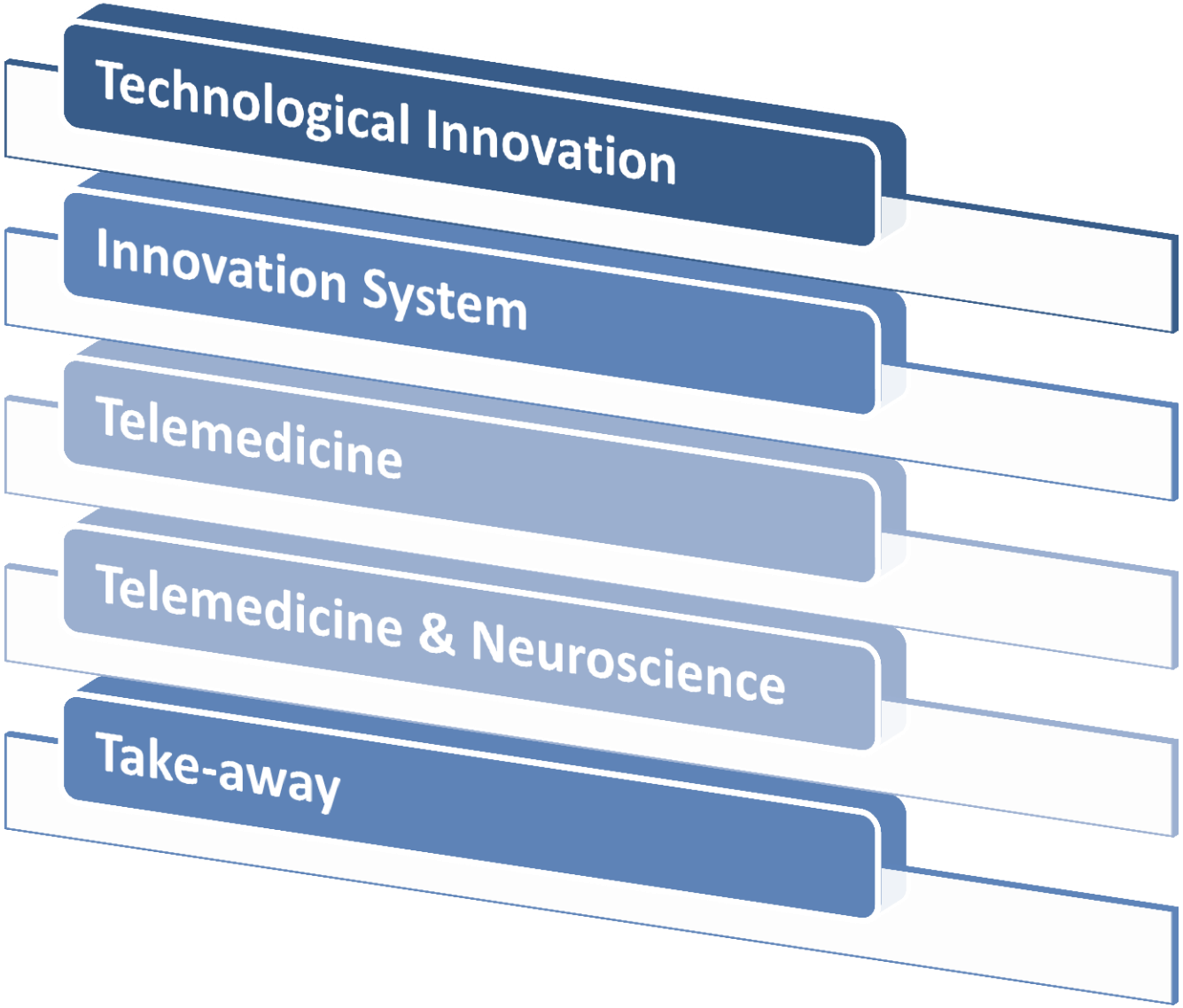
INNOVATING HEALTHCARE TECHNOLOGY

TELEMEDICINE & NEUROSCIENCE

Sebastiano Massaro, PhD
Warwick Business School
GRP Behavioural Science

January 26, 2016

Today's Agenda



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Technological Innovation

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A Technological Innovation Is …

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A Technological Innovation Is …

A Technological Innovation Is …

Collins Dictionary

1 The application of practical or mechanical sciences to industry or commerce.
2 The methods, theory, and practices governing such application.
3 The total knowledge and skills available to any human society.

Oxford English Dictionary

Science or industrial art; literally, the science of technique i.e. systematic knowledge of technique. Technique: the interaction of people/tools with machines/objects which defines a 'way of doing' a particular task.

***Technology and Change – the New Heraclitus* (Schön 1967)**

Any tool or technique: any product or process, any physical equipment or method of doing or making by which human capability is extended.

***The Trouble with Technology* (Macdonald, et al. 1985)**

Technology may be regarded as simply the 'way things are done'.

***Technology Policy of Economic Development*, IDRC, Ottawa (Vaitsos 1976)**

Identifies three properties of technology:

1 The form in which technology is incorporated: machines/equipment/materials.
2 Necessary information covering patents and conditions under which technology can be used.
3 Cost of technology i.e. capital.

A Technological Innovation Is …

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Technology Policy of Economic Developme

Identifies three properties of technology:

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2 Necessary information covering patents used.
3 Cost of technology i.e. capital.

***The Management of Technology Transfer*, International Journal of Technology Management (Djeflat 1987)**

Technology marketed as a complete entity: all technological components tied together and transferred as a whole: capital goods/materials/know how/qualified and specialised manpower.

***The Business Enterprise in Modern Industrial Society* (Child 1969)**

The equipment used in the work flow of a business enterprise and the interrelationship of the operations to which the equipment is applied.

***Competition and Control at Work* (Hill 1981)**

In the first place technology embraces all forms of productive technique, including hand work which may not involve the physical use of mechanical implements. Secondly, it embraces the physical organisation of production, the way in which the hardware of production has been laid out in a place of work. The term therefore implies the division of labour and work organisation which is built into or required for efficient operation by the productive technique.

***The Sociology of Invention* (Gilfillan 1935)**

An invention is essentially a complex of most diverse elements – a design for a physical object, a process of working with it, the needed elements of science, if any, the constituent materials, a method for building it, the raw materials used in working it, such as fuel, accumulated capital such as factories and docks, with which it must be used, its crew with their skills, ideas and shortcomings, its financial backing and management, its purpose and use in conjunction with other sides of civilisation and its popular evaluation. Most of these parts in turn have their separately variable elements. A change in any one of the elements of the complex will alter, stimulate, depress or quite inhibit the whole.

In Lay Terms…

- Likely to be completely **new** product or service
- A small improvement in existing products or services
- An **improvement** in internal processes
- Has a strong **technological** component (e.g., software, electronics)
- Meant for existing **market**, but may also create new markets or niches

Why Should We Care?

- Increases opportunity market separation
- Good for the economy as a whole
- Usually leads to cost reductions -> better margins
- Should offer consumers greater satisfaction and wider choice
- Reduces dependency on old products, services, and technological processes

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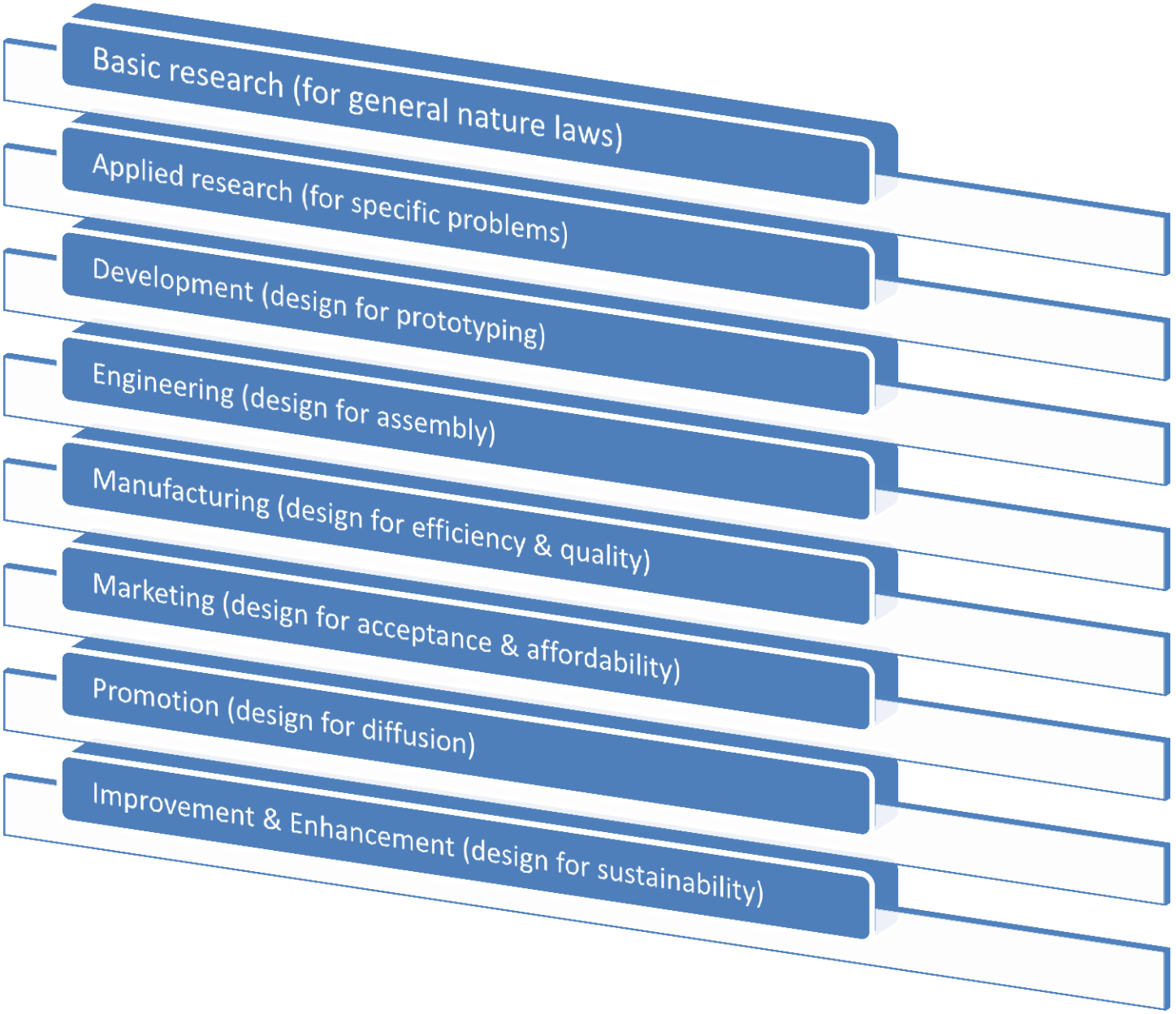
Step-By-Step



