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What is Translational Research?

Catarina I. Kiefe
University of Massachusetts Medical School

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What is Translational Research?

Catarina Kiefe, MD, PhD
University of Massachusetts Medical School
Dept of Quantitative Health Sciences
May 20, 2011
DISCLOSURE

I have no actual or potential conflict of interest in relation to this program or presentation.
Overview

- Translational Science
  - Why?
  - What?
    - The translational spectrum: a changing nomenclature
- “Bench to beside”: a limited paradigm
  - Wrong endpoint (bedside)
  - Wrong direction: what about “bedside” to bench?
- Charge for the day
Why Translational Science?

• Median time from description of a new discovery in a basic science journal to publication of use of this discovery in a highly cited article in the medical literature: 24 years

• Mean time to implement a new clinical research finding into practice: 17 years
  • Balas, Boren, *Yearbook Medical Informatics*, 2000
Translational Blocks in the Clinical Research Continuum

Translational Research in US

- Introduced as part of NIH Roadmap

- NIH Definitions used in CTSA funding (e.g. RFA-RM-10-020)
  - Clinical research comprises studies and trials in human subjects
  - Translational research includes two areas of translation:
    - Applying findings from laboratory research and preclinical studies to the development of trials and studies in humans
    - Enhancing the adoption of best practices in the community
Translational Research in Europe

• **UK Cooksey Report:**
  • Process of taking the findings of either basic or clinical research to produce innovations in health care settings
  *Cooksey 2006. The Stationery Office. London*

• **The European Advanced Translational Research Infrastructure in Medicine (EATRIS)**
  • Funded in part by European Union, to be established through both public and private funds
  • “Maintain Europe's competitiveness in biomedical research and health industry”
The Continuum of Clinical and Translational Science

T1
First in Human
Phase I-II Trials
Proof of Concept

T2
Phase III Trials
Clinical Efficacy
Clinical Guidelines

T3
Dissemination
Community Engagement
Health Services Research
Comparative Effectiveness

T4
Public Health
Prevention
Population Health Impact
Behavioral Modifications
Lifestyle Modifications

Adapted from Waldman and Terzic. Clin Transl Sc 2010 3(5): 254-7
The Continuum of Clinical and Translational Science

T0
- Targets
- Biomarkers
- Genes
- Pathways
- Mechanisms

T1
- First in Human
- Phase I-II Trials
- Proof of Concept

T2
- Phase III Trials
- Clinical Efficacy
- Clinical Guidelines

T3
- Dissemination
- Community Engagement
- Health Services Research
- Comparative Effectiveness

T4
- Public Health
- Prevention
- Population Health Impact
- Behavioral Modifications
- Lifestyle Modifications

T5
- Social Health Care
- Political Security
- Economic Opportunity
- Access to Education
- Access to Health Care

Adapted from Waldman and Terzic. Clin Transl Sc 2010 3(5): 254-7

- T0: Genome
- T1: Moves genome-based discovery into candidate health application (eg genetic tests)
- T2: Assesses value of application for health practice, leads to evidence-based guidelines
- T3: Moves guidelines/evidence into practice
- T4: Evaluates “real world” health outcomes of genomic applications
- T5: Studies genomics in the context of the social determinants of health
- <3% of genomic research focuses on T2 – T5
T1 vs. T2+: Changing Boundaries

• Initially, translational research required “whole humans” or human population groups as study units. Evolving nomenclature:
  • T1 research takes knowledge from the bench (“wet lab”) to clinical knowledge
    • Initially: Phase 1-3 clinical trial (including RCTs)
    • Recently: also “T0”, mice, even cells…
  • T2+ research takes clinical knowledge into realized human benefit
    • E.g. Group-randomized implementation trials
    • Recently: also phase 3 clinical trials
T1 versus T2+ Research

- **T2+ defining elements:**
  - “dry lab” research that uses statistics and epidemiology as its basic tools
  - The study units may be individual humans, groups of humans (populations), or health systems

- **T1 defining elements:**
  - May also use “wet lab” tools but used to involve “whole humans”
  - Study unit now from lab animal to individual patient

- **Cultural innovations for both:**
  - Transdisciplinary, team science
  - Bidirectionality as emerging concept
Overview

✓ Translational Science
  ✓ Why?
  ✓ What?
    ✓ The translational spectrum: a changing nomenclature

• “Bench to beside”: a limited paradigm
  • Wrong endpoint (bedside)
  • Wrong direction: what about “bedside” to bench?

