Master Class
DIFFUSION, SPREAD AND SUSTAINABILITY OF INNOVATION

Jonathan Lomas
Former CEO
Canadian Health Services Research Foundation
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A Roadmap

• What is innovation and is it always valuable?
• The challenges to the spread of innovation
• Some classic views on innovation spread
• Using the ‘innovation adoption chain’ to explore a general principle and three corollaries of spread
  – Production/evaluation
  – Dissemination
  – Adoption
• The importance of organisational factors in sustaining innovation
What is Innovation?

- Oxford English Dictionary: “a new method, idea, product, etc.”
- Wikipedia: “a new way of doing something….incremental, radical, and revolutionary changes in thinking, products, processes, or organizations”
What is Innovation?

Two elements

- Novelty – a new configuration of behaviours, techniques or resources, and

- Problem-orientation – improving the way in which products, services or organizations achieve desired objectives
The Value of Innovation:
Lethality of War Wounds, US Soldiers

<table>
<thead>
<tr>
<th>WAR</th>
<th>Lethality of War Wounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revolutionary War 1775-83</td>
<td>42%</td>
</tr>
<tr>
<td>War of 1812</td>
<td>33%</td>
</tr>
<tr>
<td>Civil War (Union Force)</td>
<td>33%</td>
</tr>
<tr>
<td>World War I 1914-18</td>
<td>21%</td>
</tr>
<tr>
<td>World War II 1939-45</td>
<td>30%</td>
</tr>
<tr>
<td>Korean War 1950-53</td>
<td>25%</td>
</tr>
<tr>
<td>Vietnam War 1961-73</td>
<td>24%</td>
</tr>
<tr>
<td>Persian Gulf War 1990-91</td>
<td>24%</td>
</tr>
<tr>
<td>Afghanistan/Iraq Wars 2001-2002</td>
<td>9%</td>
</tr>
</tbody>
</table>

Source: Gawande, NEJM 2004:351:24
But, Is Innovation Always a Good Thing?

Some innovations by workers …

that upon evaluation may not prove to be such a good idea after all
The painters
The shipyard mechanics
The air conditioner installers
The expert in biological weapons
The city council maintenance team
The shooting gallery assistant
Not All Innovation Is Good
The Innovation: Duct Tape (for wart removal)

The Evaluation

The Innovation: Duct Tape (for wart removal)

The Evaluation

% whose warts recurred

Random allocation group

Placebo

Duct Tape

33%

75%

Healthcare’s Response to This Innovation

The Response

“I don’t think that those of us who have used duct tape in the past few years will stop using it because of this (study). I think we will say – as we did then – “We have no idea if this works or not, or how it works, but it has been reported to help some people.””

Dr. Neil Shear
Head of Dermatology
Sunnybrook Health Sciences Centre
Ottawa Citizen, March 20, 2007
Innovation – A Warning

“Innovation can also be undesirable when it is used as an empty buzz word meaning “new and exciting”. In this context it tempts managers to over-ride the need for reasonable caution, even scepticism, before subjecting teams, departments or entire organizations to rapid cycles of disruptive change based on premature adoption of the latest unproven fads and fancies.”
(excerpted from Lomas J. ‘Formalised Informality’, July 2007)

• Hence the need to focus on proven innovations
What are the Challenges to the Spread of Proven Innovation?

Recall the elements of innovation:

Novelty and problem-orientation

- The power of the status quo – we resist novelty and change
- Defensive response to the identification of problems – “it won’t work here”
- Contrary to the interests of one or more powerful groups
- Weak links in the innovation adoption chain
The Innovation Adoption Chain

Three inter-linked elements:

• Production/evaluation (proven innovation)
• Dissemination (communication)
• Adoption (behaviour change)
The Spread of Innovation: Is There Room for Improvement?
The Innovation: Airline Boarding (to improve speed)

The Evaluation

Boarding time for 120 person plane (minutes)