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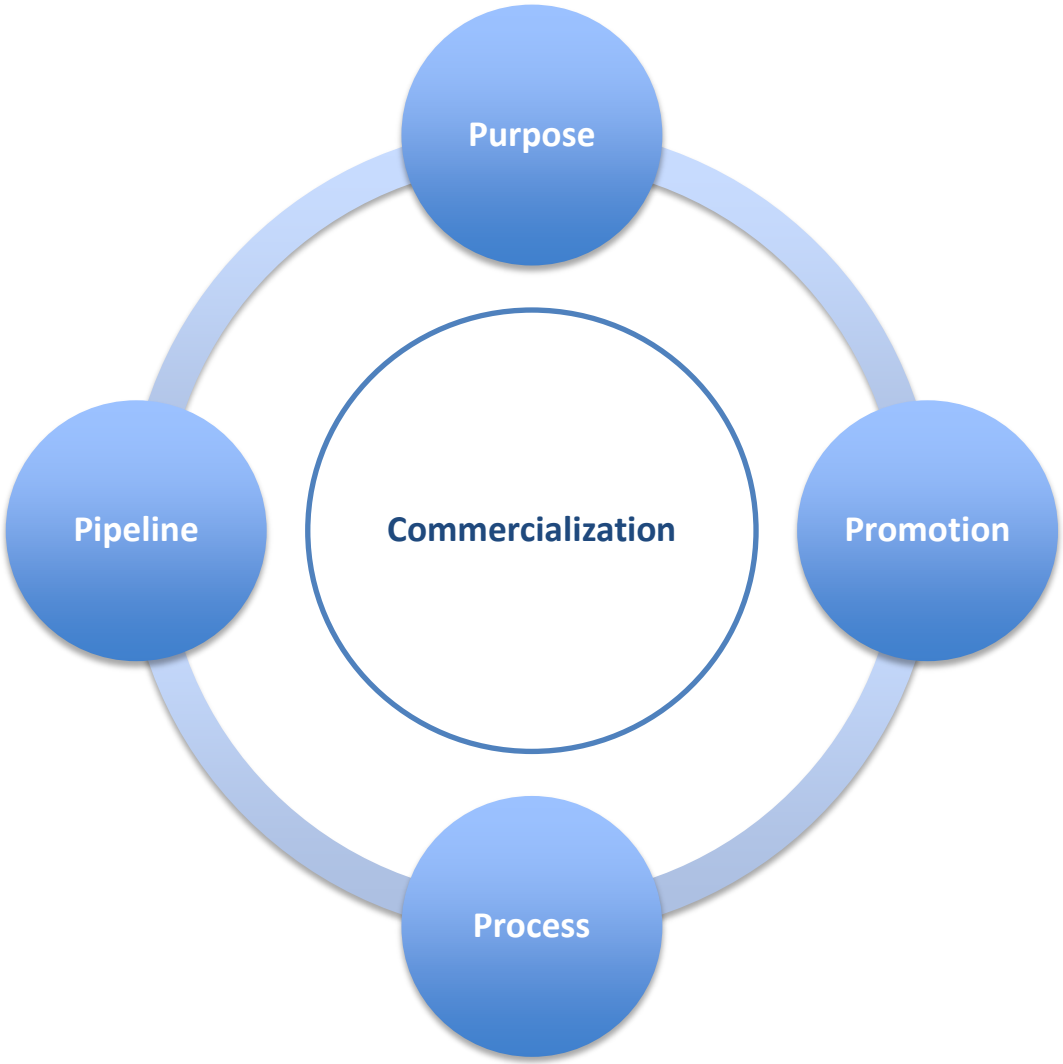
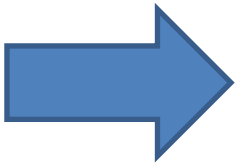
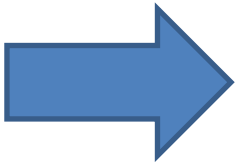
Every Innovation Has 4 P's



The “Doing it Better”





“Playing the Game Differently”

Sustaining Innovation

- Way For Products to Change
- Does Not Create New Growth

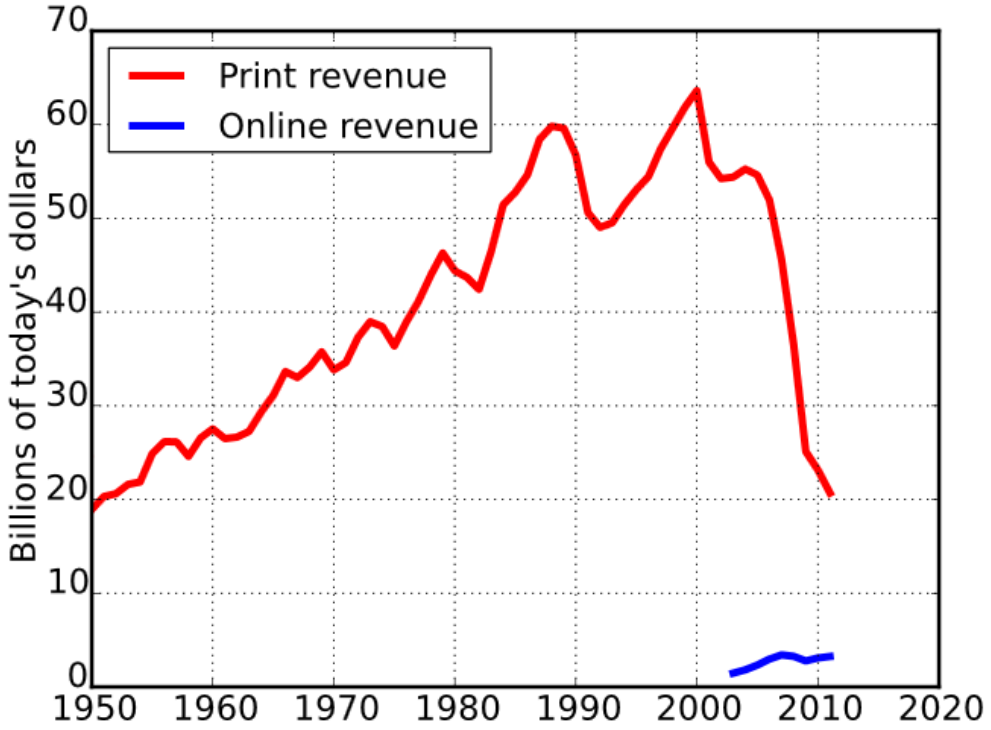
Disruptive Innovation

- Creates a New Market
- Transforms or Destroys Current Market
- Products Become
  - Simpler
  - More Affordable
  - More Accessible
  - Customizable
- Drives Growth

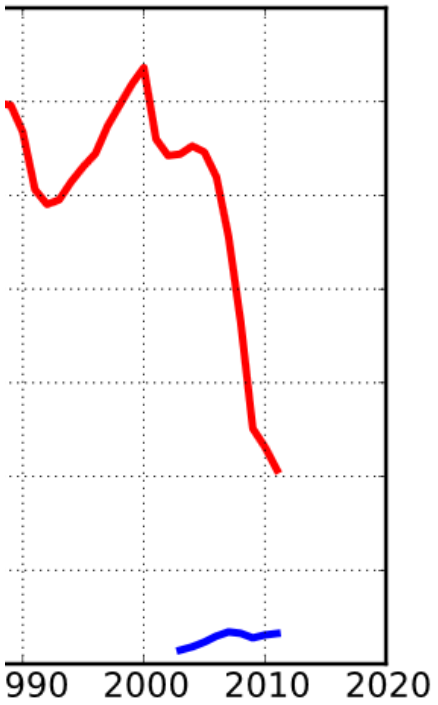
Elements for Disruptive Innovation

- **Technological enabler**. Typically, sophisticated technology whose purpose is to simplify, it routinizes the solution to problems that previously required unstructured processes of intuitive experimentation to resolve.
- **Business model innovation**. Can profitably deliver these simplified solutions to customers in ways that make them affordable and conveniently accessible.
- **Value network**. A commercial infrastructure whose constituent companies have consistently disruptive, mutually reinforcing economic models.

Technology Is Going To Advance



Even If It Changes An Industry…



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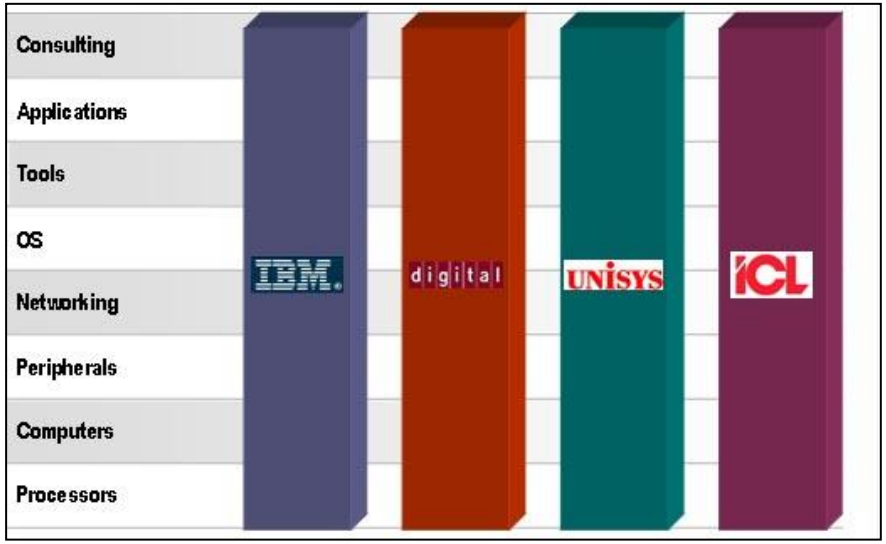
Get on Board Or Stay Behind?

