Rethinking screening for developmental-behavioral challenges in community pediatric settings

R. Chris Sheldrick, Ph.D.

rshldrck@bu.edu

www.theSWYC.org

Boston University School of Public Health
Learning Objectives

Participants will be able to:

• Describe the relationship between sensitivity, specificity, and positive predictive value

• Understand the concept of “threshold probability” when applying screening results to individual patients

• Identify factors that influence optimal decision thresholds for screening
Objective 1: Introduce SWYC
Collaborators

- Brandi Henson, PsyD
- Shela Merchant, MA
- Emily Neger, BA
- Kate Mattern, BA

Ellen C Perrin, MD
Developmental-Behavioral Pediatrician
Overview

• Clinical screening instrument for children birth – 5 years
• Comprehensive
• Easy to access
• Freely available to all, including clinicians, researchers, and public health officials

www.theSWYC.org
Survey of Well-being of Young Children

- Behavior
- Development
- Family

SWYC
Survey of Well-being of Young Children (SWYC)

- Behavior
- Development
- Family

Months:
- 2
- 4
- 6
- 8
- 10
- 12
- 14
- 16
- 18
- 20
- 22
- 24
- 26
- 28
- 30
- 32
- 34
- 36
- 38
- 40
- 42
- 44
- 46
- 48
- 50
- 52
- 54
- 56
- 58
- 60
Development
- Delays
- Autism

Behavior
- Internalizing
- Externalizing

Academic Pediatrics, 2013

Baby Pediatric Symptom Checklist (BPSC)

Preschool Pediatric Symptom Checklist (PPSC)

Academic Pediatrics, 2012
Development

• Delays
• Autism

Behavior
• Internalizing
• Externalizing

Family

Parent Depression, Concerns, and Family Stressors
### DEVELOPMENTAL MILESTONES

These questions are about your child's development. Please tell us how much your child is doing each of these things. If your child doesn't do something any more, choose the answer that describes how much he or she used to do it. Be sure to answer ALL the questions.

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Not Yet</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runs</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Walks up stairs with help</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Kicks a ball</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Names at least 5 familiar objects - like ball or milk</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Names at least 5 body parts - like nose, hand, or tummy</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Climbs up a ladder at a playground</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Uses words like “me” or “mine”</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Jumps off the ground with two feet</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Puts 2 or more words together - like “more water” or “go outside”</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Uses words to ask for help</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

### PRESCHOOL PEDIATRIC SYMPTOM CHECKLIST (PPSC)

These questions are about your child's behavior. Think about what you would expect of other children the same age, and tell us how much each statement applies to your child.

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Not at all</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does your child... Seem nervous or afraid?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Seem sad or unhappy?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Get upset if things are not done in a certain way?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Have a hard time with change?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Have trouble playing with other children?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Break things on purpose?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Fight with other children?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Have trouble paying attention?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Have a hard time calming down?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Have trouble staying with one activity?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Is your child... Aggressive?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Fidgety or unable to sit still?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Angry?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Is it hard to... Take your child out in public?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Comfort your child?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Know what your child needs?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Keep your child on a schedule or routine?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Get your child to obey you?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

### PARENT'S OBSERVATIONS OF SOCIAL INTERACTIONS (POSID)

<table>
<thead>
<tr>
<th>Interaction</th>
<th>Many times a day</th>
<th>Few times a day</th>
<th>Few times a week</th>
<th>Less than once a week</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Usually</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Sometimes</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>Rarely</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

### PARENT'S CONCERNS

Do you have any concerns about your child's learning or development?

<table>
<thead>
<tr>
<th>Concern</th>
<th>Not At All</th>
<th>Somewhat</th>
<th>Very Much</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you have any concerns about your child's behavior?</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

### FAMILY QUESTIONS

Because family members can have a big impact on your child's development, please answer a few questions about your family below.