<table>
<thead>
<tr>
<th>Boarding Method</th>
<th>Time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Back to Front</td>
<td>25</td>
</tr>
<tr>
<td>Alternate rows + window to aisle</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: Steffen JH. J Air Transport Management 2008;14:146
Airlines’ Response to Innovation

The Response

“We want to board the business class first, and these are much more important considerations for us. We like the status quo and have no plans to redraft boarding policies based on research showing there are faster ways”

Canada’s two major airlines as quoted in Ottawa Citizen, May 22, 2008
The Innovation: Umpire’s Position (to call strikes)

The Evaluation

% accuracy in calling strikes and balls

Location of umpire behind the batter

Baseball’s Response to Innovation

The Response

“Oh sure, a scientific test. I don’t think it’s going to make a great change here. I can’t even fathom what he [the researcher] is saying.”

Marty Springhead
Executive Director of Umpires
Globe and Mail, May 6, 1999
The Spread of Innovation *in Healthcare*: Is There Room for Improvement?
Poor Fidelity of Healthcare Delivery

• 55% of U.S. healthcare delivered according to quality standard (McGlynn et al NEJM 2003; 348)
• 27% of Canadian cataract patients worse off six months after surgery (Wright et al. CMAJ 2002)
• 30% of eligible post-MI VA patients did not receive beta-blockers; reduced to 5% after system improvement initiatives (Jha et al NEJM 2003; 348)
The Case of Scurvy

The Innovation
1601  Lancaster shows that lemon juice eliminates scurvy among sailors
1747  Lind’s research shows the same for citrus juice

The Adoption
1795 - 194 years after discovery -
   British Navy first uses citrus juice for sailors
1854 - 253 years after discovery -
   British Board of Trade uses citrus for sailors
Citrus Juice Versus iPods:

- In January 2001 no one had heard of Apple’s iPod
- By January 2010 Apple had sold 250 million iPods
- Why and how did Apple succeed where Lind and Lancaster failed?
The Case of Scurvy: Why the Lack of Innovation Spread?

- Major challenge to ‘accepted scientific wisdom’ of the time (phlogiston and humours were all the rage) – status quo
- Inadequate links between those doing the innovating and evaluating and those who could adopt the results
- Poor institutional memory and communication
- Adoption contrary to vested interests (military and ‘corporate’)

The Case of Apple’s iPod: Why the Rapid Innovation Spread?

- A ‘better’ (and simpler) solution to the problem of portable music (improves the status quo)
- Those developing and evaluating were in the same organization as those marketing and communicating (with lots of money)
- Main potential adopters (the young) had multiple social networks for peer-to-peer communication
- Innovation aligned with vested interests (digital music)
Three Views on Innovation Spread
Everett Rogers’ Predictors of Spread

- Significant improvement over the status quo
  - Compatible with extant values and beliefs
- Communication channels to potential adopters
  - Dissemination rather than just diffusion
- Time
  - Accommodate early, middle and late adoption
- Sympathetic social systems and context
  - Value of leadership, networks and colleagues
Gladwell’s ‘Tipping Point’

• Only 10-20% need to be convinced for accelerated spread if it’s the ‘right’ people, e.g. drug companies and local opinion leaders

• Individual “champions” matter e.g. Steve Jobs versus Charles Lind

• The “stickiness” of a message is crucial e.g. Viagra (“sex after sixty”) versus coordinated team care for stroke (“patient outcomes and costs can be improved”)

Plsek’s Complex Adaptive Systems

• Focus is on the conditions that encourage spread in an organization
• Provide minimum specifications not complex plans:
  – Direction pointing
  – Boundaries
  – Resources
  – Permissions
BREAK TIME
An exercise

We’ll pick a proven innovation that could/should be spread within an organization and then answer the following questions:

• What is the evidence base for its worth and how was it evaluated?
• Who will the innovation benefit and how? Who will suffer and how?
• How will you communicate the value of this innovation? Will you vary the message or the messenger depending on the audience? How?
• What changes need to happen in processes, organization, funding, regulation and behaviour for the positive outcome/s to occur?
• In addition to communication, how will you encourage adoption of the innovation and how will you know the extent of adoption?
Where am I?