Modularity

1980's



2010's

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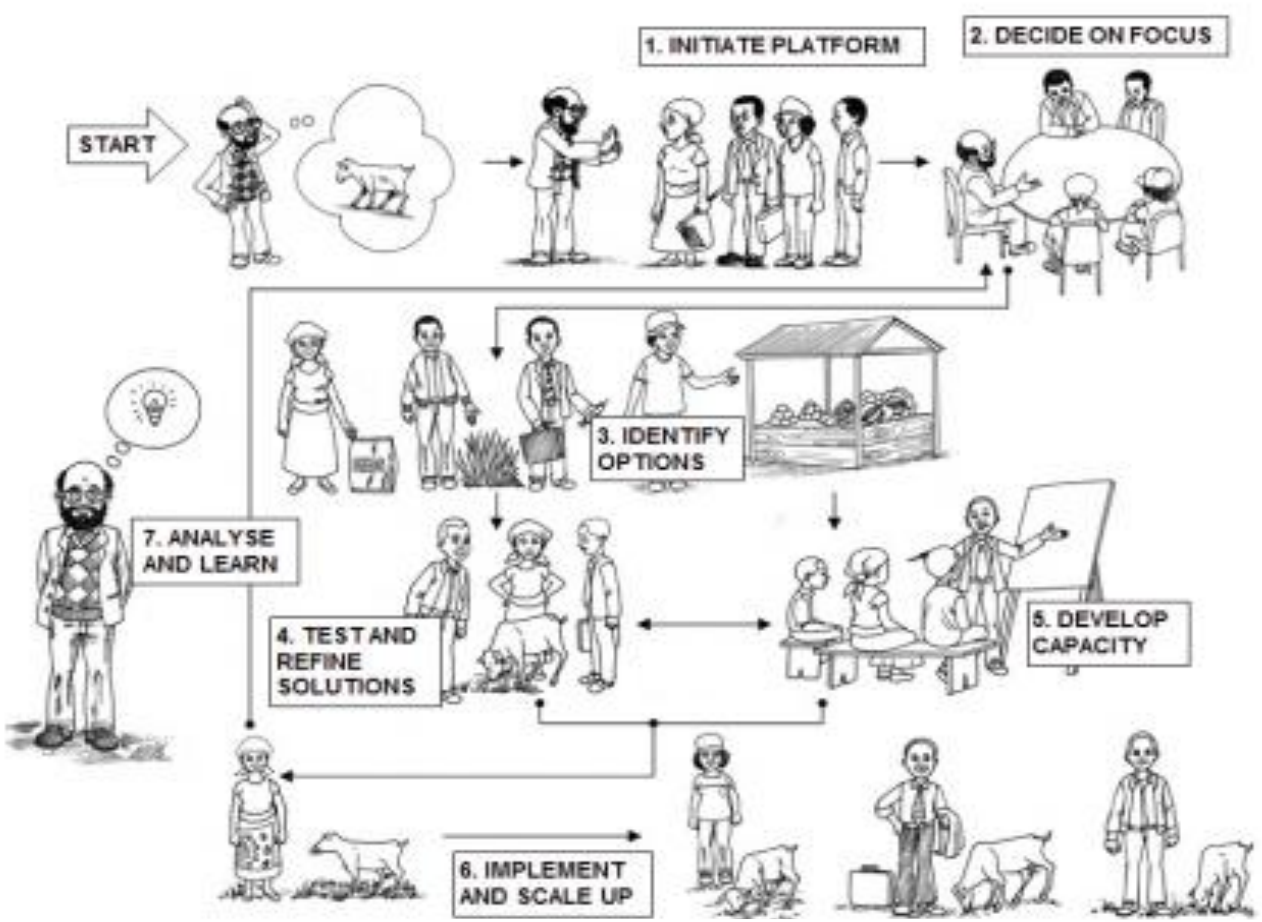
How Can We Make it Work?



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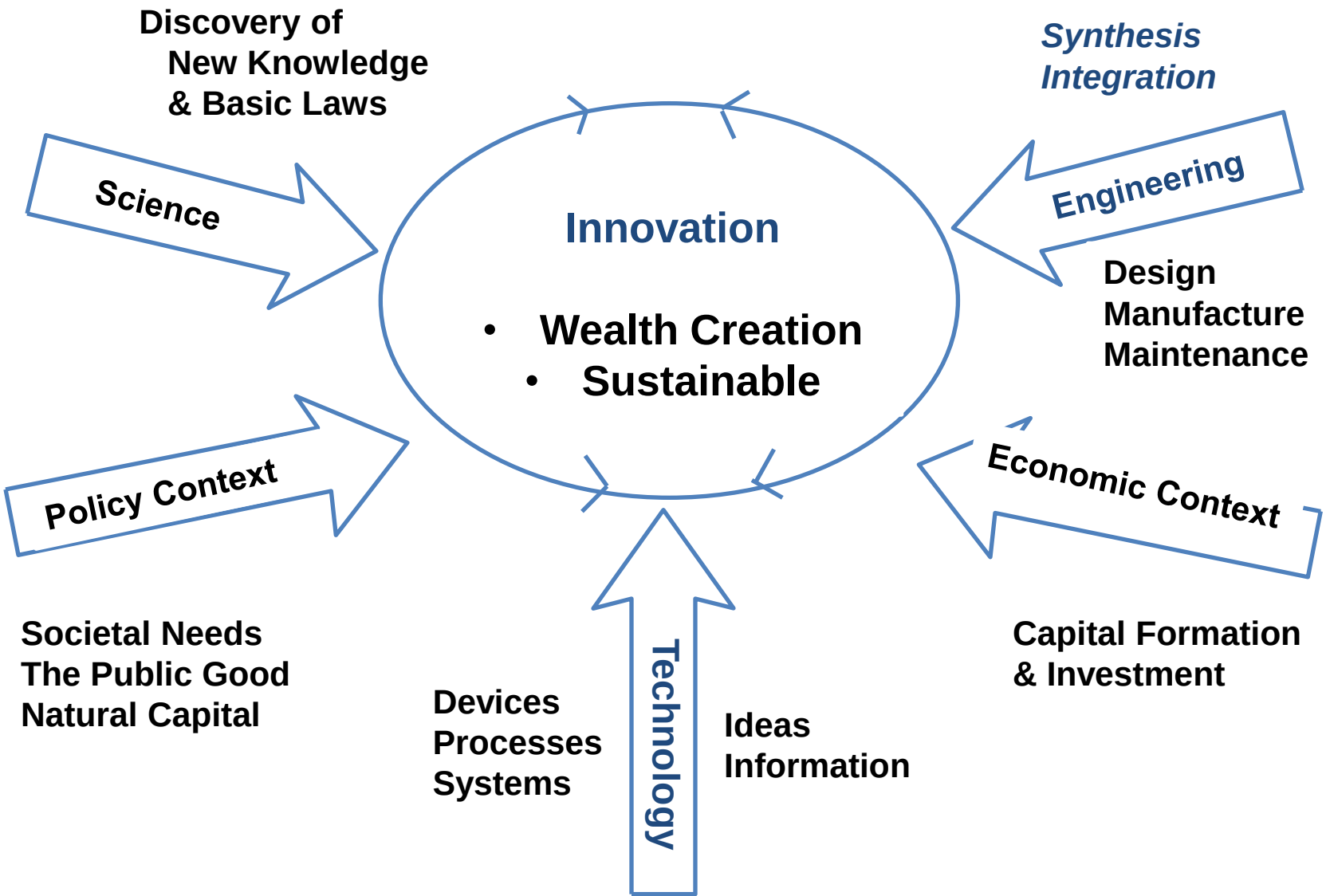
Does It Always Work?

The Innovation System



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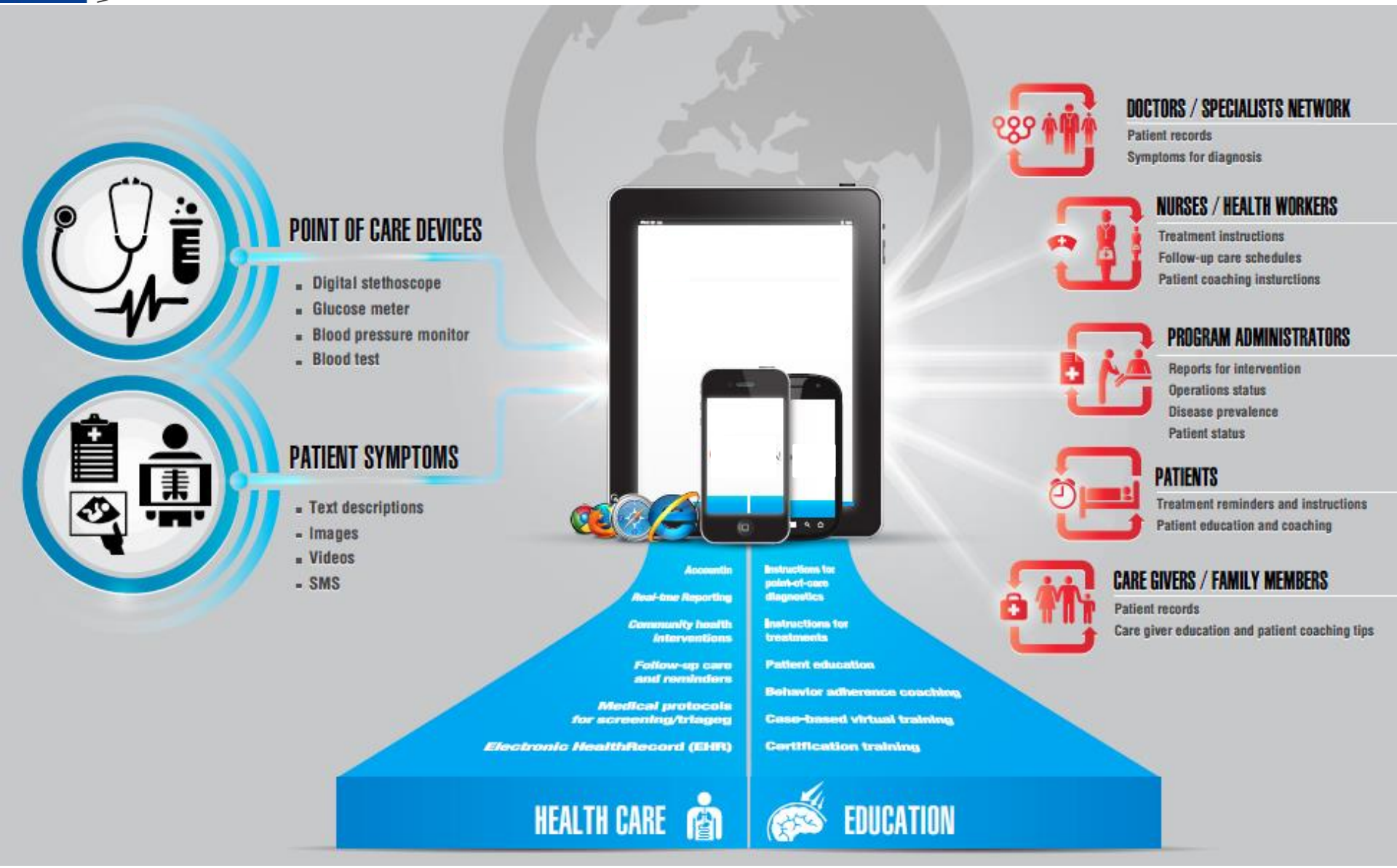
The Healthcare System

An Innovation System



What is Telemedicine?

the use of electronic information and communication technologies to provide and support health care when distance separates the actors. . .

Institute of Medicine, 1996

What Does It Mean?