1. Does anyone smoke tobacco at home?                                     | □          | □        | □         |
2. In the last year, have you ever drunk alcohol or used drugs more than you wanted to? | □          | □        | □         |
3. Have you felt you wanted or needed to cut down on your drinking or drug use in the last year? | □          | □        | □         |
4. Has a family member's drinking or drug use ever had a bad effect on your child? | □          | □        | □         |
5. In the past month was there any day when you or anyone in your family went hungry because you did not have enough money for food? | □          | □        | □         |
6. Over the past two weeks, how often have you been bothered by any of the following problems? | □          | □        | □         |
7. Feeling down, depressed, or hopeless?                                  | □          | □        | □         |
8. In general, how would you describe your relationship with your spouse/partner? | □          | □        | □         |
9. Do you and your partner work out arguments with?:                      | □          | □        | □         |

---

Please continue on the back.
Timeline

Funding

Commonwealth Fund

Partners

Research

Products

2008

Define objectives; Develop item pool

2009

Collect data (n~1500)

2010

Analysis

2011
Website & manual

www.theSWYC.org

The Survey of Well-being of Young Children (SWYC)
User’s Manual

by
Ellen C. Perrin, MD
Chris Sheidtuck, PhD
Zach Visco, BA
Kathryn Matern, BA

The Survey of Well-being of Young Children (SWYC) is a freely available, comprehensive screening instrument for children under 5 years of age. The SWYC was written to be simple to answer, short, and easy to read. The entire instrument requires 15 minutes or less to complete and is straightforward to score and interpret. The SWYC is approved by Mass Health for compliance with the Children’s Behavioral Health Initiative screening guidelines.

Overview

The Survey of Well-being of Young Children

Translations
The SWYC has been translated into Spanish, Burmese, Nepali, and Portuguese. Learn more about the process and download the translated versions.

Need more information?

Share your feedback!
Interested in sharing your thoughts on the Survey of Wellbeing of Young Children? Please take this 5-10 minute survey. Your feedback will be very helpful as we work to further develop and support the use of the SWYC. Click here to complete the survey.

©Tufts Medical Center, 2016
Version 1.03, 3/4/18
All updates to this manual will be available for download at www.theSWYC.org. Please check the website to make sure you are consulting the most recent version.
Screening in community settings

“There is nothing so practical as a good theory.”
-Kurt Lewin, 1951
Lewin, Kurt. "There is Nothing So Practical as a Good Theory."
“...programs are based on explicit and implicit theories about how and why the program will work.”

-Carol Weiss, 1994
So if there is nothing so practical as a good theory....
-Kurt Lewin, 1951

There are also few things so misleading as a bad theory.
, just now
What theories are implicit in screening recommendations?
American Academy of Pediatrics (AAP) Policy Statement

“Sensitivity and specificity levels of 70% to 80% have been deemed acceptable for developmental screening tests.”

American Academy of Pediatrics (AAP)
Policy Statement

What theories are implicit in these recommendations?
Response from pediatricians
Self-reported use of standardized developmental screening instruments among pediatricians
% Positive Screens Referred

Developmental screening trials:
- Earls et al., 2009
- King, 2010
- Guevara et al., 2013
- Dawson & Camp, 2014

Behavioral screening trials:
- Murphy et al., 1996
- Gall et al., 2000
- Stevens et al., 2008
- Rausch et al., 2012
- Jonovich & Alpert-Gillis, 2013
- Romano-Clarke et al., 2014

Meta-analysis of % referred

60% (95% CI: 33-82%)

Proportion of children who screen positive who are recognized and/or referred by pediatrician

(I²=97%)
Change in referrals attributable to screening

Developmental screening trials:
- Schonwald et al., 2009
- Guevera et al., 2013

Behavioral screening trials:
- Murphy et al., 1996
- Hacker et al., 2006
- Stevens et al., 2008
- Wintersteen, 2010
- Berger-Jenkins et al., 2012
- Jonovich & Alpert-Gillis, 2013
- Romano-Clarke et al., 2014

Meta-analyses:
- Developmental & Behavioral Screening Trials
- Depression Trials (Gilbody, Sheldon & House, 2008)

RR = 1.8 (95% CI: 1.1-2.9)
RR = 0.97 (95% CI: 0.81-1.18)

Change in case identification/referral after implementing evidence-based screening
(Relative Risk; 95% CI)
Do our implicit theories of screening explain these results?
Using models for inference
A few thoughts about models...

• “All models are wrong... but some are useful.”

Attributed to George E.P. Box
Models

• ...designed to achieve a specific purpose or solve a particular problem
Thresholds: A systematic decision tool for developmental screening.