You're 30 metres above the ground in a balloon.

You must be a researcher?

Yes.

How did you know?

Because what you told me is absolutely correct but completely useless.

You must be a policy maker.

Yes, how did you know?

Because you don’t know where you are, you don’t know where you’re going, and now you’re blaming me.

The problem...
Innovation Spread

The General Principle

- Innovation spread is about coordinating three ‘teams’ in the innovation chain: those who create new knowledge, those who disseminate it, and those who can use it
  - Production/evaluation
  - Dissemination
  - Adoption
The Innovation Adoption Chain

Three inter-linked elements:

- Production/evaluation (proven innovation)
- Dissemination (communication)
- Adoption (behaviour change)
What proportion of adopted innovations are supported by research/evaluation?
The Role of Evaluation in Adoption: Glass Half-full or Half-empty?

• Review of 124 decisions in Berkshire District Health Authority in the UK in 1997/98
  – decision: “a statement of intent to introduce, change or withdraw a service”

• Assessed all for availability of Cochrane evidence to support decision

• Assessed random 10 for availability of non-RCT quantitative studies to support decision
The Role of Evaluation in Adoption: Glass Half-full or Half-empty?

<table>
<thead>
<tr>
<th>Category</th>
<th>Evidence to Support Decision</th>
<th>Equivocal Evidence</th>
<th>No Evidence</th>
<th>Evidence Not Supporting Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cochrane RCTs</strong></td>
<td>34%</td>
<td>13%</td>
<td>52%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Non-RCTs</strong></td>
<td>50%</td>
<td>50%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Johnstone and Lacey, JHSRP 2002;7:166-9
Corollary 1

• The best way to spread innovation locally is to co-produce the evaluation
NEED CASH
FOR ALCOHOL
RESEARCH
The Best Predictors of When An Innovation Will Spread Locally

1. The adopter already believed in the innovation before you told her about it
Seeing Eye to Eye is Believing

“When people reject a truth or untruth it is not because it is a truth or an untruth that they reject it,
No, if it isn’t in accord with their beliefs in the first place they simply say, “Nothing doing”, and refuse to inspect it
Likewise when they embrace a truth or an untruth it is not for either its truth or its mendacity,
But simply because they have believed it all along, and therefore regard the embrace as a tribute to their own fairmindedness and sagacity.”

Ogden Nash (1941)
The Best Predictors of When An Innovation Will Spread Locally

1. The adopter already believed in the innovation before you told her about it

2. The adopter was linked into the evaluation of the innovation as a collaborator from the start
The Power of Co-production: Evidence from Clinical Research

- North American Asymptomatic Carotid Endarterectomy Trial (NASCET) in the 1990s
- Multi-centre Randomized Controlled Trial of use of carotid endarterectomy for minimal, medium or major blockage of carotid arteries
- Tu and colleagues compared uptake of results by those participating as a trial centre and those not participating in the Canadian province of Ontario

[arrows indicate release of trial results in 1990 and 1998]
Trends in Number of Carotid Endarterectomy Done by Hospitals Participating and Not Participating in NASCET trial, Ontario 1988-2001

Year
Total number of Carotid endarterectomies
NASCET hospitals
Non-NASCET hospitals


- NASCET hospitals
- Non-NASCET hospitals
The Power of Co-production: Evidence from Policy Evaluation

Systematic review of 24 studies that asked over 2000 policymakers what facilitated or prevented their use of research and evaluation

• #1 facilitator = “personal contact between researchers and policy-makers” (13/24)

• #1 barrier = “absence of personal contact between researchers and policy-makers” (11/24)

Innvaer et al. J Hlth Serv Res Pol 2002;7:241
What the Policy-Makers Say

“Personal two-way communication between researchers and decision-makers should be used to facilitate the use of research. This can reduce mutual mistrust and promote a better understanding of policy-making by researchers and research by policy-makers”

Innvaer et al. J Hlth Serv Res Pol 2002;7:241
The Value of Co-production of Evaluations According to Mark Twain

“The mere knowledge of a fact is pale; but when you come to realize a fact, it takes on color. It is all the difference of hearing of a man being stabbed to the heart, and seeing it done.”

