Solution-Oriented Research to Prevent & Treat Childhood Obesity

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Clinical & Public Health Practice & Policy

Questions: What works?
What should we do?
How do we do it?
To whom?

Answer: Ummm. We don’t really know, but...

Expert panels
Make recommendations, evidence insufficient, recommend more research
Not meeting our needs (not fast enough)
Problem-oriented research paradigm

Focus on etiologies or determinants of diseases and risk factors ("problems")

Goal: to generate hypotheses about potential treatment, prevention, and control strategies ("solutions")

Assumption: Knowing the cause of a problem is necessary to know how to treat or prevent it

Many successes: antibiotics for infectious diseases, statins for cholesterol, etc.; basis for future promise from genomics, microbiome, and personalized medicine…

Very comfortable for researchers (reductionist)

I am NOT rejecting the value of problem-oriented research

…but it often falls short
“...Of 101 very promising claims of new discoveries with clear clinical potential that were made in major basic science medical journals between 1979 and 1983, only five resulted in interventions with licensed clinical use by 2003 and only one had extensive clinical use.”


Underpants Gnomes
A complementary research paradigm: solution-oriented

Focus on etiologies of health ("solutions")
Can be based on hypotheses generated by problem-oriented research, but not always
Assumption: it is not always necessary to first know the cause(s) of a problem to determine how to effectively prevent or treat it
Present & future oriented: factors that preceded, accompanied, caused or contributed to the problem in the first place may no longer exist or be susceptible to change.


A complementary research paradigm: solution-oriented

Perceived to be higher risk by researchers…but should be more comfortable for clinicians and public health practitioners (e.g., John Snow and the Broad Street pump)
Emphasizes the questions: “what works, how to do it, and to whom?” Most relevant for clinical and public health practice and policy
Shortens the time lag from discovery to improved population health

## Contrasting research paradigms

<table>
<thead>
<tr>
<th>Problem-Oriented</th>
<th>Solution-Oriented</th>
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<tbody>
<tr>
<td>• Past orientation (historical)</td>
<td>• Present or future orientation</td>
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<tr>
<td>• Assumes reversal of identified causal factors will result in a solution</td>
<td>• Knowing cause may or may not lead to a solution (e.g., Sickle Cell Anemia)</td>
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<td>• Factors that preceded, accompanied, caused or contributed to the problem in the first place may no longer exist or be susceptible to change.</td>
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### Example: screen time & obesity

Observational studies depend on validity of measures of screen viewing.

Associations attenuated or biased by measurement error.

Even an experimental study proving that increased television watching causes obesity would not tell us what to do about it (and/or how).

Solution-oriented: RCT of effects of reducing screen time on weight gain.

Robinson, TN. *JAMA* 1999;282:1561-7
### Implications for study design & interpretation

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<tr>
<td>• Experimental studies – capable of proving causality for the problem</td>
<td>• Experimental studies – capable of proving causality for improved health</td>
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<tr>
<td>• Observational (epidemiological) studies</td>
<td>• Exposure manipulated</td>
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<tr>
<td>- incapable of proving causality</td>
<td>- less influenced by measurement error</td>
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<tr>
<td>- more limited by measurement error</td>
<td>- better effect size estimate</td>
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<tr>
<td>- moderators and mediators may or may not be relevant</td>
<td>- identified moderators and mediators can be used to target treatments and identify possible mechanisms</td>
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<tr>
<td>- more likely to be &quot;wrong&quot;</td>
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### Example: SSBs and Obesity

**Beverage industry says not proven to be the cause of obesity.**
Observational studies unable to prove cause so no amount of observational data will satisfy industry or critics

Even an experimental studies proving that SSB consumption causes obesity will not satisfy industry or critics

“Officials with the American Beverage Association, the trade association for makers of nonalcoholic beverages, criticized the studies, saying that obesity is not caused by a single food or beverage…” Rabin RC. *NY Times*, Sept. 21, 2012

Generating new hypotheses

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<td>Hypotheses re: treatment and prevention limited to identified causes and risk factors</td>
<td>Frees investigators to generate and test innovative, theory-based, and interdisciplinary treatment and prevention hypotheses to improve health (e.g., energy balance).</td>
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Stealth Interventions

Does a health behavior change intervention need to look, feel, sound, smell or taste like health education?

Where physical activity/reduced inactivity or diet changes are “side effects” of the intervention

Robinson TN. Obesity, 2010;18(suppl 1):S17-S22.
Motivation

To adopt the new behavior (the outcome)

To participate in the intervention itself (the process)

Motivation for physical activity and eating behaviors

Medical/Public Health
- Obesity
- Diabetes
- Hyperlipidemia
- Hypertension
- Risk for CVD & Cancer

Children (and Adults)
- Fun / Taste
- Choice & Control
- Goals & Challenge
- Pride, sense of accomplishment
- Peer/social approval/disapproval
- Parent/adult approval/disapproval
- Personal appearance
- Social interaction
Taking Stealth Interventions to the Next Level

Social & Ideological Movements

- Environmental Sustainability/Climate Change
- Food Justice/Urban Agriculture
- Food Safety
- Community Safety, Beautification, Traffic Reduction
- Human Rights/Social Justice
- Anti-Globalization/Nationalism
- Animal Protection
- Political Action
- Anti-Consumerism
- Violence and Crime Prevention
- Cause-Related Fundraising
- Energy Independence
- National Security/Anti-Terrorism

Solution-Oriented Policy Research

Let’s Move, USDHHS, USDA, FDA, USDOT, USDOEd, States, Counties, Cities, School Boards, Community Centers...