R. Christopher Sheldrick

1Developmental-Behavioral Pediatrics, Tufts Medical Center, Boston, Massachusetts
2Division of Developmental-Behavioral Pediatrics, Floating Hospital for Children, Boston, Massachusetts
3Department of Psychiatry, University of Connecticut Health Center, Farmington, Connecticut

Background: The accuracy of developmental behavioral screening can ideally be assessed through the use of positive predictive value (PPV), which is calculated as the proportion of children who receive a positive screening test result and subsequently go on to receive a diagnosis of a developing disorder. PPV is important because it provides a direct measure of the potential to influence disease prevention, early intervention, and appropriate follow-up. This study sought to calculate PPV of several commonly used developmental behavioral screening tools and to determine whether PPV is an appropriate measure of screening accuracy.

METHODOLOGY

Is a Positive Developmental-Behavioral Screening Score Sufficient to Justify Referral? A Review of Evidence and Theory

R. Christopher Sheldrick, PhD; Daryl Garfinkel, BA

From Developmental-Behavioral Pediatrics, Floating Hospital for Children, Tufts Medical Center, Boston, Massachusetts. The authors have no conflicts of interest to disclose.

Abstract

Background: The accuracy of developmental behavioral screening can ideally be assessed through the use of positive predictive value (PPV), which is calculated as the proportion of children who receive a positive screening test result and subsequently go on to receive a diagnosis of a developing disorder. PPV is important because it provides a direct measure of the potential to influence disease prevention, early intervention, and appropriate follow-up. This study sought to calculate PPV of several commonly used developmental behavioral screening tools and to determine whether PPV is an appropriate measure of screening accuracy.

Abstract

In their recommendations on screening for autism and developmental disabilities, the American Academy of Pediatrics recommends referral subsequent to a positive screening result. In this article, we argue that positive screening results are not always sufficient to justify a referral. We show that although positive predictive values are often low, they actually overstate the probability of having a disorder for many children who screen positive. Moreover, recommended screening thresholds are seldom set to ensure that the benefits of referral will equal or exceed the risks associated with intervention. As a result, we recommend that screening policies be developed that consider the costs and benefits of actions recommended after a positive screen are appropriate to the patient's condition. We recommend greater focus on clinical guidelines, the education of physicians, including those in primary care, with patients and their families. Finally, we recommend broadening the scope of screening research to include intervention studies that study the accuracy of specific screening instruments, and we recommend improving decision-making in the context of intervention.
A simple screening model

Screener Scores

Mean = 4

Healthy Population

Frequency

Screener Scores

Mean = 4
20% in the affected population
Here’s that same image, with the affected population flipped.
Sensitivity = Specificity = 78%

Among children with disabilities

78% screen negative

Among typically developing children

78% screen positive
Positive Predictive Value < 50%

Among children who score positive

<50% have disabilities
Same risk?
PPV averages risks across all who score positive.

No disorder

Disorder
Although simple, this model is useful for:

• Demonstrating the limits of group-level statistics for individual decision making
• Demonstrating the tradeoff between sensitivity & specificity
Empirical data
Figure. CBCL results

Distributions of screening scores by diagnostic status and estimated probability density functions

Parametric estimates of Sensitivity, PPV and threshold probability

Notes: Light gray dotted lines reflect non-parametric estimates of sensitivity and PPV. Vertical lines represent recommended screening thresholds
Figure. SDQ results

Distributions of screening scores by diagnostic status and estimated probability density functions

SDQ
North Carolina Sample

SDQ
National Comorbidity Study – Adolescent Supplement

Parametric estimates of Sensitivity, PPV and threshold probability

Note: Light gray dotted lines reflect non-parametric estimates of sensitivity and PPV. Vertical lines represent recommended screening thresholds.
But what threshold is optimal?

...we need a another model
THERAPEUTIC DECISION MAKING: A COST-BENEFIT ANALYSIS

Stephen G. Pauker, M.D., and Jerome P. Kassirer, M.D.

Abstract To help the physician decide whether or not to treat a patient who may or may not have a disease, a method has been developed for calculating a therapeutic threshold. If the probability of disease in a given patient exceeds the threshold, the preferable course of action is to treat; if the probability is below the threshold, the preferable course of action is to withhold treatment. This method is applicable in many medical and surgical settings in which some diagnostic uncertainty exists after all appropriate studies have been carried out. The technic not only exposes some of the basic principles of therapeutic decision making in the face of diagnostic uncertainty but also forms a convenient framework for analyzing the impact of “soft” clinical data on the decision-making process. (N Engl J Med 293:229-234, 1975)

