Asking an answerable research question to contribute to “25 x 25”

D Prabhakaran FRCP, FNASc

Executive Director, Centre for Chronic Disease Control, New Delhi
Director, CoE-CARRS, Public Health Foundation of India
Adjunct Professor, Emory University
Honorary Professor, London School of Hygiene and Tropical Medicine
Asking a research question: Outline

• Identifying the problem and asking the overarching question?
• Understanding the challenges from multiple angles
• Identifying resources, Innovations and approaches
• A case study
Set of 9 voluntary global NCD targets for 2025

- Premature mortality from NCDs 25% reduction
- Essential NCD medicines and technologies 80% coverage
- Drug therapy and counseling 50% coverage
- Diabetes/obesity 0% increase
- Raised blood pressure 25% reduction
- Tobacco use 30% reduction
- Salt/sodium intake 30% reduction
- Physical inactivity 10% reduction
- Harmful use of alcohol 10% reduction
Larger Question

• Can we reduce high blood pressure burden in India by 25% in the next 12 years?
What is needed?

• We need a benchmark to start with!
  – Situational analysis/ Epi data/Surveillance

• We need to know what works and what does not?
  – Clinical trial evidence (drugs; strategy etc)

• Will the policy makers be receptive?
  – Policy research

• Is there enough financial resources?
  – Economic modeling; costing; utility; Best buys

• Do we have enough human resources
  – Physicians/non physician health care providers

• Will the non health sector be receptive
  – Establishing a multi-disciplinary structure and multi sectoral framework
What do we know?

..... Control of blood pressure is no longer disputed & is supported by most impressive evidence base accumulated over the last 40 years both for individuals and populations.
Compliance with BP Medicines in the UK

- Persistence
- Adherence/compliance
- Perfect adherence

Fall in adherence because of discontinuation of treatment
Fall in adherence because of poor execution of dosing regimen

No of patients remaining in study: 3108 980 828 618 474 400 331

Vrijens et al. BMJ 2008;336:1114-7
Beyond Policy: Main Challenges?

Health system challenges
• Lack of access
• Uneven distribution of health care
• Curative care over prevention
• Insufficient human resources
• Lack of clear guidelines

Individual challenges
• Costs of care and out of pocket expenditure
• Compliance
• Inability to change behaviors

Several innovations have the potential to overcome these challenges
What are the innovations needed for hypertension management and control

- Individual level
  - Improving compliance
  - FDC
- Health system strengthening through task shifting and task sharing; team based care
- Role of structured behavior change using frontline health care workers
- Population level Salt reduction
- Integration of chronic care
- Setting based interventions
- Use of affordable technologies
• Health system strengthening through task shifting and using inexpensive technology
  – An example of disruptive innovation

• **Disruptive innovation**: An innovation that creates a new market by applying a different set of values, which ultimately (and unexpectedly) overtakes an existing market.
A gallery of **disruptive technologies**

**Estimated potential economic impact of technologies across sized applications in 2025, $ trillion, annual**

1. Mobile Internet
2. Automation of knowledge work
3. Internet of Things
4. Cloud
5. Advanced robotics
6. Autonomous and near-autonomous vehicles
7. Next-generation genomics
8. Energy storage
9. 3-D printing
10. Advanced materials
11. Advanced oil and gas exploration and recovery
12. Renewable energy

**SOURCE:** McKinsey Global Institute
mHealth technologies

- Consumers: improved convenience, more active engagement in self-care, and greater personalization.
- Clinicians: Reduced demands on time and refocus on the art of medicine.
- Potential to change every aspect of the health care environment and to do so while delivering better outcomes and substantially lowering costs

Need: Real-world clinical trial evidence to provide a roadmap for implementation

Steinbuhl, Muse, Topol, JAMA, Oct 2013
Health System Intervention: Approaches

- Inter/multidisciplinary
- Trans Disciplinary
Inter disciplinary research

• Simple: Collaboration on a question of mutual concern to investigators from different disciplines e.g.; TB In individuals with diabetes

• Complex: Prevention of obesity
Multidisciplinary Research

Study of multiple facets of a problem, with questions of both separate and convergent interest to investigators, eg; cardiologists, biochemists, geneticists, public health experts, policy makers........)
From asking a research question to scaling up: an example

Can we demonstrate the efficacy of frontline health workers enabled with IT or smart phones in reducing outcomes for patients with hypertension and diabetes?
IT support systems in HT management: What is the evidence?

