

Overview of Medical Imaging Equipment Characteristics at the Health Station Level

William R. Hendee, PhD

Distinguished Professor
Radiology, Radiation Oncology,
Biophysics, Institute for
Health & Society
Medical College of Wisconsin

Professor of Biomedical Engineering
Marquette University

Adjunct Professor
Electrical Engineering
University of Wisconsin-Milwaukee

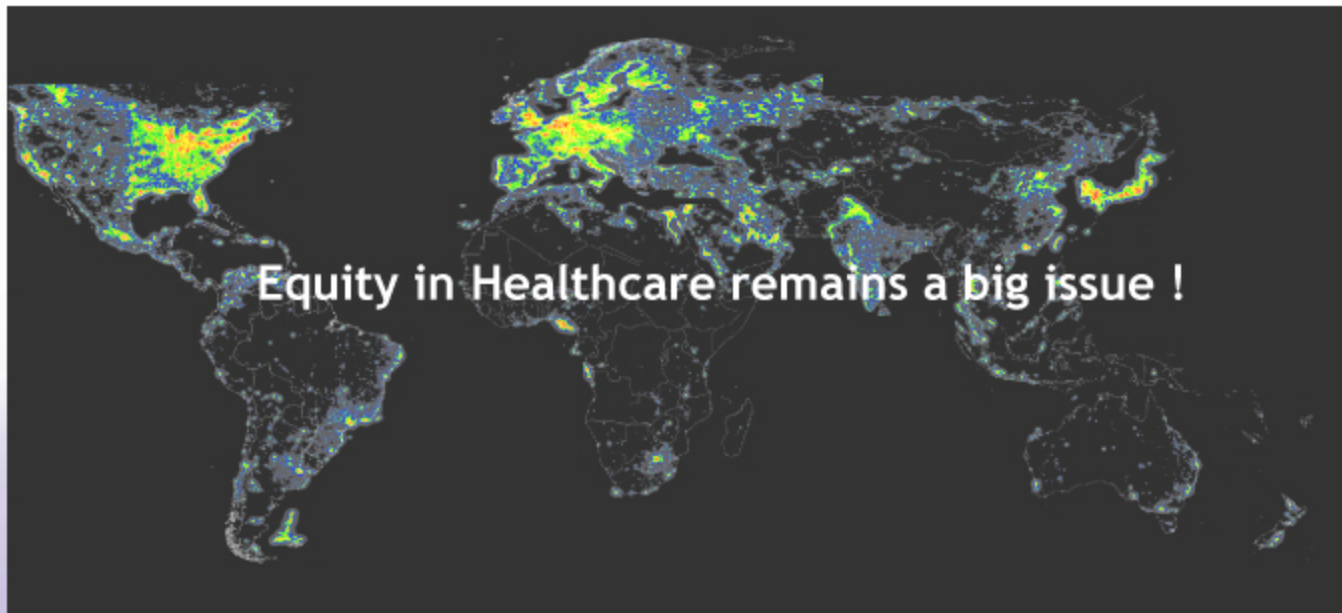
Adjunct Professor of Radiology
University of New Mexico

Adjunct Professor of Radiology
University of Colorado



Global Context

- Innovation in HTs do not **always answers health needs**
- Needed HTs are not **distributed fairly**



Nocturnal picture of our world

Medical devices arena



Medical devices have a huge potential to

- improve health status of people
- support people with disabilities

Are medical devices

- Available?
- Accessible?
- Appropriate?
- Affordable?



Public health needs and medical devices ...



| Public health needs:

- diseases and risk factors
- disabilities and functioning problems

| Do we know the data?

| Do we use the data?

| **... are not properly matched**



>90% Fail in the First 5 years



95% of all medical equipment in resource-limited settings are donated

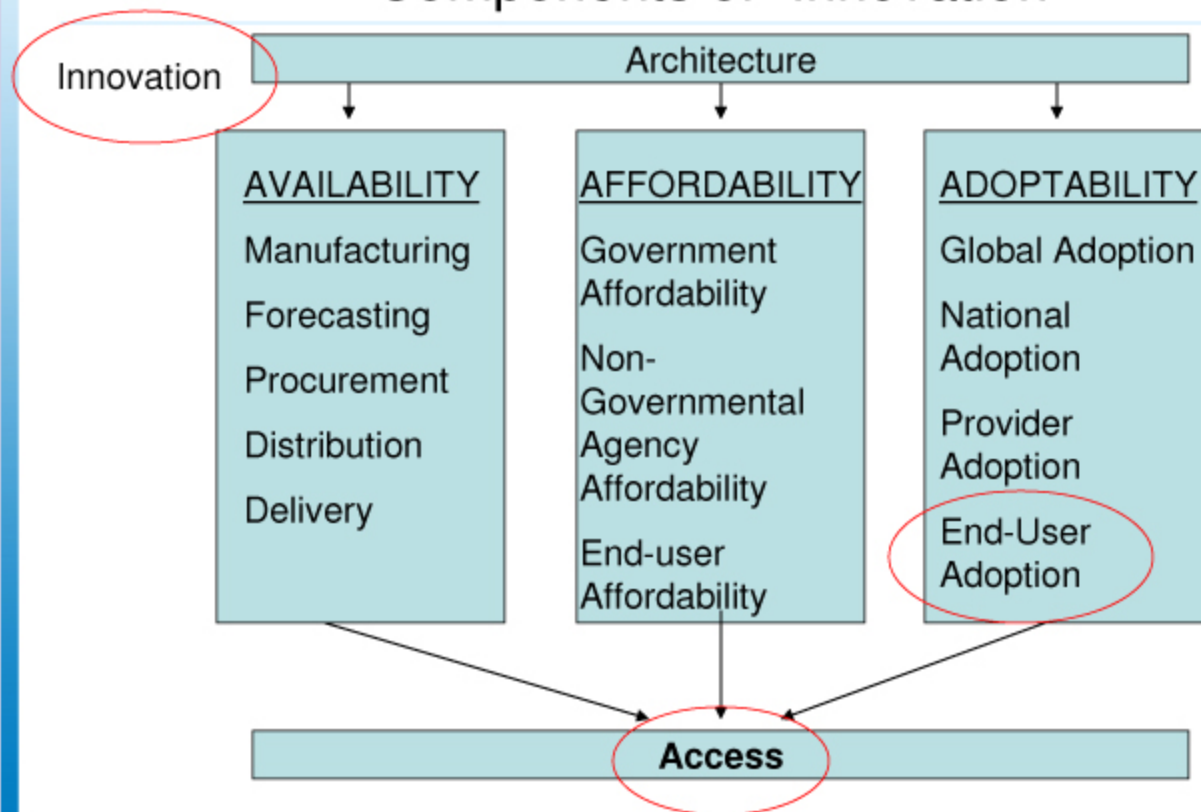
Source: Malkin, R. Design of Health Care Technologies in the Developing World. Annu. Rev. Biomed. Eng. 2007.