Telecommunications Technology

+

Medicine

=

An Innovation System for Biomedical Engineers

A Brief History

- In 1924, with the concept of a physician seeing his patient over the radio using a television screen
- First wave of telemedicine programs started in the 1950s
- Most programs that began in the 1960s-1980s no longer exist, due to dependence on external funding

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THE RADIO DOCTOR—*Maybe!*

See Page 1406

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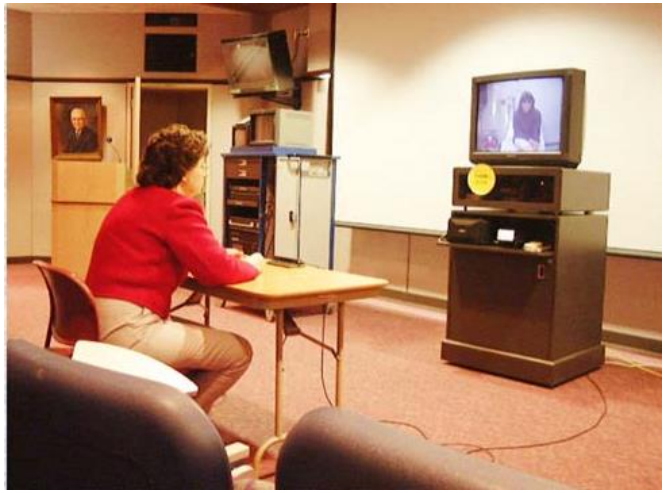
Dr. J. A. Fleming, F.R.S.
F. W. Dunmore and
F. H. Engel of
Bureau of Standards
Howard S. Pyle
Brainard Foote

THE 100% RADIO MAGAZINE




Specialty Care

Today

- Tele-radiology, store-and-forward, remains most common application
- Technology is rapidly changing and costs are decreasing
- Moving into private physicians use
- Expanding applications

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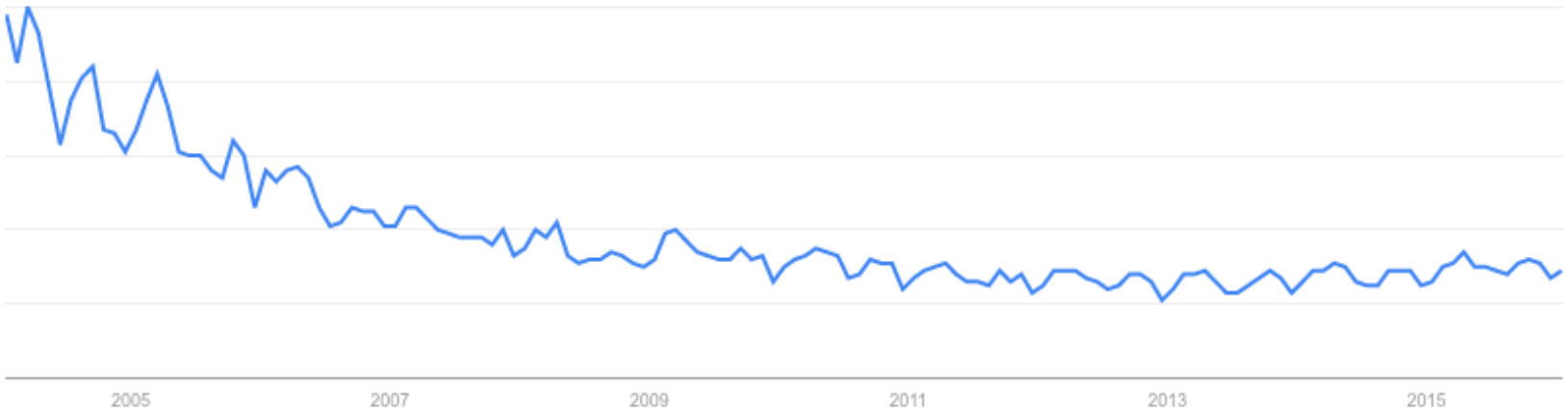
The Trend



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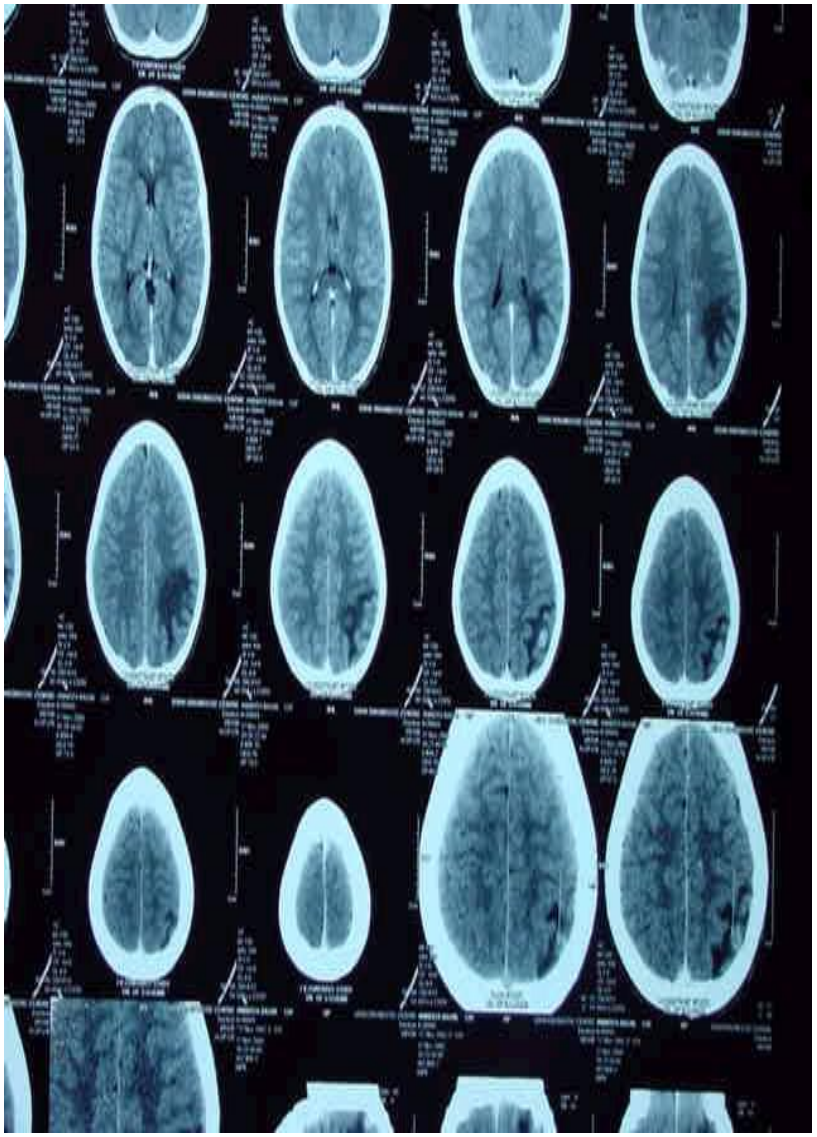
TeleNeurology: A Case Study



Stroke in USA

- Stroke is the fourth leading cause of death in the United States
- 795,000 people in the U.S. suffer strokes each year
- 133,000 deaths in the U.S. each year
- From 1998 to 2008, the stroke death rate fell approximately 35 percent and number of deaths fell by 19 percent
- 7,000,000 stroke survivors

2011 National Stroke Association

Stroke in USA

- A leading cause of adult disability
- Up to 80 percent of all strokes are preventable through risk factor management
- On average, someone suffers a stroke every
- 40 seconds in the United States