Mark Twain, A Connecticut Yankee, 1889
The Innovation Adoption Chain

Three inter-linked elements:

• Production/evaluation (proven innovation)
• Dissemination (communication)
• Adoption (behaviour change)
Innovation Spread - Dissemination

Corollary 2

• Disseminating and spreading innovation is a contact sport – more of a social process than a technical fix
The Different Spread of Innovation Between (Solitary) Robins and (Gregarious) Titmice
The Case of Synthetic Dyes

1856  William Henry Perkin discovers first synthetic dye (anilinc purple) in Britain
1857  Perkin & Sons of England starts selling commercial synthetic dye all over Europe
1857 – 1865 Britain dominates the synthetic dye industry with nearly 90% of world market
1865 - 1870 Germany takes over 50% of the world market
1900 - 1912 Germany maintains 85% of world market
The Case of Synthetic Dyes

• Why did Britain lose the scientific advantage?
  or
• How did Germany gain the implementation advantage?
Three reasons:
  – Patent laws
  – Central trade association lobbying
  – **Ongoing links to the latest knowledge through a university-industry network of identified individuals**
Circles = industrial chemists  Rectangles = academic chemists
Arrowed lines = teacher-student relation  Thicker lines = more important
Right-side = Germans  Lower left = British  Upper left = French/Swiss
Source: Johan Peter Murmann ‘Knowledge and Competitive Advantage’, Cambridge University Press, 2003
The Case of Synthetic Dyes – The Value of Networks

“That firms that were able to maintain ties to the best chemical talent of the day outperformed rivals that were not as well connected …. This created an informal network of ties that connected players in industry and academia … the academic-industrial knowledge network”

Johan Peter Murmann ‘Knowledge and Competitive Advantage’, Cambridge University Press, 2003
Does it matter who communicates and how it’s communicated?
Dissemination – Importance of Source

Source: Tunis et al., Annals of Internal Medicine 1994; 120:956
Broad Dissemination – It’s Hard to Overcome the Local Influence

“In all communities the “results” which the majority are watching are not in the distant and confusing findings of the literature but those in their local communities”

Greer AL Int J Tech Assess Health Care 1988; 4: 12
The Innovation Adoption Chain

Three inter-linked elements:

- Production/evaluation (proven innovation)
- Dissemination (communication)
- Adoption (behaviour change)
Corollary 3

It is as important to equip adopters in the system with the tools to find and use proven innovations as it is to help evaluators (and others) to disseminate them – ‘pull’ versus ‘push’
“Despite our limited knowledge of implementation methods, it seems reasonable to assume that the skills required for implementation may not be the same as those needed to carry out good research… Implementation is largely concerned with bringing about change in health care. But this, surely, is the essence of operational management, the basic task of most health service managers.”

Black N. J Hlth Serv Res Pol 1996; 1:184
Four Puzzles

• Opinion leaders improve quality of services delivered by obstetricians but not obstetrical nurses. Why?
• Screening for prostate cancer in men over 50 is over-used but screening for breast cancer in women over 50 is under used. Why?
Four Puzzles (Cont.)

- In Ontario order of access to cardiac surgery correlates highly with severity but access for knee replacements does not. Why?
- Flu-season leads to emergency room overcrowding in Ontario but not in Alberta. Why?
Four Puzzles Revisited

Opinion leaders improve quality of services delivered by obstetricians but not obstetrical nurses. Why?

