Seventh: Now you are ready to demonstrate that you have been successful - how to choose your outcomes?

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Declarations

• No relevant conflicts
Fast and furious.

www.quora.com
Exhausted but determined.
Take home messages.

• Our central problem is that the characteristics of an **ideal outcome measure** are frequently in opposition

• A **conceptual model** of the causal chain between intervention and patient outcome could be useful in selecting outcome measures
  • Patient outcomes: clinical outcomes & patient derived outcomes
  • Surrogate measures: fidelity, intervening variables, and process measures

• **To maximise impact**, we should consider decision makers when selecting outcome measures
• Eli Perencevich has discussed surveillance

• Maaike van Mourik has discussed automated/semi-automated surveillance

So I’m going to:
• Focus on selection of outcome measures to evaluate an intervention
• Take a conceptual approach rather than too many details
What are the ideal characteristics of an outcome measure in infection prevention and antimicrobial stewardship research?

SHEA White Paper

Research Methods in Healthcare Epidemiology and Antimicrobial Stewardship: Randomized Controlled Trials

Deverick J. Anderson (a1), Manisha Juthani-Mehta (a2) and Daniel J. Morgan (a3)  
https://doi.org/10.1017/ice.2016.93  Published online: 25 April 2016
All outcomes

Sufficiently common to detect a difference between groups

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Easy and objective to ascertain

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Relevant to patients and clinicians

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Relevant to clinicians

the problem

Overview

• Conceptual framework

• Patient outcomes

• Surrogate end points

• Selecting outcomes to optimise impact
The Quality of Care
How Can It Be Assessed?

Avedis Donabedian, MD, MPH

Those who have not experienced the intricacies of clinical practice demand measures that are easy, precise, and complete—as if a sack of potatoes was being weighed.

Donabedian Model. A framework for examining health services and evaluating quality of health care.

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“The attributes of the settings in which care occurs.”

Donabedian Model.
A framework for examining health services and evaluating quality of health care.

“What is actually done in giving and receiving care.”

Donabedian Model. A framework for examining health services and evaluating quality of health care.

Structure → Process → Outcome

“The effects of care on the health status of patients and populations.”

Structure
The attributes of the setting.
Process
What is actually done.
Outcome.
Effects on health status of the user.
Donabedian Model.

Examples:

- Staff to patient ratio
- Availability of ABHR

- Hand hygiene compliance

- Appropriate prophylactic antibiotics

- S. aureus bloodstream infection

- Surgical site infection

Human error: models and management
James Reason

- Systems approach to patient harm
- The holes in the defences arise for two reasons: active failures and latent conditions.
  - **Active failures** are the unsafe acts committed by people who are in direct contact with the patient or system.
  - **Latent conditions** are the ‘resident pathogens’ within the system. They arise from decisions made by designers, builders, procedure writers, and top level management.

Reason J. *BMJ* 2000;320:768
A causal chain linking interventions to outcome.

Structure → Management processes 
Latent errors

Intervening variables, eg, morale

Fidelity

Generic intervention

Clinical processes 
Active errors

Fidelity

Specific intervention

Patient outcomes

Throughput, eg, number of patients treated

Outcome selection in infection prevention literature

Interventional studies + Specialty journal + Published in 2018 = 43 papers

Title includes:
- “quasi-experimental”
- “before-after”
- “randomised”
- “randomized”

AJIC
ARIC
ICHE
JHI

Stephanie Curtis

ESCMID eLibrary

MONASH University
Primary Outcomes.

- Management processes
  - Latent errors

- Clinical processes
  - Active errors

- Intervening variables, eg, morale

- Patient outcomes
  - Infection: 10 (23%)
  - Colonisation acquisition: 8 (19%)
  - Colonisation loss: 1
  - Other clinical outcome: 1
  - Colonisation of environment or healthcare worker: 8 (19%)

- Staff knowledge & skills: 2
- Human-factors usability and subjective experience: 1

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Overview

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• Surrogate end points
• Selecting outcomes to optimise impact
Types of patient outcomes

**Clinical**
e.g. morbidity or mortality

**Patient-derived**
e.g. quality of life or patient satisfaction

More relevant to patients?
Types of patient outcomes

**Clinical**
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More relevant to patients?
Key considerations

• Type of events
  • Colonisation
  • Infection

• The way we measure these events
  • Count 2
  • Prevalence 1
  • Incidence proportion 9
  • Incidence rate 5
  • Burden (incidence + outcome) e.g. DALYs
Use a standard definition. Importance for evidence synthesis.