2011 National Stroke Association

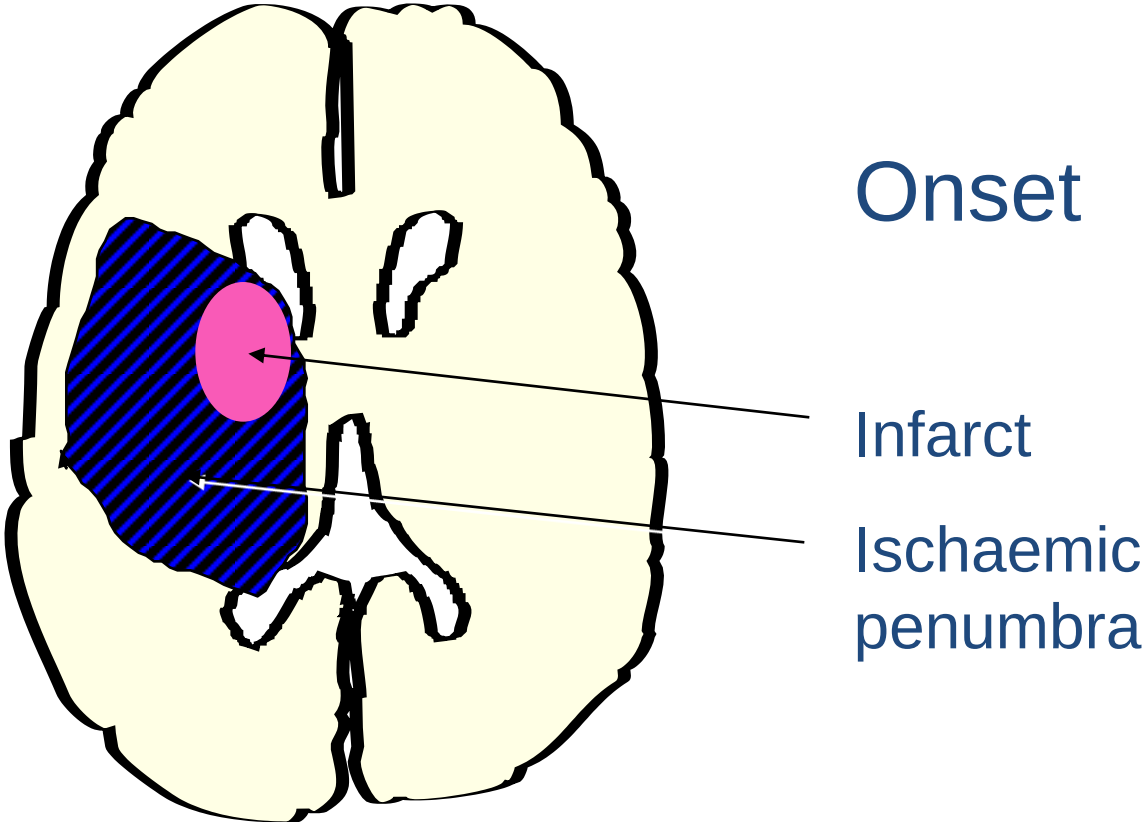
The Cost of Stroke

The estimated direct and indirect cost of stroke is 73.7 billion in 2010

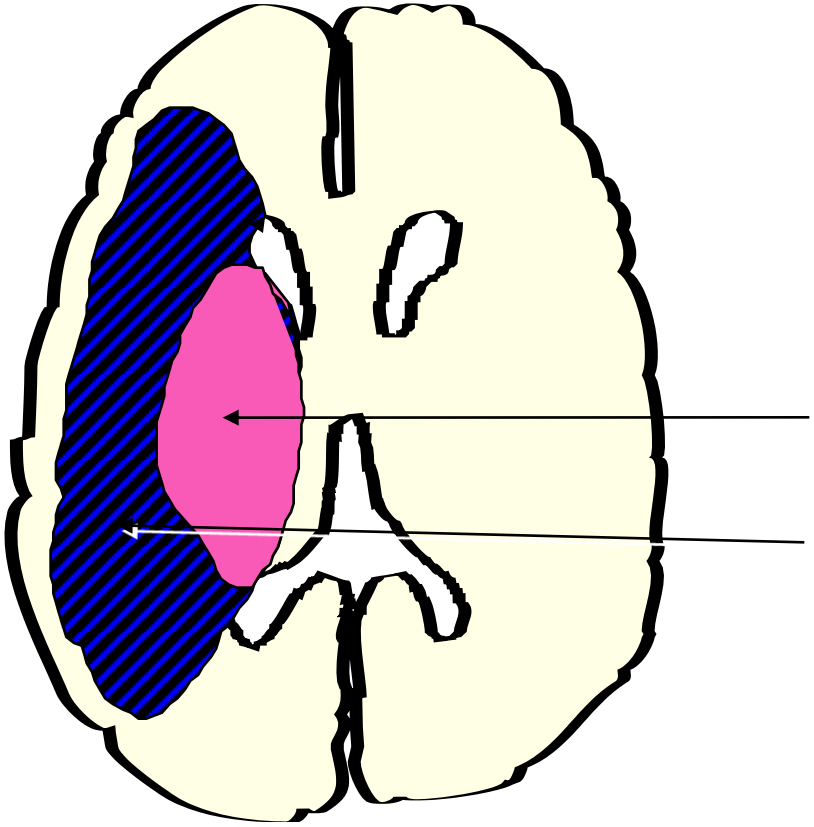
The mean lifetime cost of ischemic stroke is about $140,048 in the U.S.

2011 National Stroke Association

Cerebral infarct - onset



Cerebral infarct – 6 hours

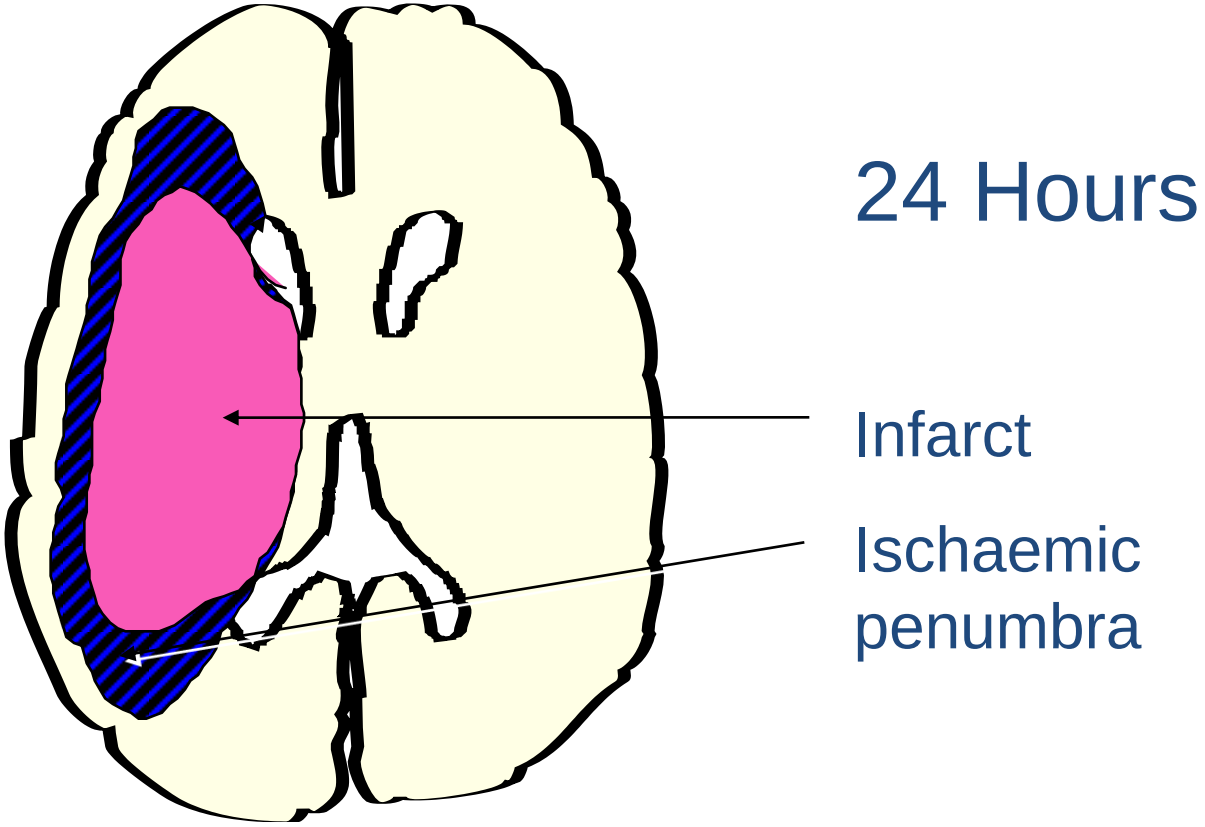


6 Hours

Infarct

Ischaemic penumbra

Cerebral infarct – 24 hours



A TeleNeurology Case

Treatment Access Gap Impacts Overall Quality of Stroke Care

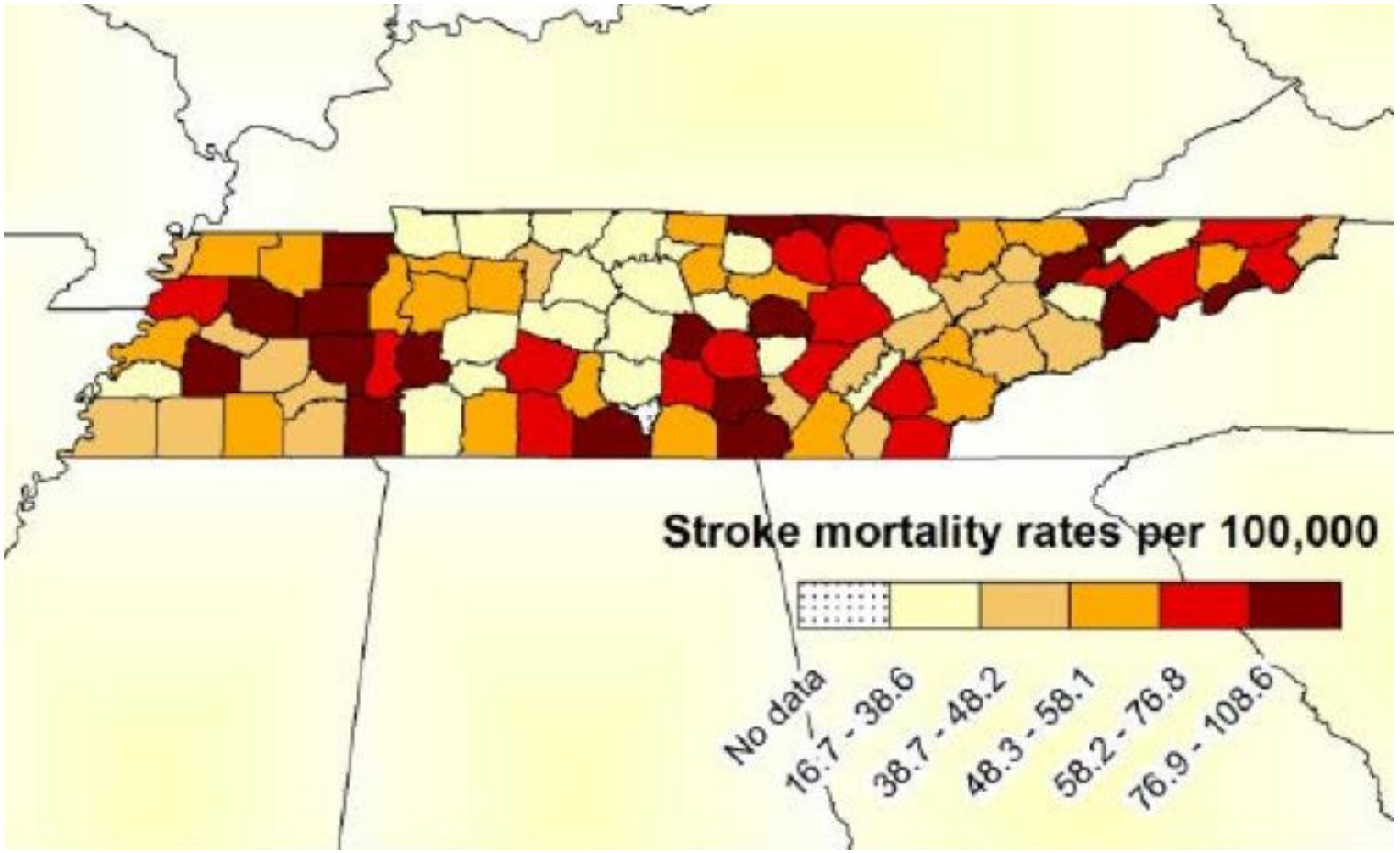
US Geographic Distribution of rt-PA Utilization for Acute Ischemic Stroke, by Hospital

- Only 22% of Americans live within a 30-minute drive of a stroke center; only 55% live within a 60-minute drive.
- 64% of hospitals have yet to implement basic stroke care and have not yet delivered thrombolytic therapy to stroke patients.