* sociology of professions
* working environments of nurses versus physicians
Four Puzzles Revisited

Screening for prostate cancer in men over 50 is over-used but screening for breast cancer in women over 50 is under used. Why?

* gender politics
* PSA profits
Four Puzzles Revisited

In Ontario order of access to cardiac surgery correlates highly with severity but access for knee replacements does not. Why?

* centrally managed waiting list system for cardiac but not for orthopaedic surgery
Four Puzzles Revisited

Flu-season leads to emergency room overcrowding in Ontario but not in Alberta. *Why?*

* regionalized system with control over community and institutional resources in Alberta but not in Ontario
Innovation Spread - Adoption

- No (wo)man is an island
- Individuals operate within teams, teams within organisations, and organisations within systems
- Each level needs to be aligned for adoption of innovations
What kind of initiatives might improve the capacity of individuals and organisations to adopt proven innovations?
Two initiatives to improve adoption of innovations in organisations

- Training individual leaders in evidence-based change management
- Institutionalising knowledge brokers
EXTRA is a 2-year fellowship program designed to train health services leaders (CEOs, Directors, Senior Managers) and their organisations to become even better decision makers by learning how to access, appraise, adapt and apply research-based evidence on innovation.

It does not train them to **do** research. It trains them to **use** research as a change management tool.
Fellows stay in their home organisations but commit 20%+ of their time for 2 years and receive:

- Six weeks of in-class learning in residency sessions
- Mentors who guide them through an intervention project to implement a research-based innovation in their home organisation
- A state-of-the-art desktop of resources including access to research databases
- Support for an ongoing ‘community of practice’
Some measures of the program’s impact on individual fellows:

<table>
<thead>
<tr>
<th>Measure</th>
<th>At entry</th>
<th>At graduation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research literacy</td>
<td>16</td>
<td>71</td>
</tr>
<tr>
<td>Knowledge of research-based evidence</td>
<td>17</td>
<td>90</td>
</tr>
<tr>
<td>Skills for doing research</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Skills for assessing quality of research</td>
<td>12</td>
<td>52</td>
</tr>
<tr>
<td>Knowledge of change management</td>
<td>50</td>
<td>95</td>
</tr>
<tr>
<td>Ability to promote the use of research evidence in my own organisation</td>
<td>16</td>
<td>86</td>
</tr>
</tbody>
</table>

Source: Denis, Lomas, Stipich, JHSRP 2008; 13(suppl 1):5
Some measures of the program’s impact on fellows’ organisation:

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>At entry</th>
<th>At graduation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunities to learn more about research while at my work</td>
<td>0%</td>
<td>24%</td>
</tr>
<tr>
<td>Opportunities to use research in collaboration with other professionals in my own organisation</td>
<td>8%</td>
<td>33%</td>
</tr>
<tr>
<td>Opportunities to use research in collaboration with other professionals in other organisations</td>
<td>0%</td>
<td>9%</td>
</tr>
</tbody>
</table>

Source: Denis, Lomas, Stipich, JHSRP 2008; 13(suppl 1):5
Some measures of the program’s impact on fellows’ organisation:

<table>
<thead>
<tr>
<th>Impact Description</th>
<th>% Yes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased use of research evidence in decisions</td>
<td>95</td>
</tr>
<tr>
<td>Increased implementation of “better” practices</td>
<td>90</td>
</tr>
<tr>
<td>Created an environment in which there is an expectation that issues will be</td>
<td>90</td>
</tr>
<tr>
<td>challenged by research evidence</td>
<td></td>
</tr>
<tr>
<td>Increased collaboration with researchers</td>
<td>81</td>
</tr>
<tr>
<td>Changed the culture towards more use of evidence-based decision-making</td>
<td>76</td>
</tr>
<tr>
<td>Changed roles and expectations of the senior management team and board of directors</td>
<td>52</td>
</tr>
</tbody>
</table>

Source: Denis, Lomas, Stipich, JHSRP 2008; 13(suppl 1):5
Knowledge Brokers

“Implementation is more likely given active professional support and leadership … thus the development of hybrid researcher-practitioner roles (rather than the reliance on external ‘scientists’) may help … The development of mechanisms to promote active boundary spanning, dialogue and joint learning is important.”

