• Active caries (disease indicators present) • No remineralization occurring • Heavy plaque</td>
<td>1-3 months</td>
<td>• Twice or more daily brushing with F toothpaste • Stannous fluoride on cavitated lesions • Dietary changes</td>
<td>• ITR • Sealants • Conventional restorative</td>
<td>1-3 months</td>
<td>• Xylitol gum or candies • Calcium phosphate paste</td>
</tr>
</tbody>
</table>
## Caries Risk Assessment and Self-Management Goals

### Biologic Factors
- **Child has history of active caries**
  - [ ] Y
  - [ ] N
- **Mother has active caries**
  - [ ] Y
  - [ ] N
- **Siblings have active caries**
  - [ ] Y
  - [ ] N
- **Continuous bottle use**
  - [ ] Y
  - [ ] N
- **Swallows juice/milk in Sippy cup**
  - [ ] Y
  - [ ] N
- **Sleeps with bottle or nurses on demand**
  - [ ] Y
  - [ ] N
- **Frequent snacking**
  - [ ] Y
  - [ ] N
- **SHCN**
  - [ ] Y
  - [ ] N
- **Potential caries causing medications**
  - [ ] Y
  - [ ] N

### Protective Factors
- **Tooth brushing**
  - [ ] Y
  - [ ] N
  - [ ] _x/day
- **Assistance with brushing**
  - [ ] Y
  - [ ] N
  - SW
- **Fluoride toothpaste**
  - [ ] Y
  - [ ] N
  - [ ] _x/day
- **Topical fluoride (Gelkam, Prevident, ACT)**
  - [ ] Y
  - [ ] N
  - [ ] _x/day
- **Floss**
  - [ ] Y
  - [ ] N
- **Drinks fluoridated water**
  - [ ] Y
  - [ ] N

### Disease Indicators / Risk Factors
- **Cavitation**
  - [ ] Y
  - [ ] N
  - Where_________________
- **Demineralization**
  - [ ] Y
  - [ ] N
  - Where_________________
- **Enamel defects**
  - [ ] Y
  - [ ] N
  - Where_________________
- **Visible plaque**
  - [ ] Y
  - [ ] N
  - SW
- **Gingivitis**
  - [ ] Y
  - [ ] N
  - Improved
  - SW
- **Deep pits/fissures**
  - [ ] Y
  - [ ] N
  - SW

### Indicators of Improved Caries Risk
- **Remineralization**
  - [ ] Y
  - [ ] N
  - Where_________________
- **New remineralization**
  - [ ] Y
  - [ ] N
  - Where_________________
- **Meeting self-management goals**
  - [ ] Y
  - [ ] N
  - SW
  - NA
- **Stannous fluoride staining**
  - [ ] Y
  - [ ] N

### Overall Caries Risk:
- [ ] Low
- [ ] Medium
- [ ] High

### NV:
- [ ] ___ months for DM/F varnish and ________________________________

### Self Management Goals

1. [ ] F-toothpaste ___x/day
2. [ ] Gelkam ___x/day

### Clinician’s Comments:

---

**Self Management Goals for Caregivers**

- **Patient Name:** ____________________________  **DOB:** ____________________________

Your child has been assessed to have the following risk for caries (circulate):
- [ ] High
- [ ] Moderate
- [ ] Low

The pictures checked are the ones you should focus on between today and your next visit.

- [ ] Only water/monument
  - [ ] order to drink

- [ ] Only water
- [ ] in sippy cup or only water in cup
- [ ] Only drinking

- [ ] Drink water with this amount of fluoride to drink:

- [ ] Must be still, use only water

- [ ] Sip water
- [ ] in sippy cup

- [ ] only water

- [ ] Use caries ___x/day
  - [ ] Apply this amount to all teeth
  - [ ] -eating, chewing or rinsing for 20 minutes

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## ECC Collaborative Phase I*
### Outcomes After 30 Months

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Boston Children’s Hospital</th>
<th>St. Joseph Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ECC (N=403) %</td>
<td>Baseline (N=129) %</td>
</tr>
<tr>
<td>New cavitation</td>
<td>26</td>
<td>75</td>
</tr>
<tr>
<td>Pain</td>
<td>13</td>
<td>22</td>
</tr>
<tr>
<td>Referral to Operating Room</td>
<td>11</td>
<td>21</td>
</tr>
</tbody>
</table>

*Funded by DentaQuest Institute

# Early Childhood Caries Collaborative Phase II* Results (7 sites)* ◊

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>ECC (N=344)**</th>
<th>Baseline (N=316)</th>
<th>Percentage Improvement</th>
<th>Improvement Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Cavitation</td>
<td>33%</td>
<td>46%</td>
<td>▼28%</td>
<td>▲14% - ▼71%</td>
</tr>
<tr>
<td>Pain</td>
<td>8%</td>
<td>11%</td>
<td>▼27%</td>
<td>▲80% - ▼100%</td>
</tr>
<tr>
<td>Referral to the Operating Room</td>
<td>14%</td>
<td>22%</td>
<td>▼36%</td>
<td>0% - ▼81%</td>
</tr>
</tbody>
</table>

**Results include seven (7) clinical locations:** Boston Children’s Hospital (MA); Holyoke Health Center (MA); Native American Health Center (CA); Nationwide Children’s Hospital (OH), Neighborcare (WA); St. Joseph’s Hospital for Specialty Care (RI); University Pediatric Dentistry (NY)

**Random sample drawn from a population of total ECC Phase II population of 3030**

*Funded by DentaQuest Institute

ECC Phase III*

Over 18 months, 30+ teams nationally have been engaged in testing changes, collecting data, and working with nationally recognized clinical and quality improvement experts to implement the practices and protocols of ECC disease management.