Difference in SBP (mm of Hg) between the DSS (both computerised and non-computerised) versus control groups

mhealth in HT: Development of DSS

Development
- Stakeholder and situational analysis
- Algorithmic approach based on guidelines
- Knowledge base development
- Feb - April 2011

Beta Testing
- End user testing
- User interface fine tuning
- Feedback sessions
- May – June 2011

Validation
- Real versus virtual comparison
- DSS output compared to independent experts
- Risk, staging of BP, drug management, lifestyle support and follow up advice compared
- July – Sep 2011

Qualitative Research
Feasibility
Demonstration

Receiver Operator Curve for comparing the DSS and independent experts on drug management.

Area under ROC curve = 0.8482
mhealth in HT: cRCT among physicians (16 PHCs; AP)

Mean blood pressure in randomised groups by month and differences vs. baseline

Unpublished data – not for quoting
CBS: Chart based support; DSS: Decision Support System
*Covariates included: age, gender, height, waist, body mass index, alcohol intake, pickle and papad (salty food) intake, portions of vegetable/fruit consumed per day and baseline differences in blood pressure
Can these results be extended to Community Health Workers?
CHWs and Hypertension Management in India: Economic Modeling

- 3 day training program
- $700,000 hospital cost savings / million population annually
- 700 CVD deaths / million averted
- 750 hospitalizations for stroke / MI averted
- If annual salary of CHW drops below $3500 (200000 Rs) then the program is cost saving.

Gaziano, Prabhakaran et al. for ICHEALTH
Objective

• To design a **feasible and sustainable evidence-based, decision support-enabled, health care delivery model** for the management of hypertension and diabetes at the primary health care facilities of Himachal Pradesh

Funded by Medtronic foundation

Unpublished data: Please do not quote
Smartphone DSS
Screen-shot

Physician certified co-morbid conditions

- PVD
- Myocardial Infarction
- COPD/Asthma
- Renal/Liver Failure (Creatinine>3mg)
- Heart Block

Diastolic Blood Pressure Reading2 (mm of Hg)

- 100

16. Height in cms:

- 165

17. Weight in kgs:

- 80

Body Mass Index (BMI) [kg/m^2]:

- 29.4

18. FBS (Fasting Blood Sugar)

19. PP (Post Prandial)

20. OHA (Oral Hypoglycemic Agent)

- OHA=0

21. Insulin

- No

Unpublished data: Please do not quote
Screening of eligible patients at 5 CHCs (8 Months: March- October 2013)

56814 clinic attendees

13860 eligible (>30 years)

5086 HT or DM
New HT or DM (54%)
Change in mean SBP during first follow-up visit

<table>
<thead>
<tr>
<th>Group</th>
<th>Baseline (first visit)</th>
<th>Follow-up (3 month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Known (822)</td>
<td>135.1</td>
<td>144.9</td>
</tr>
<tr>
<td>New (573)</td>
<td>143.8</td>
<td>159.6</td>
</tr>
<tr>
<td>Overall (1,395)</td>
<td>138.7</td>
<td>151.0</td>
</tr>
</tbody>
</table>

Unpublished data: Please do not quote
Change in mean Fasting Blood Sugar during first follow-up visit

Fasting Blood Sugar (mg/dl) for Diabetic patients

- **Known (268)**
  - Mean FBS at Baseline (first visit): 138.4
  - Mean FBS at 3 month (follow-up): 162.5

