Questions

1. what is the value of telemedicine in the developing world?

2. what is the experience so far?

3. what could be done in the future?
Outline

1. telemedicine in general
2. telemedicine in developing countries
3. experience with networks
4. Swinfen Charitable Trust
5. interesting SCT cases

What is telemedicine?
(or telemedicine, telehealth, online health, e-health etc)

... medicine at a distance

i.e. any kind of medical activity where distance is involved
  - diagnosis
  - treatment
  - education (staff or patient or general public)

Alfred Traeger's pedal radio, 1929
Approximate synonyms

The following terms all mean roughly the same thing

– telemedicine
– telehealth
– telecare
– online health
– e-health
– connected health

Health care interactions – what are the alternatives?

• move the doctor* to the patient, e.g. a visiting or outreach service
• move the patient to the doctor, e.g. patient transport
• facilitate a distance interaction

*or other health care worker
Move the doctor/move the patient

- e.g. Royal Flying Doctor Service

- but note that non-scheduled air travel is not without hazard

VH-LQH
Toowoomba, Qld

Aerial view showing the accident location

Accident wreckage

Royal Flying Doctor Service of Australia
Facilitate a distance interaction

- videoconferencing
- Internet or other networks
  - email
  - Web
- telephone/radio
- fax
- mail

What are the potential benefits?

- improved access to health care
- fewer unnecessary referrals
- improved consistency and quality
- decreased professional isolation
- better CME (continuing medical education)
- reduced health care costs (?)
Examples of good practice

- ... are hard to come by
- systematic reviews continually show that the evidence for telemedicine is weak*
- examples
  1. teleradiology (S&F)
  2. telepaediatrics (real-time)


Example 1. Teleradiology

- NightHawk Radiology Services is based in Sydney, Australia
- provides teleradiology services to hospitals in the US
- mainly radiology cover for emergency departments during evening and night hours in the US – this corresponds to daytime and evening work hours in Australia
Example 1 ...cont

• rapid preliminary radiological interpretations at the time of the patient visit to the emergency department (official [primary] interpretations provided by local radiologists at the hospital the following day)

• all radiologists are certified by the American Board of Radiology. The radiologists are fully licensed in all American states and have credentials in all hospitals for which they provide their radiology services

Teleradiology

• little formal evidence for cost-effectiveness

• probably the most mature application of telemedicine (not even thought of as "telemedicine" now)
Example 2. Telepaediatrics

Mackay

Brisbane

1100 km

5000 consultations (Aug 2007)

Patient consultations per month

Cardiology

Respiratory

Neurology 5%
Orthopaedics 5%
General Paeds 5%
Endo 5%
Oncology 10%
Rheumatology 4%
Respiratory 3%
Surgical 3%
Burns 22%
Oncology 14%

Cardiology
Service costs

1499 patient consultations over 5 years

<table>
<thead>
<tr>
<th>Costs</th>
<th>VC ($)</th>
<th>FTF ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>638,246</td>
<td>0</td>
</tr>
<tr>
<td>Variable</td>
<td>317,750</td>
<td>1,553,264</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>955,996</td>
<td>1,553,264</td>
</tr>
<tr>
<td>Average per consult</td>
<td>638</td>
<td>1036</td>
</tr>
</tbody>
</table>

Smith AC, Scuffham P, Wootton R. The costs and potential savings of a novel telepaediatric service in Queensland. *BMC Health Serv Res* 2007 Mar 2;7:35

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So, what are the advantages of telemedicine?

**Primary benefit is remote access**

- increased speed of access
- (reduced cost of access)

**Other benefits**

- increased uniformity in practice (quality)
- better support for rural health workers
What telemedicine won’t do

• solve the problem of doctor shortage
• slash the cost of health care

Why so few examples of success?