*Funded by DentaQuest Institute
ECC Phase III*: Goals

- Provide tools, guidance and support to everyone willing to learn...to commit to continuous improvement...to achieve better care and outcomes...

*Funded by DentaQuest Institute
Utilization ECC vs. Baseline*

ECC Disease Management patients had more visits, more preventive visits, and fewer restorative and OR visits than historical control patients.

Mean number of diagnostic and preventative visits by lengths of follow-up for ECC compared to baseline patients.

<table>
<thead>
<tr>
<th>Months</th>
<th>Mean number of visits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>0 to 3</td>
<td>1.2 visits</td>
</tr>
<tr>
<td>0 to 6</td>
<td>1.4 visits</td>
</tr>
<tr>
<td>0 to 9</td>
<td>1.7 visits</td>
</tr>
<tr>
<td>0 to 12</td>
<td>2.0 visits</td>
</tr>
<tr>
<td>0 to 24</td>
<td>3.4 visits</td>
</tr>
</tbody>
</table>

Visit type utilization for ECC compared to baseline patients

<table>
<thead>
<tr>
<th>Type of dental care</th>
<th>Parameter Estimate</th>
<th>St Error</th>
<th>P-value</th>
<th>Hazard Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic or preventive²</td>
<td>0.55</td>
<td>0.11</td>
<td>&lt;.0001</td>
<td>1.734</td>
</tr>
<tr>
<td>Restorative/ITR</td>
<td>1.32</td>
<td>0.42</td>
<td>.0016</td>
<td>3.728</td>
</tr>
<tr>
<td>OR</td>
<td>-0.59</td>
<td>0.20</td>
<td>.0028</td>
<td>0.552</td>
</tr>
<tr>
<td>Restorative/surgical</td>
<td>-0.61</td>
<td>0.12</td>
<td>&lt;.0001</td>
<td>0.545</td>
</tr>
</tbody>
</table>

¹ Using Proportional hazards models adjusting for patient age, gender, race, ethnicity, type of dental insurance, and spoken language
² Including disease management among ECC patients
OR=operating room

*Funded by DentaQuest Institute
Costs: ECC vs. Baseline *

Mean patient costs for all dental care, including 1st month

<table>
<thead>
<tr>
<th>Length of evaluation</th>
<th>COSTS (2011 dollars) 1</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Months</td>
<td>Baseline</td>
<td>ECC</td>
<td>Net savings</td>
<td>p-value</td>
</tr>
<tr>
<td>3</td>
<td>$699</td>
<td>$669</td>
<td>$30</td>
<td>0.7736</td>
</tr>
<tr>
<td>6</td>
<td>$1,092</td>
<td>$880</td>
<td>$212</td>
<td>0.1514</td>
</tr>
<tr>
<td>9</td>
<td>$1,660</td>
<td>$1,097</td>
<td>$563</td>
<td>0.0091</td>
</tr>
<tr>
<td>12</td>
<td>$2,025</td>
<td>$1,262</td>
<td>$762</td>
<td>0.0028</td>
</tr>
<tr>
<td>24</td>
<td>$2,678</td>
<td>$1,834</td>
<td>$844</td>
<td>0.0260</td>
</tr>
</tbody>
</table>

1 Mean costs of care were estimated using generalized linear models, adjusting for patient age, gender, race, ethnicity, type of dental insurance, and spoken language.

*Funded by DentaQuest Institute
**Estimated Savings to the Medicaid Program** *

(n=361 beneficiaries)

<table>
<thead>
<tr>
<th>Length of evaluation</th>
<th>Outcomes¹</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MassHealth costs (2011 US $)</td>
</tr>
<tr>
<td>Month</td>
<td>Baseline</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>3</td>
<td>$456</td>
</tr>
<tr>
<td>6</td>
<td>$662</td>
</tr>
<tr>
<td>9</td>
<td>$778</td>
</tr>
<tr>
<td>12</td>
<td>$918</td>
</tr>
<tr>
<td>24</td>
<td>$1,418</td>
</tr>
</tbody>
</table>

Medicaid payments were estimated as a percentage of charges as follows:
- 57.8% of charges related to disease management visits
- 43.1% of charges for Restor/Surg visits
- 42.7% of charges for Restor/ITR visits
- 40.7% of charges for sedation
- 12.2% of charges in the OR