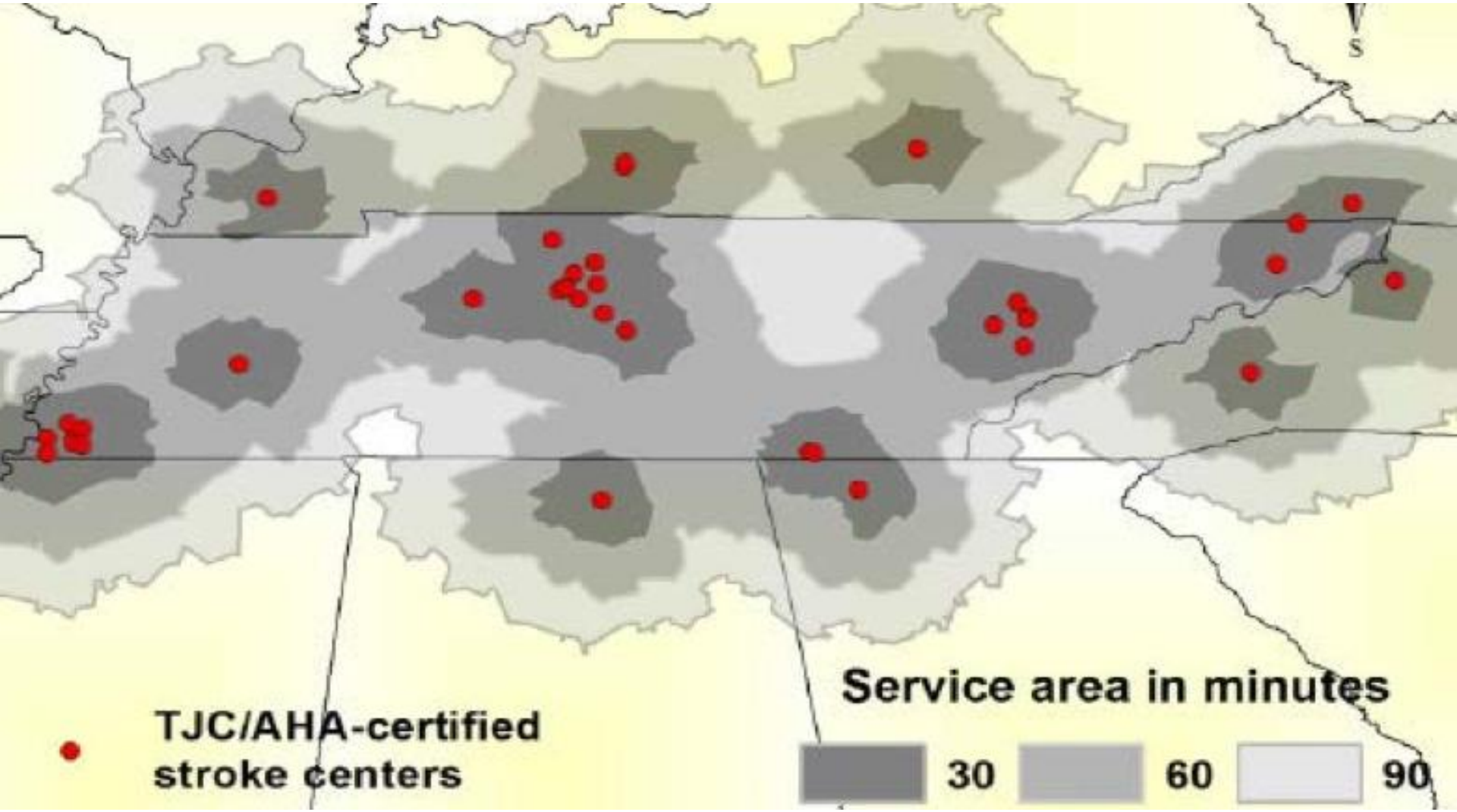
- **Hospitals With rt-PA Treatment Rate Equal or Greater Than 10%**
- **Hospitals With rt-PA Treatment Rate at National Average or Above**

rt-PA = recombinant tissue plasminogen activator.
Source: Kleindorfer D et al. *Stroke* 2009;40:3580–3584.

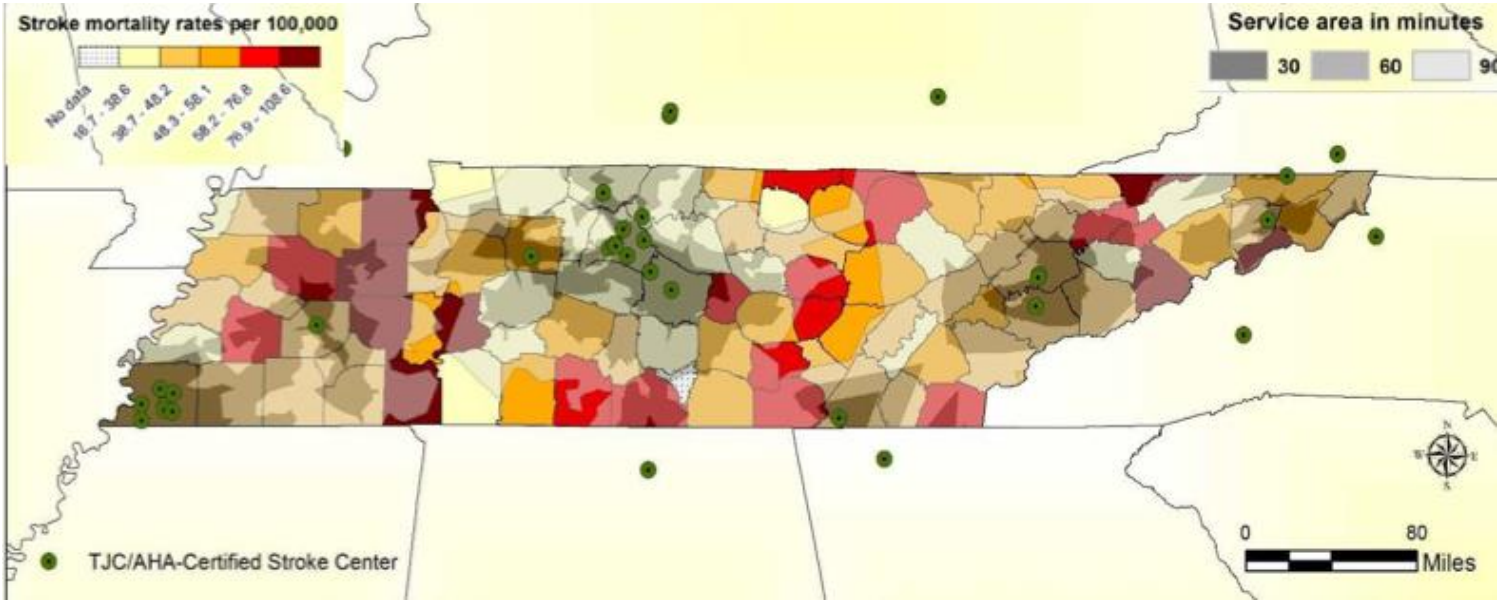
Mortality Rates (Tennessee 2014)



Stroke Centers



Action Time



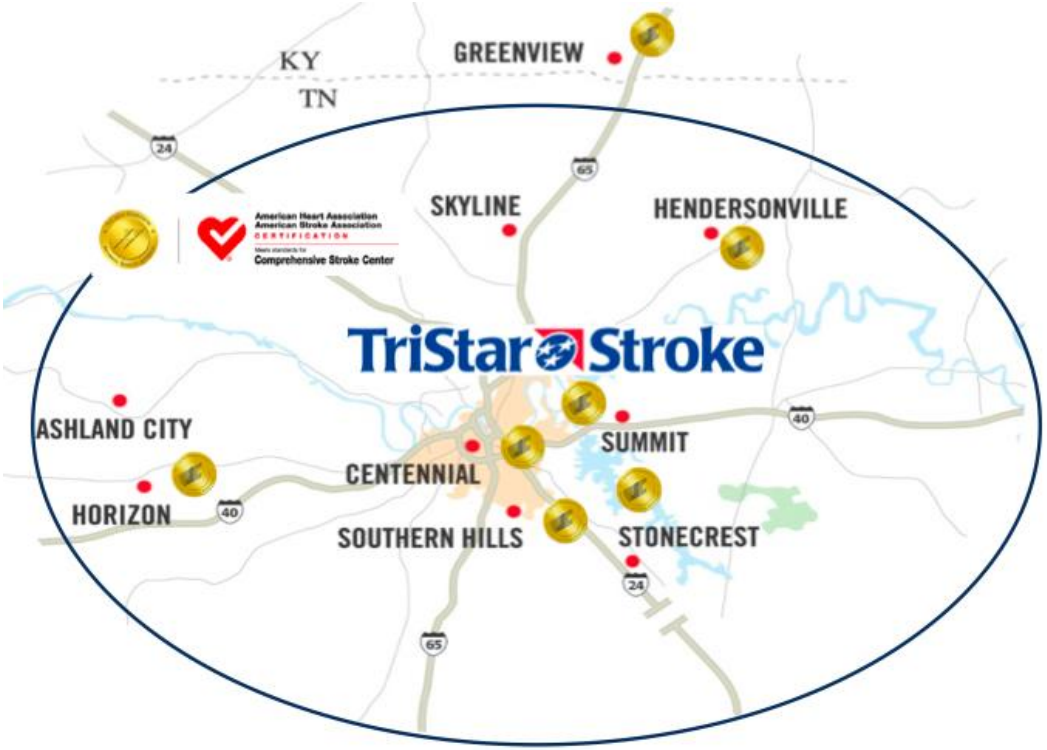
45.1% live within 30 minutes ground travel time from a certified stroke center

69.8% within 60 minutes

89.1% within 90 minutes

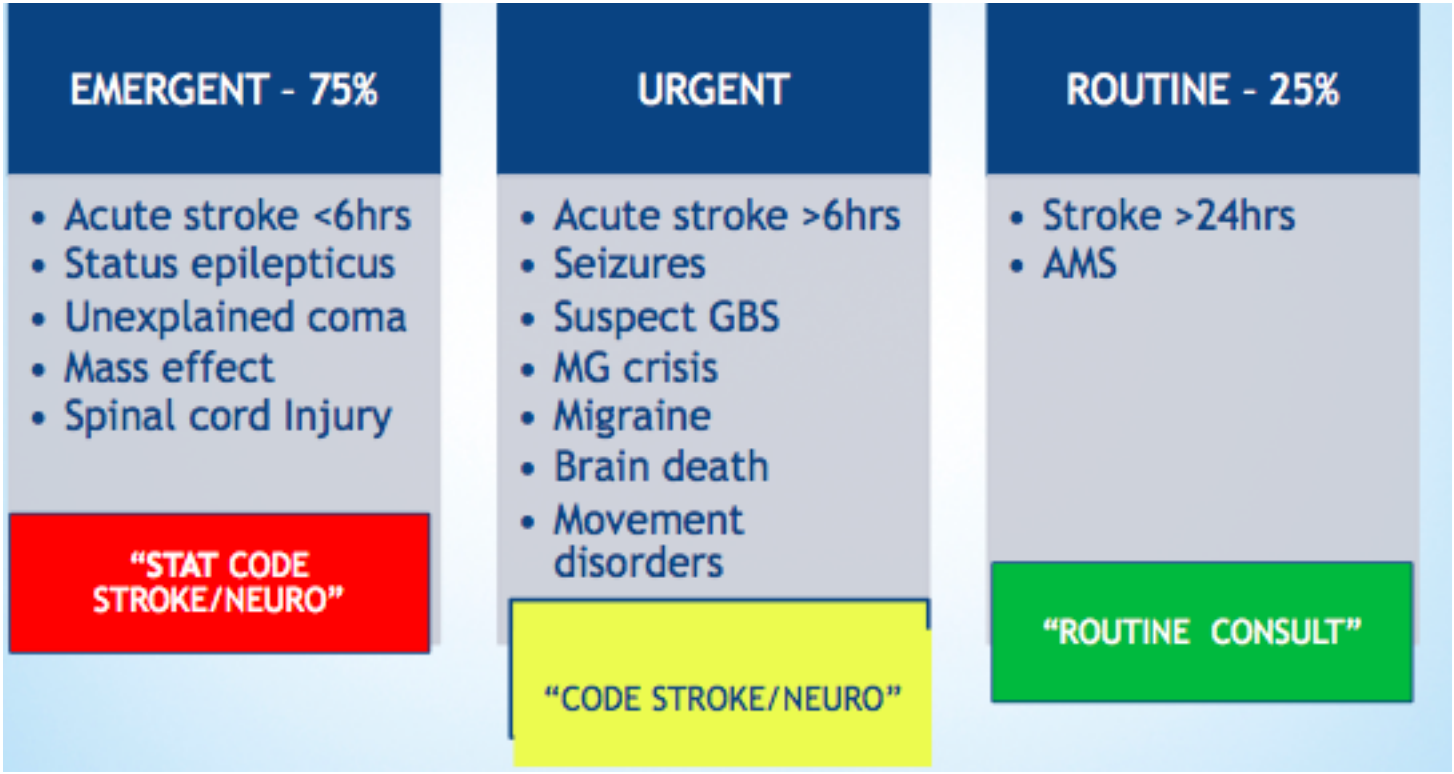
10.9% of Tennesseans, an estimated **691,725** people, live more than 90 minutes ground travel time from a certified stroke center.