Observational studies (including “natural experiments”) provide supporting or circumstantial evidence

Solution-oriented policy studies: Experimental, can demonstrate cause & effect, and better estimates of effects, costs, potential side effects/unintended side effects, comparisons between policy alternatives.

Feasible? 20+ states mandate BMI/weight screening in schools. Many surveillance programs.

Too expensive? Not compared to costs of getting it wrong.

Robinson TN. Obesity, 2010;18(suppl 1):S17-S22.

Robinson TN. Arch Pediatr Adolesc Med 2012;166:189-90
Multi-Level vs Systems Approaches

- Holistic
- Dynamic
- Interactions
- Feedback Loops
- Non-Linear Changes
- Multiple causal pathways


www.foreight.gov.uk

Systems Science ≠ Modeling

“All models are wrong but some are useful”
- George E. P. Box
Robustness in the Strategy of Scientific Model Building (1979)

- Unmeasured factors (you don’t know what you don’t know)
- Measurement error
- Non-linear changes
- Complex interactions (higher order & order effects)
The butterfly effect: The difference between hitting .250 and .300

Solutions Science meets Systems Science

- Holistic
- Dynamic
- Interactions
- Feedback Loops
- Non-Linear Changes
- Multiple causal pathways

www.foresight.gov.uk
Is systems thinking new to public health/behavior change research?

Stanford Three Community Study
North Karelia Study
Stanford 5-City Project
Minnesota Heart Health Program
Pawtucket Heart Health Program

Barriers to solution-oriented research

- Inertia - training/education
- Definition of clinical, translational and public health research
- More difficult?
- Tougher to build a thick C.V.

Consequences:
Repeatedly confirm (or refute) the same set of correlates (and possible causes) without getting much closer to knowing how to intervene.

Ethical Implications:
Do potential benefits balance costs?
time, effort, inconvenience, known and unknown risks, etc.

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<td>• If re-discovering or re-generating the same hypotheses, does that help participant or others or advance knowledge?</td>
<td>• Questions of immediate relevance to practice and policy</td>
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<td>• Even if no humans involved, responsibility to funders (public) to advance knowledge to improve health</td>
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A Proposed Litmus Test

Clinical medicine: Do not order a test unless...

(1) you know what you will conclude from any possible result AND
(2) the result may change the care of the patient

Clinical & Public Health Research: Do not perform a study unless...

(1) you know what you will conclude from any possible result (positive, negative or null) AND
(2) the result may change how you intervene to address a clinical or public health problem

Example: neighborhood safety and physical activity

Current approach: cross-sectional or prospective observational study of objective or subjective measures of neighborhood safety and physical activity.

Will any result change your hypothesis?

What will you conclude from a null result?
What will you conclude from a significant negative result?
What will you conclude from a significant positive result?

Would any result change what you would do?

Solution-oriented studies: RCTs of theory-driven neighborhood safety interventions.
Solution-Oriented Research

- Focus on testing solutions rather than documenting problems -- assumption: it is not always necessary to first know the causes of a problem to determine how to effectively prevent or treat it
- Present and future oriented (vs. looking back)
- Experimental rather than observational
- Frees investigators to generate and test innovative, theory-based & transdisciplinary hypotheses (e.g., stealth interventions)
- Ethical
- Consistent with systems thinking, non-linear changes, involving complex, higher-order interactions & feedback loops
- Know what you will conclude from any possible result and the result may change clinical or public health practice/policy
- Most direct pathway to evidence for what works, how to do it, and to whom
- Reduces lag from discovery to improved population health
Phase 1. Generate hypotheses about causes & mechanisms of illness (problem-oriented)

Clinical observations
Basic science/animal studies
Case-Control and cross-sectional correlates studies
Prospective risk (protective) factor studies (establish temporal associations) -- includes natural history studies/natural experiments

Collect Underpants

Problem-Oriented Research  Solution-Oriented Research
Phase 2. Test hypothesized treatment, prevention and control strategies (solution-oriented)

Feasibility/pilot/safety studies (whether worth testing efficacy at all)

Efficacy trials
  Moderators & Mediators

Effectiveness research
  Moderators & Mediators

Diffusion research
Solution-Oriented Research: A Proposed Litmus Test

Clinical & Public Health Research:
Do not perform a study unless...

(1) you know what you will conclude from any possible result (positive, negative or null) AND

(2) the result may change how you intervene to address a clinical or public health problem