Ferlie et al. JHSRP 2000;5(2):101
Knowledge Brokers

- Intermediaries between otherwise disconnected pools of knowledge and disconnected organisations

- They help the transfer of new knowledge (innovation) between parties that never or rarely interact
Knowledge Brokers

Can be ‘supply-side’ (push), ‘demand-side’ (pull) or ‘neutral territory’ (intermediary) brokers

Tasks and abilities:

• Understanding of both the evaluation and implementation environments
• Ability to find and assess relevant proven innovation
• Mediation and negotiation skills
• Communication skills
• Credibility
Knowledge Brokers: Who Are They And What Do They Do?

Survey of 412 in Canada with 75% response rate: n=301

Types

Push broker  (in universities)  28%
Pull broker  (in health system)  50%
Intermediary broker (in between)  22%
Knowledge Brokers: Who Are They And What Do They Do?

N=301 Brokers

Activities (by % of time)

Knowledge transformation 30%
Networking and intermediation 20%
“Day job” (e.g. teaching, managing) 50%

Source: Gold, Landry, Amara, Villeneuve, 2006
Sustaining Innovation: Leadership, Champions and Organisational Characteristics
Some Real-Life Examples of Leadership and Champions

- Sir Michael Peckham and NHS R&D program
- Sir Ian Chalmers and Cochrane Collaboration
- Ken Kizer and the Veteran’s Administration Health System
- Jack Wennberg and shared patient decision-making
Leadership We Can Do Without
Leadership We Can Do Without
Leadership We Can Do Without
Three Types of Successful Champions

- Boundary spanner – networks with individuals outside to bring new knowledge into the organization
- Organizational maverick – creates insulated space where risks can be taken
- Network facilitator – builds coalitions across functional departments of the organization

Greenhalgh et al ‘Diffusion of innovations in service organizations: systematic literature review’, Milbank Q 2004;82:581-629
But Are Individuals Enough?

The Intertwined Destiny Of Champions And The Organizations Within Which They Work
The Role of Organisations

“Evidence and opinion leaders seemed particularly important for immediate implementation of clinical change, whilst organisational commitment was more strongly associated with wider learning from the experience”

Dopson et al J Hlth Serv Res Pol 2001; 6(1):28
Characteristics of Innovator Organisations

- Characteristics of organisations (accounting for 15% of the variation in innovation adoption):
  - Large, mature, functionally differentiated, with decentralized decision-making
  - Focused on specialised professional knowledge
  - Slack resources and reflective time
  - Absorptive capacity for new knowledge (receptor capacity)

  Greenhalgh, T et al. Milbank Quarterly 2004;82:581-629
The Interaction Between Individuals and Organizational Structure and Process

“Knowledge depends for its circulation on interpersonal networks, and will only diffuse if these social features are taken into account and barriers overcome”

Greenhalgh et al. Milbank Quarterly 2004;82:581-629

- The apocryphal tale of the Xerox machine technicians
Overall Conclusion

• Innovation spread is only as effective as the weakest link in the knowledge chain
• Hence, efforts need to be distributed equally across each of the three phases of production/evaluation, dissemination, and adoption/sustainability
• In the last decade we’re much improved in production and dissemination of innovation (the “push” agenda)
• But, we’re still neglecting the development of skills and the organisational designs for adoption/sustainability of innovation (the “pull” agenda)
The Recurring Crises In Health Care

“It is quite important to know that virtually every day since 1948 the NHS has been said to be in crisis, and that for the last forty-five years morale within it has invariably never been lower”

Thank You!
Merci!
Some Useful Resources