Need to Innovate

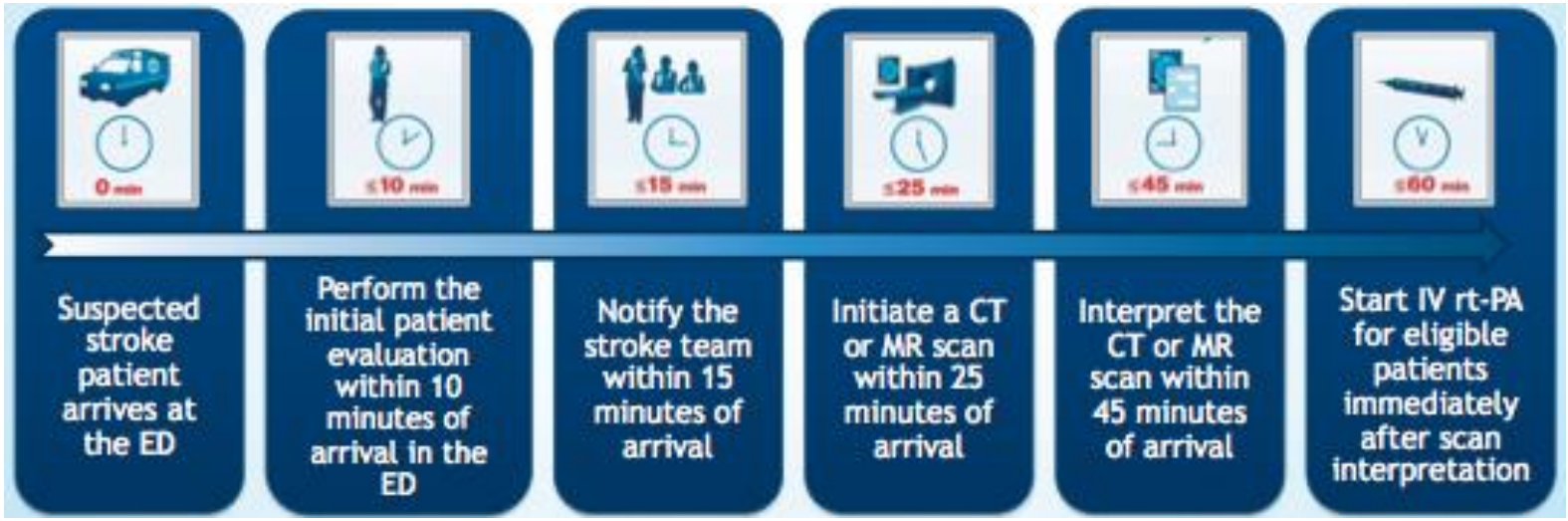


Offer a network to triage, assess, diagnosis, and treat critically ill neurological patients by leveraging telemedicine innovation

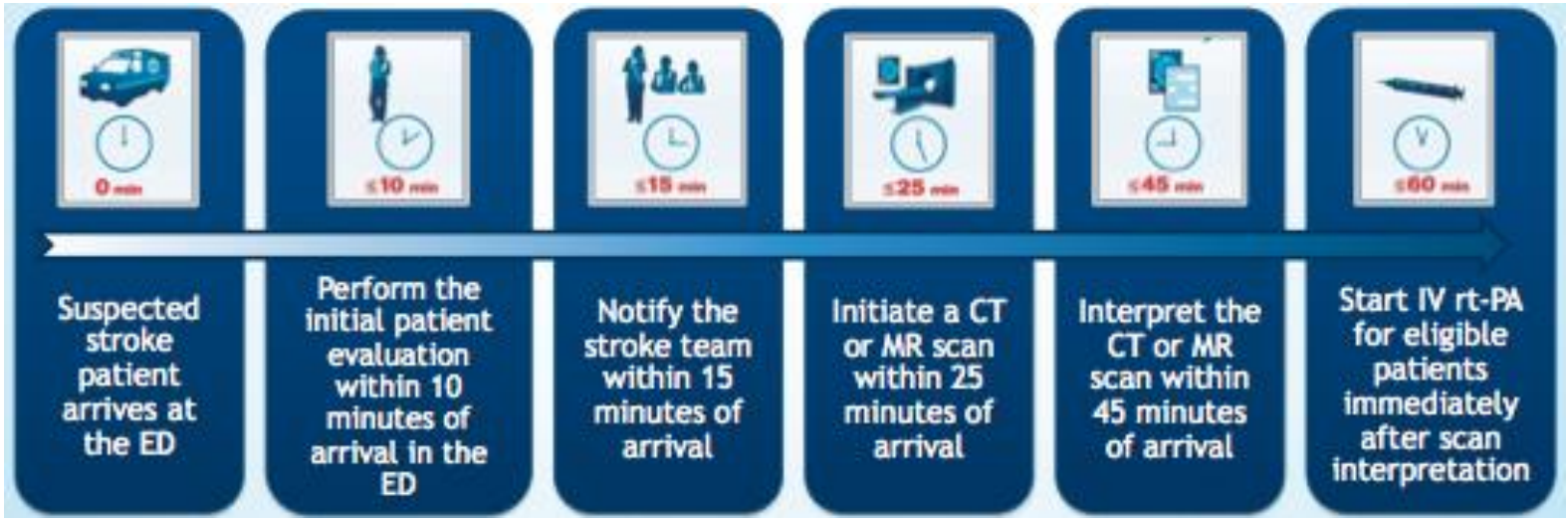
Decision-Making (I)
Color Code Strategy



A Barrier To Implementation



The "Actual" Innovation



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The Workflow

Tele-neurology facilitates Rapid, Accurate Treatment & Rapid, Appropriate Transfers

EMS goes to the nearest Acute Stroke Ready Hospital or PSC if more than 20 minutes from CSC

→

Early activation of highly skilled, committed tele-neurologist

→

Timely treatment (DTN) and rapid disposition to CSC

Decision Making (II)

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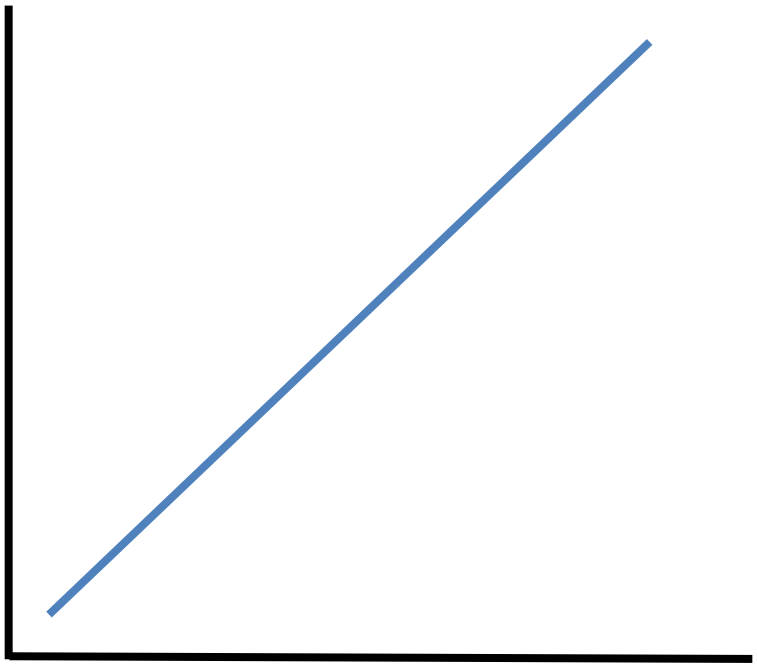
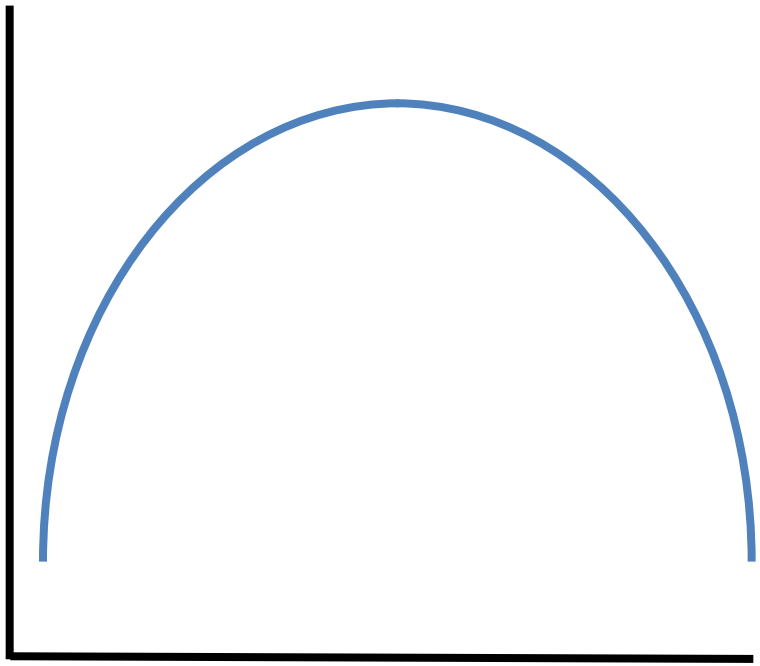
Maximizing vs. Optimizing?