- **New (86)**
  - Mean FBS at Baseline (first visit): 150.5
  - Mean FBS at 3 month (follow-up): 202.2

- **Overall (354)**
  - Mean FBS at Baseline (first visit): 141.4
  - Mean FBS at 3 month (follow-up): 172.2

Unpublished data: Please do not quote
Clinical trial to reduce outcomes

A cluster randomized trial of an electronic clinical decision-support enabled nurse led intervention for reducing death, MI, stroke in patients of hypertension and diabetes in India
TRANS-DISCIPLINARY Research

“Implies conception of research questions that transcend the individual departments or specialized knowledge bases because they are intended to solve problems that are, by definition, beyond the purview of individual disciplines”—IOM, 2003
Set of 9 voluntary global NCD targets for 2025

- Premature mortality from NCDs 25% reduction
- Essential NCD medicines and technologies 80% coverage
- Drug therapy and counseling 50% coverage
- Diabetes/obesity 0% increase
- Raised blood pressure 25% reduction
- Tobacco use 30% reduction
- Salt/sodium intake 30% reduction
- Physical inactivity 10% reduction
- Harmful use of alcohol 10% reduction
mWELLCARE:
An integrated mHealth system for the prevention and care of chronic conditions

Goal:
To develop and evaluate a mHealth system aimed to improve the treatment and care of patients with any chronic disease risk factor or state (hypertension, diabetes, depression, harmful alcohol use, obesity)

Specific Objectives:
• Design of m-WELLCARE: to provide evidence based decision support for physicians and primary health workers (PHWs) and for patient self-management tailored for the individual patient; and to monitor and give feedback to patients, physicians, PHWs and health service managers;
• To evaluate m-WELLCARE in two States to determine its effectiveness
• To produce a plan for ensuring scalability and sustainability of m-WELLCARE in partnership with potential users.
mWELLCARE:
Trans disciplinary team

• Epidemiologists
• Health experts in
  o Cardiovascular diseases
  o Metabolic disorders
  o Mental health
  o Tobacco cessation
• Health economists
• Health systems researchers
• Technology developers
• Business development experts
• Experts in governance
# Inter-Multi-Trans disciplinary research: My personal journey

<table>
<thead>
<tr>
<th>Trans disciplinary Research</th>
<th>Multidisciplinary Research</th>
<th>Interdisciplinary Research</th>
<th>Within Disciplinary Research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration in which exchanging information, altering discipline-specific approaches, sharing resources and integrating disciplines achieves a common scientific goal (Rosenberg 1992).</td>
<td>Researchers from a variety of disciplines work together at some point during a project, but have separate questions, separate conclusions, and disseminate in different journals.</td>
<td>Researchers interact with the goal of transferring knowledge from one discipline to another. Allows researchers to inform each other’s work and compare individual findings.</td>
<td>INTERHEART</td>
</tr>
</tbody>
</table>

**Can we integrate care for all chronic diseases: VP, DP and others**

RA: Hypertension control in PHCS with EHR and DSS
AV: Acceptability and feasibility of nurses and DSS in rural HP
DP and NT: Demonstration in CHCs of HP
TG and others: Economic modelling of HT care by CHW

VP: CHW in mental Health
DP: CHW in Hypertension

CREATE Registry
Larger Question

• Can we reduce high blood pressure burden in India by 25% in the next 12 years?
Research questions have multiple angles

• Scientific credibility
  (evidence & rationale?) → Biomedical & Epidemiological research (Strength, Quality, generalizability)

• Financial feasibility
  (cost effective? affordable?) → Health economics research

• Operational stability
  (sustainable? scalable?) → Health systems research

• Political viability
  (is the community ready & receptive?) → Social sciences research

Combining all these: A trans disciplinary approach

Acknowledgement: Prof KS Reddy
Conclusions

• A research question for WHO 2025 goals is simple yet complex

• Multiple angles

• Multiple players

• Scaling up and sustainability plans should be embedded in the research question.