The dilemma of whether or not to administer a certain drug or carry out a certain operation in a patient without an established diagnosis is familiar to physicians. In many clinical situations considerable uncertainty exists about the presence or absence of a given disease because no further confirmatory diagnostic studies are available. Given this uncertainty, administering a treatment known to be effective for the disease under consideration will be beneficial if the disease is actually present, but may be quantitative estimate of the probability and utility (value) of each outcome, and combining the estimates by a method that provides a measure of the “expected value,” or worth, of each course of action. Starting from these principles, a simple and clinically useful mathematical relation has been derived in this study between the benefits and costs of a treatment in a given disease and the threshold level of clinical suspicion of the disease. When the probability of a patient’s illness exceeds this
Ask yourself: If your doctor said you might have brain cancer and that surgery is available, would you do it?
What would you want to know to make a good decision?

- Intervention
- Availability of resources

- Risk/benefit of intervention
- Availability of resources
Using models to make sense of implementation studies

What if screening improved accuracy but did not change thresholds?
False Positives
Don’t need treatment, referred anyway

False Negatives
Need treatment, not referred

Decision Threshold
False Positives
Don’t need treatment, referred anyway

False Negatives
Need treatment, not referred

Severity compared with decision threshold
Decision whether to refer

Severity assessment
Physician’s diagnostic accuracy

Decision Threshold
False Positives
Don’t need treatment, referred anyway

False Negatives
Need treatment, not referred

Decision Threshold

Severity compared with decision threshold
Decision whether to refer

Severity assessment
Physician’s diagnostic accuracy

Model structure

number of false negatives
+

number of false positives
−

51
False Positives
Don’t need treatment, referred anyway

False Negatives
Need treatment, not referred

Decision Threshold

Severity compared with decision threshold
Decision whether to refer

Number of false negatives

Number of false positives

Lost to follow-up
Delay

Severity assessment
Physician’s diagnostic accuracy

False positives known to physician

Lost to follow-up
Delay
False Positives
Don’t need treatment, referred anyway

Regret about false positives

False Negatives
Need treatment, not referred

Decision Threshold

Severity compared with decision threshold
Decision whether to refer

Physician’s diagnostic accuracy
Severity assessment

Regret about false negatives

false negatives known to physician

number of false negatives

lost to follow-up

delay

number of false positives

lost to follow-up

delay

false positives known to physician
False Positives
Don’t need treatment, referred anyway

False Negatives
Need treatment, not referred

Decision Threshold

Decision whether to refer

Severity compared with decision threshold

Severity assessment

Physician’s diagnostic accuracy

Regret about false negatives

Physician lowers threshold

Physician raises threshold

false positives known to physician

false negatives known to physician

number of false negatives

number of false positives

Regret about false positives

lost to follow-up

delay

delay

lost to follow-up

Physician lowers threshold

Physician raises threshold

Physician’s diagnostic accuracy

Severity assessment

Physician's diagnostic accuracy

Physician’s diagnostic accuracy

Physician’s diagnostic accuracy
False Positives
Don’t need treatment, referred anyway

False Negatives
Need treatment, not referred

Decision Threshold

Physician lowers threshold

Physician raises threshold

Regret about false negatives

Regret about false positives

Severity assessment

Physician’s diagnostic accuracy

Severity compared with decision threshold

Decision whether to refer

Number of false positives

Number of false negatives

Lost to follow-up

Delay

Delay
False Positives
Don't need treatment, referred anyway

False Negatives
Need treatment, not referred

Physician lowers threshold

Physician raises threshold

Regret about false positives

Regret about false negatives

Number of false positives

Number of false negatives

Severity compared with decision threshold

Decision whether to refer

Severity assessment

Physician’s diagnostic accuracy

Decision Threshold

Delay

Lost to follow-up

Lost to follow-up

Delay

Physician's diagnostic accuracy

56
Results

![CAUTION]

Theoretical model
Uncertainty prevails
Specificity

Sensitivity

70%

Proportion/Probability

Base Case

Note: *moving average over 500 patients
Specificity

70%

Sensitivity

Proportion/Probability

Base Case

1: Increased accuracy

Note: *moving average over 500 patients
Results

If we assume that screening improves accuracy but clinicians ignore thresholds:

• Clinicians will continue to favor PPV over sensitivity
• They will not refer all children who score positive, and
• The impact on detection rates is modest
So what is happening to referral rates?
Change in referrals attributable to screening