Medical devices ...

- | ... deserve to be on the agenda of national policy makers, international organisations, manufacturers, and users.
- | ... need collaborative effort of all involved stakeholders on global, national, regional levels to meet public health needs.
- | ... require a public health approach focusing on access to appropriate medical devices.



Invention, Adoption, and Access are essential Components of “Innovation”



Adapted from: Laura Frost & Michael Reich, Access, Harvard U. Press; 2008.

Choosing medical devices ...



Factors

- Extreme diversity
- Context dependency
- Clinical guidelines
- Clinical outcome
- Lack of information
- Fascination with technology
- Costs

... is a complex process



Using medical devices ...



- | Design
- | Medical devices management
- | Maintenance problems
- | Training
- | **... could be improved**





Context: questions faced by decision makers

- Is this new HT **necessary** for my country?
- Is the new HT **justified** sufficiently by the overall **benefits** achieved in terms of safety, health outcomes, and costs in my country?
- Which **patients can benefit the most** from this new HT in my country?
- Among the **big number of choices** of HTs, **which are the most appropriate** for a specific health problem in my country?



Appropriate Technologies for Developing Communities

- Small scale
- Energy efficient
- Environmentally sound
- Labor intensive
- Controlled by community
- Simple to maintain
- Match user and need with complexity
- Foster
 - Self-reliance
 - Cooperation
 - Responsibility

Innovation and research



| Medical device research options according to

- Availability
- Accessibility
- Appropriateness
- Affordability

| A possible way forward

- Partnerships for local innovation
- Public private partnerships
- Collaborations between manufacturers in high and low resource settings
- Partnerships with academia





World Health Organizations Estimates

- 2/3 world population without access to x-ray imaging
- Need for 1 imaging system per 50,000 people
- 1/2 WHO imaging installations in operation (sustainability)



Challenges of Medical Imaging in Developing Countries

- Lack of resources and/or improper choice of equipment
- Poor image quality
- Poor maintenance
- Lack of trained manpower
- Misinterpreted images



What Needs to Be Present for Imaging in Developing Countries

- Integrated into national healthcare system
- Regulated according to international standards
- Appropriate to level of healthcare system
- Appropriate to therapy capabilities available



Requirements at the National Level

- Government commitment/support;
- National plan for imaging services
- National radiation protection control authority
- Specialist advisory groups
- Needs assessment
- Upgrade, repair, maintenance of facilities
- National quality system



World Health Imaging Alliance Goals

- 20,000 digital x-ray systems
- Additional 1 billion people with x-ray access
- Image acquisition, storage, teleradiology, remote monitoring
- Partnerships beyond Rotary International



View from Crossroads Clinic, Cape Town, SA

Low-Cost Digital Imaging

Problem: Basic radiological services are lacking in much of the developing world.



WHIS-RAD



Computed Radiography (CR) Image Detector

Solution: Proven x-ray technology linked to CR- or DR-based digital image capture with a single simple graphical interface. Technical training and service are included in the cost of the system.



BME MS student Parmede Vakil at the Crossroads installation

Implementation: World Health Imaging Alliance founded to deploy systems in South Africa and Guatemala, (so far).

Partners: Merge Healthcare, Sedecal, Carestream, Rotary, Western Cape CHC



World Health Imaging Alliance

- Carestream CR system, HP workstation, multiple viewing stations
- Merge PACS software, Internet connectivity
- No film, darkroom, chemicals
- Immediate access to images
- Electronic storage/retrieval
- Teleradiology consultation
- Role of Rotary clubs/foundation



World Health Imaging Alliance X-Ray Installations

- Bulawayo, Zimbabwe
- Gumry, Armenia
- Lusake, Zambia
- St. Lucia
- South Africa (digital)
- Guatemala City, Guatemala (digital)





Useful Websites for Imaging in Developing Countries

- <https://internationalservice.acr.org>
- <http://imagingtheworld.org>
- <http://www.rad-aid.org>
- <http://medicalimagingpartnership.org>
- <http://www.rsna.org/international/CIRE/ivpp.cfm>
- <http://www.eastafricafoundation.org>
- <http://www.who.org>
- <http://www.iaea.org>