• Systematic review of strategies to reduce non-ventilator-associated hospital-acquired pneumonia

• 15 articles

• Almost as many different definitions for NV-HAP:
  • Chest x-ray + clinical symptoms of pneumonia
  • Administrative coding data
  • Clinical Pulmonary Infection Score
  • Centers for Disease Control and Prevention (CDC) definition
  • Local national professional guidelines
  • No clear definition

Mitchell, Russo et al. Submitted.
Make a trade-off between power & clinical relevance.

Clinical relevance

- Process errors
  - e.g. hand hygiene omissions

Colonisation

Sufficiently common to detect difference between groups

Infection
Consider the signal-to-noise ratio

Patient outcomes targeted by an infection prevention interventions are influenced by many other factors.

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Select an outcome with high signal-to-noise ratio
~ preventability

- HA-BSI
- Other causes
- Error

- CLABSI
- Other causes
- Error
Only include the subset of outcome cases caused by error.

Appropriate antibiotic use

Inappropriate antibiotic use

Broad spectrum antibiotic use

BUT involves agreeing on definitions, training of assessors, subjectivity & blinding etc..
Baader-Meinhof Phenomenon in action
Outcome selection issues mentioned this ECCMID…

- Denominator selection for device-related infections
  - Events per device-days vs. events per patient-days
  - Device-days may under-estimate impact of interventions that reduce device use

- Hospital ‘acquisition’ of colonisation based on culture date
  - 48-hour rule for community-onset vs. hospital onset
  - Much more convenient than screening on admission
  - But results in misclassification bias
Types of patient outcomes

**Clinical**
e.g. morbidity or mortality

**Patient-derived**
e.g. quality of life or patient satisfaction

More relevant to patients?
**Patient-reported experience measures (PREMs)**

- Capture a person’s perception of their experience with health care and health services
  
  *patient satisfaction*

  - Examples:
    - time spent waiting
    - access to and ability to navigate services
    - involvement in decision making
    - knowledge of care plan and pathways
    - quality of communication

**Patient-reported outcome measures (PROMs)**

- Capture a person’s perception of their health
  
  *Can be condition specific or generic*

  - Examples:
    - Quality of life e.g. EQ-5D, AQoL
    - Symptoms e.g. pain (NPRS), fatigue (FSS)
    - Distress e.g. depression (K10, PHQ2), anxiety (GAD7)
    - Functional ability e.g. WHODAS 2.0, ODI
    - Self-reported health status e.g. SF-36
    - Self-efficacy e.g. GSE
Impact of wound edge protection devices on surgical site infection after laparotomy: multicentre randomised controlled trial (ROSSINI Trial)

- RCT evaluating standard care or the use of a wound edge protection device during surgery
- Primary outcome: Surgical site infection within 30 days of surgery
- Secondary outcome: health related quality of life using the EuroQol (EQ-5D 3L) tool.
- No difference in QoL between arms

Pinkney et al. BMJ 2013;347:f4305
Overview

- Conceptual framework
- Patient outcomes
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- Selecting outcomes to optimise impact
Surrogate end points

- Structure
- Management processes: Latent errors
- Clinical processes: Active errors
- Patient outcomes
- Intervening variables, eg, morale
- Fidelity
  - Generic intervention
  - Specific intervention
- Throughput, eg, number of patients treated

Why evaluate surrogate end points?

• Conventional RCTs ask the question, “does it work?”