Estimated payments are adjusted for background differences (patient age, gender, race and ethnicity, type of dental insurance and spoken language) between the baseline and the ECC patients

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**Definitions**

- **Measurement month** = month for which data are complete, e.g. August 2012, sampled after August 31, 2012.
- **Active patient** = Patients between the age of 6 and 60 months of age with a comprehensive oral exam within 18 months of the last day of the measurement month, unless otherwise excluded.
- **Initial Disease Management (DM) Visit** = The visit after project start at which the patient was first designated as ‘high’ risk.
- **Disease Management (DM) Visit**: Any visit where the child's current risk status should be assessed. Include billable exams, restorative visits, and non-billable, short-interval visits for high risk patients. This includes all diagnostic or preventive visits other than emergency visits.
- **Dummy Code**: Non-ADA codes used in electronic dental records systems (EDRs) to record events such as self-management goals review.

**Notes**

1. Sites that perform sedation on-site should consider these patients as ‘self-referrals’ and count them accordingly.

Revised 10/23/13
Coding in Dentrix Enterprise

Quick buttons

Boston Children's Hospital
Until every child is well
ECC Team Reporting Cycle

“Measurement Month”
- Data entry – procedures
- PDSA tracking

Paper visit form

Registry Mode

Patient encounter

EDR Client Mode/ Import Mode Data Entry

EDR Client Mode/ Import Mode Data Entry

Aggregator

Team Progress Report

PDSA Log

DQI

Team Progress Report

DQI

Dashboard

Last work day of measurement month

2nd Friday of every month

End of month

Data Deadline
- Aggregator generates dashboard
- Team meets, updates progress report
- Upload 3 files to DQI

Assessments Distributed
- Feedback available for review

Assessments Distributed

Patient:
- Birthdate:
- New Procedures

Patient:
- Birthdate:
- New Procedures

Patient:
- Birthdate:
- New Procedures

Notes

Notes

Patient:
- Birthdate:
- New Procedures

Notes

Notes

Notes

ECC Team Reporting Cycle

Patient:
- Birthdate:
- New Procedures

Notes

Notes

Notes

ECC Codes

ECC-3 Disease Management Registry
Aggregate Process Measures

Pct Risk Assessed

Pct SMG

Pct On Time
Aggregate Outcomes

Pct Decreased Risk

Pct New Cav

Pct Pain

Pct Referred
Risk assessed (S4)
Self-Management Goals (S9)
On-Time Visits (S6)
How Data are Used

• Evaluate practice patterns in total and consistency of practice among providers

• Recall patients due for DM visits by caries risk by running reports
  – High risk within 3 months
  – Med risk within 6 months
  – Low risk within 12 months
ECC III Accomplishments

- DQI team facilitated spread of disease management for ECC
- Successfully taught quality improvement methodology to oral health professionals
- Facilitated first DQI virtual learning session (>100 participants)
- Gained knowledge about collecting population health data electronically through electronic dental record systems
ECC III Barriers to Implementing DM Protocol

- **Staff buy-in to disease management**
- **Time constraints**
  - Both time during patient visits and lack of time to meet with and train staff
- **Challenges with recall intervals: e.g. high no-show rates**
- **Lack of reimbursement**
ECC III Challenges

• **Data collection:**
  – Setting up and using the Aggregator
  – Using dummy codes in the EDR
  – Reliable use codes

• **Organizational/Administrative issues:**
  – EDR implementation, staff or leadership turnover
  – Finding time dedicated to this work
  – Buy-in from other staff/leadership
Lila—from Cape Cod

- At age 2, local dentist recommended dental treatment in OR
- Mom sought second opinion
- Mom agreed to CDM protocol & FV and DM visits q3 mos
- At age 3-4, allowed sealants, fillings & crowns in clinic
- Continues to be Low Risk
Mason—from Western MA

- At age 3, local dentist recommended dental treatment in OR
- Mom sought second opinion
- Mom agreed to CDM protocol & FV and DM visits q3 mos
- Some areas of decay arrested
- At age 3-4, allowed fillings in dental office
- Continues to be Low Risk
- Returns every 6 months
Alexa—from Boston

- At age 4, Class II caries on BWs
  - Parents agreed to CDM protocol and q3 mos & FV
  - Experienced difficult restorative visit
- At age 6, replaced faulty composite
- High Caries Risk
  - q3-6 mos DM visits & FV
  - Sealants on 6’s
  - Monitoring Class II caries
Observations

• Early results from ECC CDM interventions have demonstrated that CDM
  – can be implemented into clinical practice
  – has strong potential for reduction in new cavitation, dental pain and referral to the operating room compared to baseline rates

• QI methods have been helpful in facilitating use of risk-based DM approaches
Conclusions

• ECC CDM may curtail caries activity while complementing dental repair -- stopping disease progression and cavity recurrence

• ECC CDM will require and benefit from evolving healthcare delivery and financing systems that reward health outcomes

• Measurement is necessary in efforts to improve quality of care and outcomes
Thank you!
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