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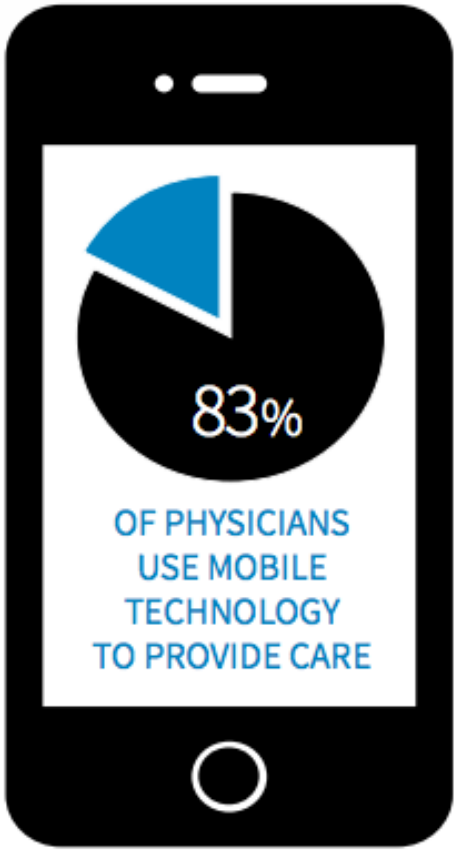
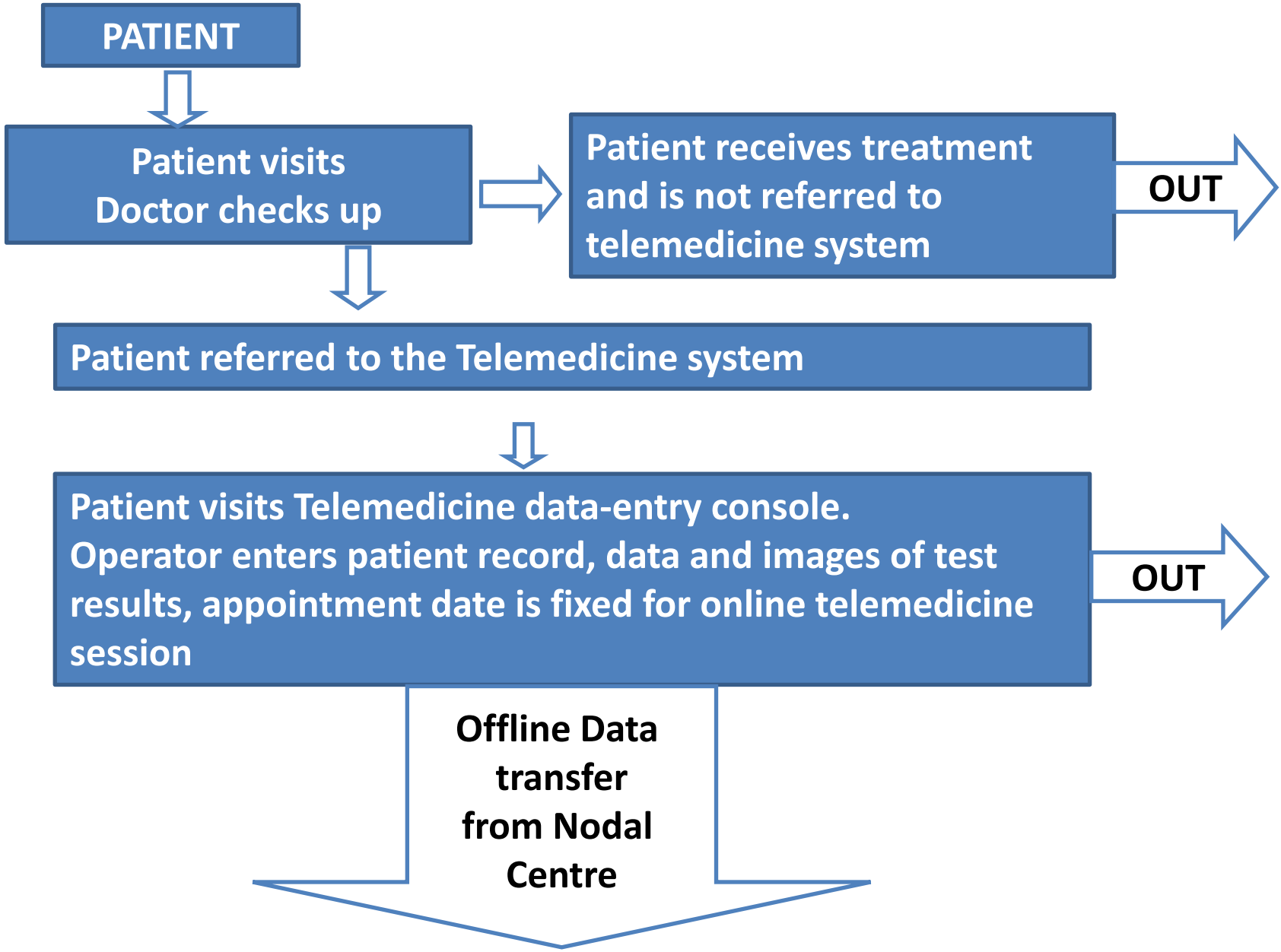
Novel Opportunities

The Follow-up

HIMSS Analytics
3rd Annual HIMSS Analytics Mobile Survey
(February 26, 2014)



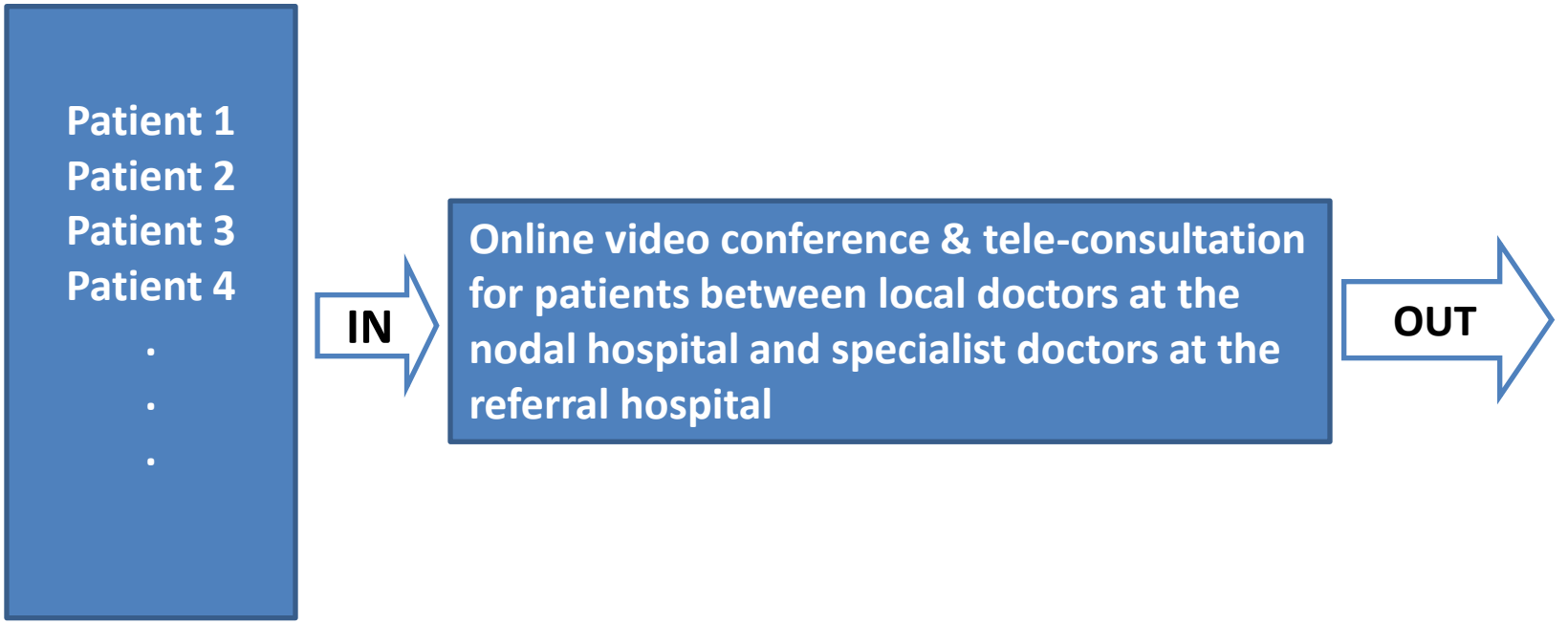
Follow-Up



Step One

Tele-consultation

Step Two



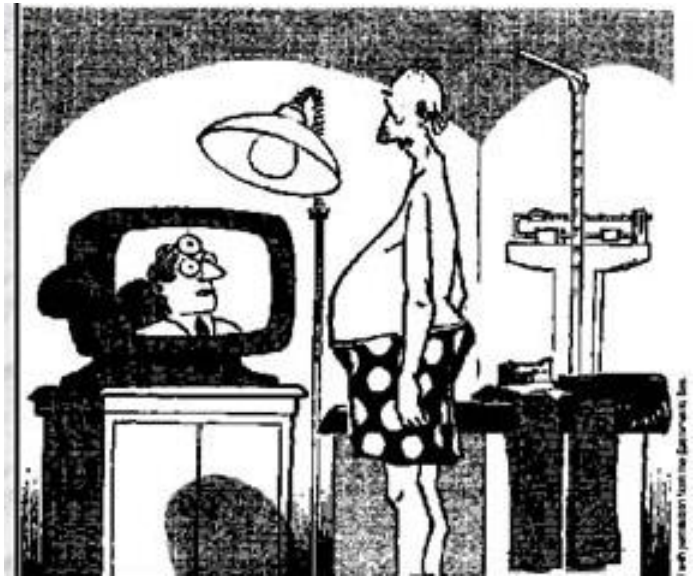
Innovation System

- There is a marketplace
- Shifting site of care (Hospital <- > Home)
- Team Care
- Improved communications between provider and patient
- Digital convergence

Challenges & Barriers

- Equipment costs
- Connectivity costs
- Licensing
- Liability
- Privacy
- Infrastructure
- End-user issues

Still…



"Hello, I'm your new primary-care physician. Your original HMO has been acquired by an insurance company that recently merged with a multi-national phone company specializing in interactive telecommunications

Drop your pants, please."

Take-away

- Technological innovation is not just a product but also a process
- It works within a system
- It tackles a market demand
- Needs constant implementation/creativity
- Healthcare is a perfect playground centered on biomedical engineers

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THANKS!

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