• For ‘complex interventions’ there is need for further information

• Process evaluations help in the interpretation of the outcome result: “how and why does it work?”
1. **Fidelity** = Extent to which an intervention is implemented as intended

<table>
<thead>
<tr>
<th>Study result</th>
<th>High implementation fidelity</th>
<th>Low implementation fidelity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive impact on patient outcomes</td>
<td>Supports plausibility of the benefit of the intervention</td>
<td>Substantial changes are unlikely to be attributable to the intervention</td>
</tr>
<tr>
<td>No impact on patient outcome</td>
<td>Intervention is inherently faulty (failure of intervention concept or theory)</td>
<td>Intervention was badly delivered (implementation failure)</td>
</tr>
</tbody>
</table>
The Feedback Intervention Trial (FIT) — Improving Hand-Hygiene Compliance in UK Healthcare Workers: A Stepped Wedge Cluster Randomised Controlled Trial

• Stepped wedge cluster RCT evaluating the impact of a feedback intervention on healthcare worker hand hygiene compliance
• Setting: 16 English/Welsh Hospitals
• Complex intervention: involving observation, feedback and personalised action planning

**Fidelity to intervention.** Ward co-ordinators were asked to fill out a form to record, observations, feedback, goals and action plans (www.idrn.org/nosec.php) each time an observation and/or feedback session took place and to return them to the study team. The number of forms returned each month was used as a proxy measure of fidelity to intervention.

974 forms were returned, representing 33% of the 2948 forms expected from the 33 implementing wards.

“The intervention proved harder to implement than anticipated, and further implementation studies are required”

2. Intervening variables

- Some (diffuse) interventions aim to strengthen an organisation in a generic sense.
  e.g. increasing ‘safety culture’
- For these, it is useful to measure “intervening variables” that result in impact on clinical errors.

Promoting health workers’ ownership of infection prevention and control: using Normalization Process Theory as an interpretive framework

D.J. Gould, R. Hale, E. Waters, D. Allen

Generic Intervention
Frontline ownership checklist
In South Wales health board

Management processes → Intervening variables → Clinical processes → Patient outcomes

18 months post-intervention
- *C. difficile* rates down 42%
- MRSA rates below the national average
- Caesarean SSI better than in the rest of the country
- CLABSI decreased

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D.J. Gould, R. Hale, E. Waters, D. Allen

How might the generic intervention have resulted in these outcomes?

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Generic Intervention
Frontline ownership checklist
In South Wales health board

Qualitative interviews with clinical staff
Themes included:
• ‘Always being vigilant’
• ‘Importance of access to information’
• ‘Being able to learn together in a no-blame culture’

3. Clinical process (active error)

- We are very familiar with monitoring these – audits, checklists

- Clinical process is the closest surrogate to patient outcomes
  - Causally & chronologically

- Usually more common than the corresponding patient outcome

- More power to detect an impact
• What circumstances lead to active failures in transmission-based precautions?
• Direct observation inside and outside patient rooms on clinical units
• Patients in contact or droplet precautions
• 325 room observations conducted at 2 sites
• 283 failures observed
  • 102 violations (deviations from safe operating practices or procedures),
  • 144 process or procedural mistakes (failures of intention)
  • 37 slips (failures of execution).
• Behavioural, organisational, and environmental strategies needed
A potential downside
May be hard to capture the impact of ‘generic interventions’ on all processes that are involved.
Overview

- Conceptual framework
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- Selecting outcomes to optimise impact
A “beautiful” study is not enough to change practice
Tips from implementation science

• To optimise impact, when designing your study, be clear about:
  • What is the decision that we’re trying to inform?
  • Who are the decision makers? clinicians, patients, managers, policy makers, research funders…
  • What information do these decision makers need?

• When selecting outcome measures: “If this trial shows positive clinical impact, what are the other pieces of information that decision makers need, and how can we collect that information as part of this trial?”

What information do decision makers need?

- How big is the problem we’re trying to address? (incidence & outcomes)
- What is the real benefit of this intervention and who will benefit?
- What are the alternatives?
- What are the start-up costs?
- What are the maintenance costs?
- Is it cost-effective?
- What are the potential unintended consequences?
- Is it acceptable to & supported by hospital staff?
- Is it acceptable to patients & families?
- Can it be integrated into service delivery or does it require a different model of care?
- How do we implement this?
- What are the reputational implications?
- How does this align with organisational values and performance indicators?
Selecting outcomes to increase impact.

- Involve decision makers at study design phase

- Ensure that your study to addresses questions beyond the primary outcome:
  - Process evaluations
    - Intervention fidelity
    - Qualitative assessment
    - Theory-based process evaluation
  - Economic evaluation
Intervention → Process measures
Implementation fidelity
Intervening variables

Qualitative
Quantitative

Clinical Outcome

Harms

Cost-effectiveness analysis
Take home messages.

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  • Trade-offs are required

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