Quantitative Conundrums: 
Linking measures across system levels

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How we are teaching leaders and coaches

- Macrosystem - County Council (Registries)
- Metasystem - Organizations
- Mesosystem - Pathways for subpopulations
- Microsystem - Front Line

Macro to Micro “Drivers”

“Back and forth” (coaching)

Registry Strategy

Improvement Actions

Mico- to Macro cascade “improvement”

Measurement & Accountability

Credit: M Godfrey, TDIMA (2015), adapted
A three stage model

Leaders (Macro level)

Coaches
"Integrators"

“Leaders + Front-line”
Advise and guide
Negotiate conditions

Front Line Improvers
(Micro- and Meso- levels)

Registries
Priority Measures
Driver Diagrams
Creating Conditions
Run Charts & SPC

Aims
PDSA Measures
Data Collection
Tick & Tally
Run Charts
The Cascading Measures Concept

- **Smallest replicable unit of service delivery**
- **2 or more related Microsystems**
- **Multiple Microsystems**
- **“Whole system measures”**
- **Multiple Macrosystems**
- **“National/country measures”**

**Microsystem**

**Mesosystem**

**Macrosystem**

**Metasystem**
Linking Short-Term Process and Long Term Outcome Measures for Improvement...
Measures for Improvement...

Short-term Measures

- Feed-forward & Feed-back
- Registry or “Front-Line”
- Process Outcome Experience (PROM)

PDSA cycle:
1. Plan
2. Do
3. Study
4. Act
Basic cascading measures dashboards...

**Indicator #1: Physical Exercise**

- p Chart (Funnel Limits):
  - Physical Exercise by Area

**Indicator #2: SBP Control**

- SBP Control (XmR Chart)
Driver Diagrams...

Specific aims

Aim

Outcome (Registry)

Primary Drivers

1

2

3

Specific aims

Secondary Drivers

A

C

D

‘Cause the outcome’

Credit: S. Harrison, Sheffield MCA (2014)
The critical assumption...

Do small scale improvement efforts (targeting identified drivers) significantly relate to changes in the longitudinal outcome?
Why this matters...

Leaders (Macro level)

Coaches “Integrators”

Front Line Improvers (Micro- and Meso-levels)

“What work should I prioritize and support, and for how long?”

“How can I get leaders and the front line to see the connections in their work?”

“We are improving here but is it making a difference to the organization (or county)?”
Two analytic pathways...

1) Registry variables available that are applicable to all levels

2) When #1 is not available or practical (often)
The **Swedeheart** registry is a great example of a well developed comprehensive quality register - this particular registry focuses on quality of cardiac care.
• Requires well developed registry with strong penetration across sites

• Process metrics are readily available in the registry

• Variables can be linked at the individual level and aggregated at micro-, meso-, and macro-levels.

• Allows for use of multiple regression analysis, including effect modification, interaction effects, and mediation.

• Allows for predictive modeling

• Problems with confounding (context specific factors)

• Problems with aggregation over time (data collection “too slow” to inform rapid cycle change)

Table 1. The SWEDEHEART quality index.

<table>
<thead>
<tr>
<th>Quality Indicator</th>
<th>0.5 points</th>
<th>1 point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reperfusion in STEMI/LBBB</td>
<td>80</td>
<td>85</td>
</tr>
<tr>
<td>Reperfusion in STEMI/LBBB within recommended time</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Coronary angiography in target group in NSTEMI</td>
<td>75</td>
<td>80</td>
</tr>
<tr>
<td>P2Y12 blockers in NSTEMI</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>ACE inhibitors/ARBs in target group for myocardial infarction</td>
<td>85</td>
<td>90</td>
</tr>
<tr>
<td>Proportion with myocardial infarction as principal diagnosis (&lt;80 years) included in RIKS-HIA</td>
<td>90</td>
<td>95</td>
</tr>
<tr>
<td>Proportion of myocardial infarctions &lt;75 years in RIKS-HIA undergoing follow-up (SEPHIA)</td>
<td>75</td>
<td>90</td>
</tr>
<tr>
<td>Proportion of smokers who have stopped after 12–14 months</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Proportion who have taken part in physical training programme after 12–14 months</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Proportion with LDL cholesterol &lt;1.8 mmol/L or &gt; 50 reduction after 12–14 months</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Proportion with systolic blood pressure &lt;140 mmHg after 12–14 months</td>
<td>70</td>
<td>75</td>
</tr>
</tbody>
</table>
Pathway #2: Door to Needle Time (Thrombolysis)

- Reduce average "door to needle time" (> 60 minutes) 2012-13
- % with referral orders
- X-ray process cycle time
- Improved average "door to needle time" (22 minutes) 2014
- NOT IN REGISTRY SYSTEM LEVEL

Registry → SHORT-TERM PROCESS MEASURES → Registry

Registry → NOT IN REGISTRY SYSTEM LEVEL → Registry
A common situation...

- Some registries are “young”
- Many variables needed for front line improvement N/A
- Registry variables “move too slow”
- Can’t link between levels at the same unit of analysis
- Can’t control (or identify) context specific effects
- Often end up assuming (hoping) that a relationship exists and that the improvement effort will have an effect.
An option for linked analysis...

Set the PDSA group (or system) as the unit of analysis.

“Drivers”

PDSA 1
PDSA 2
PDSA 3

Start with simple bivariate correlations for each path...

Micro- or Meso-level improvement measures

Aim
Outcome (Registry)
An option for linked analysis...

Aim

Outcome (Registry)

“Drivers”

PDSA 1

PDSA 2

PDSA 3

Micro- or Meso- level improvement measures

Follow with a factor analysis to determine “driver groupings”
Create a Structural Equation Model

**Aim**

Effect of coaching, effect of context, a confounder, etc.

**Outcome** (Registry)

Unidentified latent variable

**“Improved access”**

“Latent Variables”

“Improved self-care”

“Original Drivers”

PDSA 1

PDSA 2

PDSA 3

“Simultaneous improvement and research knowledge generation”

Micro- or Meso-level improvement measures
An industrial example (and a potential translation)...

Improvement method, improvement coaching

PDSA 1 (or Microsystem 1)

PDSA 2 (or Microsystem 2)

Macro-level outcome (Registry)

Or it might not work...

Thank you! Questions and discussion please...