• Charge for the day
Example: Type 2 Diabetes Prevention

- Chronic hyperglycemia causes severe end-organ damage through fairly well understood pathophysiology (T0, T1)
- T0-T1 research has resulted in multiple medications that control hyperglycemia
- Solid clinical research links Type 2 diabetes to overweight/obesity (T2 - T3): the diabesity epidemic
Why T2+ Research?

• The diabesity epidemic

Prevalence of obesity among men in the US

With a parallel rise in the incidence of diabetes

Freedman MMWR 2011
Important Translational Question

- Weight loss and other lifestyle modifications improve glucose control in patients with diabetes
- Can lifestyle modification and weight reduction PREVENT diabetes?
Diabetes Prevention Program (DPP)

• RCT: 3,234 persons at 27 centers, followed for 10 years \textit{Knowler, NEJM 2002; Knowler, Lancet 2009}

• Cumulative incidence of DM2 lowest in lifestyle group:
  • 58% lower incidence at 1 year
  • 34% lower incidence at 10 years

• Classical efficacy study (T1 – T2)
  • Oral GTT as the screening tool
  • Very intensive, expensive one-on-one intervention
  • Educated population, all literate
  • Overweight/obesity assumed important mediator
Why Research Beyond the “classical” RCT?

• DPP efficacy study notwithstanding, diabesity epidemic marches on

• Lawrence Latino “DPP” (LLDPP)
  • community-based effectiveness study – “real world”
  • 252 at risk pts randomized
  • Group-based less intensive intervention
  • Inexpensive
  • 30% of population illiterate in Spanish and English
DPP vs. LLDPP outcomes at 1 year

<table>
<thead>
<tr>
<th></th>
<th>DPP</th>
<th>LLDPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (lbs)</td>
<td>17</td>
<td>3.1</td>
</tr>
<tr>
<td>HgbA1c (%)</td>
<td>0.1</td>
<td>0.1</td>
</tr>
</tbody>
</table>

* Numbers approximate; personal communication from I Ockene

Why similar effect of intervention on hyperglycemia, yet much weaker effect on weight????
Why different effects
LLDDP vs. DPP?

- Efficacy vs. effectiveness study?
  - But effect on HgbA1c was similar
- Different populations?
  - Some Latino groups, Native Americans know to be exquisitely sensitive to weight gain re diabetes incidence
  - Are we seeing reverse effect here?
- Need to investigate mechanism that underlies these differences: genetics?
Bidirectionality

• Should our approach remain linear?

OR

• Should transdisciplinary teams implement true bidirectionality?
Team Science, Bidirectionality

T5 — T0

T4 — T5

T3 — T4

T2 — T3

T1 — T2

Health Care

Molecules

Population Health
3 Historical Examples of Bidirectionality

*Rutter and Plomin, Psychol Med 2009*

- **Tobacco and lung cancer**
  - First: Epidemiologic studies *Doll and Hill, BMJ 1950 and 1954*
  - Later: clinical and animal studies, then gene expression studies *Wen, Mod Path 2011*

- **Lipids and heart disease**
  - Initial rabbit studies ignored (1913)
  - Epidemiologic evidence in 1956
  - Basic lab research in ‘70s: model of how LDL causes atherosclerotic lesions
  - LRC trial in the 80s, large statin RCTs in 90’s

- **Fetal alcohol syndrome**
  - Clinical observations define syndrome *Kl Jones, Lancet 1973*
  - Mice studies confirm
SUMMARY

• Translational research is
  • Transdisciplinary
  • Bidirectional
  • Driven by the need to move from knowledge for the sake of knowledge to realized human benefit
  • Reminds us that
    “Science without conscience is the soul’s perdition”  Rabelais, Pantagruel, 1572
QUESTIONS??????
Charge for the Day

- Look for bidirectionality
  - Keynote lecture
  - Mini-symposia
  - Posters
- Think transdisciplinary teams
  - Next presentation, lunch, coffee breaks
- Tell us how to do better
  - Fill-out evaluations
- HAVE FUN
  - All day long and evening reception with posters
  - 5 prizes for best posters at evening reception