Developmental screening trials:
- Schonwald et al., 2009
- Guevera et al., 2013

Behavioral screening trials:
- Murphy et al., 1996
- Hacker et al., 2006
- Stevens et al., 2008
- Wintersteen, 2010
- Berger-Jenkins et al., 2012
- Jonovich & Alpert-Gillis, 2013
- Romano-Clarke et al., 2014

Meta-analyses:
- Developmental & Behavioral Screening Trials
- Depression Trials (Gilbody, Sheldon & House, 2008)

SD MODEL

Change in case identification/referral after implementing evidence-based screening (Relative Risk; 95% CI)

RR=1.8 (95% CI: 1.1-2.9)

RR=.97 (95% CI=0.81-1.18)
Change in avocado purchases attributable to increased accuracy

Avocados

2 Avocados

4 Avocados

Change in case identification/referral after implementing evidence-based screening
(Relative Risk; 95% CI)

PPV = 50%
→ Dinner once/week

PPV = 100%
→ Dinner once/week

PPV = 100%
→ Dinner twice/week

Avocados

Dinner once/week

How many?

2 Avocados

4 Avocados
What does this new model suggest about how to improve detection of developmental-behavioral problems?
Specificity

Sensitivity

70%

Base Case 2: Improved feedback 3. Decreased FP regret

Proportion/Probability

Sensitivity*

Specificity*

Threshold probability*

Note: *moving average over 500 patients
Specificity

Sensitivity

70%

Base Case

Combined intervention

Proportion/Probability

Sensitivity*

Specificity*

Threshold probability*

Note: *moving average over 500 patients
So good theories can be useful.

Can bad theories be harmful?
Evidence-based medicine (EBM)

“Evidence based medicine is not ‘cookbook’ medicine”

“It's about integrating individual clinical expertise and the best external evidence.”

Many screening recommendations

- Postpartum depression
- Autism
- Cognitive/language development
- Fine and gross motor development
- Behavioral symptoms
- ADHD
- Domestic violence
- Tobacco use
- Alcohol and other drug use
- Parental past life experiences (ACES)
Logistics

Each with:

– Several tools to choose from
– Recommended schedule for screening
– Different resources for follow-up

“Drowning in a Sea of Advice”

» *Pediatrics*, October 2006
American Academy of Pediatrics (AAP) Policy Statement

In the long term, what are the consequences of implementing a flawed theory?
Dynamic Complexity

“the often counterintuitive behavior of complex systems that arises from the interactions of the agents over time.”

“Policy Resistance”

“when seemingly obvious solution do not work as well as intended, or even make the problem worse”
Examples

1) Suppression of forest fires $\rightarrow$ ↑tree density, fires
2) Widespread use of antibiotics to treat infections $\rightarrow$ ↑antibiotic-resistant bacteria
3) Anti-lock brakes and rear-window tail lights: designed to prevent accidents, but allow people to drive faster and closer to other cars
4) Low-tar cigarettes: designed to reduce cancer, but people smokes more and breathed more deeply

Are there unintended consequences of screening?

- Implementation of screening
  - Physicians’ accuracy
    - Decision thresholds
      - Identification of disabilities

??
What next?
Reconsider evidence-based medicine (EBM)
Develop (and deliberate) useful theories & models

Evidence-based medicine (EBM)

- Clinical Expertise
- Best Research Evidence
- Patient values & preferences

Decision Node

- Refer/Treat
- Don't Refer

State of Patient

- Diagnosis: None
- Chance: None

Outcome

- QoL(TP)
- QoL(FP)
- QoL(FN)
- QoL(TN)

Expected utility of referral

@ indifference point, these are equal

The Diagnostic Process

Expected utility of referral
Consider process sensitivity & specificity

**Screening instrument administered?**
- yes: $Pr = c_2$ (compliance w/screener)
  - screening result:
    - TP
    - FP
    - TN
    - FN

- no
  - TP
  - FP
  - TN
  - FN

**Clinical exam**
- TP
- FP
- TN
- FN

**Attend diagnostic evaluation?**
- yes: $Pr = c_3$ (compliance w/evaluation)
  - Diagnostic eval result:
    - TP
    - FP
    - TN
    - FN
    - negative result

**Diagnosis**

---

**Process sensitivity**

**Process specificity**
Research shared decision making

Promote professional engagement to improve practice variation
Promote professional engagement to improve practice variation

• Positive deviance
• Cultural exchange theory


Thanks!

Chris Sheldrick, PhD
Boston University School of Public Health
rshldrck@bu.edu