• main advantages are to patients; there are few advantages to central specialists
• savings to patients; but costs to hospitals
World experience

- initial enthusiasm of the 1990s
- many unsustained pilot projects
- little routine activity on enterprise scale

Lessons learned

- harder to do than you first think
- many (most?) projects not sustained
- top-down planning doesn't work
- securing the support of the users is essential
- the Grand Plan is usually a recipe for disaster (remember "small is beautiful")
- concentrating on the technology is wrong
Factors in success

- key factors are well understood*
- can't be done by a top-down, authoritarian, imposed-on-doctors approach
- there has to be an incentive for the users
  - patient: reduced travel etc
  - provider: improved cost-effectiveness
  - clinician: better than the conventional alternative

*e.g. see Introduction to Telemedicine, 2nd ed. Wootton R, Craig J, Patterson V (eds). RSM Press, 2006

Outline

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2. telemedicine in developing countries
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4. Swinfen Charitable Trust
5. interesting SCT cases
Health care in the developing world

- huge disparities with industrialized world
- lack of doctors and other staff
- major inequities in access

∴ telemedicine likely to be useful

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Telemedicine experience
(98% of Medline articles on telemedicine)

Industrialized

- 18%
- 47 countries
- 1220 million people

Developing

- 82%
- 127 countries
- 5400 million people
What are the potential uses in the developing world?

1. administrative
2. education
3. clinical
   - disasters (natural and man-made)
   - second opinions

1. Administrative

• unglamorous and therefore under-reported?
• valuable for
  - conducting meetings at a distance
  - web-based data collection
  - online reporting
2. Educational

- real-time. RAFT network
- S&F. Pacific Open Learning Network

- also
  - HINARI
  - Medline

3. Clinical

  e.g. distance consultation

- real-time (video)
  - high bandwidth
  - low bandwidth
- store-and-forward (messaging)
Telemedicine

• can be done using relatively simple and cheap techniques
  – web
  – email

• real time telemedicine (e.g. videoconferencing) works well in the right circumstances – but is expensive

Telemedicine for disaster relief

Armenian earthquake, 7 December 1988
Second opinions

• there is a history in telemedicine of supporting doctors in the developing world

• some of the longer-established operations (i.e. >5 years) have developed into substantial networks

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Telemedicine networks
(operating for 5 years or more)

• Cambodia (Partners, Boston)
• Pacific Islands (Tripler)
• iPath (Basle)
• SCT (UK)
• RAFT (Geneva)

Cambodia (Partners, Boston)

• referring sites
  – Rovieng Health Centre
  – Rattanikiri Hospital
Pacific Islands (Tripler)

- referring sites
  - US-associated Pacific islands

- expert sites
  - Tripler Army Medical Center, Hawaii

iPath (Basle)

- referring sites
  - several (mainly telepathology), e.g. Cambodia, Solomon Islands, Bangladesh
  - also Ukrainian Swiss Perinatal Health Project

- expert sites
  - mainly Swiss, European

- mechanism
  - web
SCT (UK)

- Referring sites: 199 referrers from 119 hospitals in 33 countries
- Expert sites: 281 specialists
- Mechanism: email and web

RAFT (Geneva)

- Referring sites: nine countries in Africa

[Map showing distribution of referring hospitals]
## Utilization rates (second opinions)

<table>
<thead>
<tr>
<th>Network</th>
<th>Cases</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cambodia</td>
<td>900 (6 years)</td>
<td></td>
</tr>
<tr>
<td>Pacific Islands</td>
<td>3000 (10 years)</td>
<td></td>
</tr>
<tr>
<td>iPath</td>
<td>c500 (5 years)</td>
<td>Telepathology conferences</td>
</tr>
<tr>
<td>SCT</td>
<td>1500 (9 years)</td>
<td></td>
</tr>
<tr>
<td>RAFT</td>
<td>20 (5 years)</td>
<td>Education</td>
</tr>
</tbody>
</table>

## What about costs?

- **Tripler**
  - substantial set up and training costs
  - savings from reduced hospital/travel costs because fewer admissions
What evidence for benefit?

• Cambodia
  – duration of chief complaint reduced
  – fewer off-site referrals

• Tripler
  – reduced admissions
  – reduced LOS because of better triage

• SCT
  – follow-up data in PNG

What is the quality of the evidence?

• literature review

• inclusion criteria - telemedicine AND developing countries

• exclusion criteria - papers not reporting actual experience with TM, i.e. editorials, reviews etc

*Wootton R, Bonnardot L. In what circumstances is telemedicine appropriate in the developing world? JRSM Short 2010; 1: 37
What kind of report?

- of the 38 studies
  - 27 experimental (71%), i.e. the authors introduced a telemedicine intervention
  - 11 observational (29%)
- and
  - 34 clinical (89%)
  - 14 educational (37%)
  - 11 both (29%)

Assessment of quality

- studies assessed on
  - sample size
  - type of study
  - use of control group
  - measurement of costs
  - measurement of effectiveness
Review findings

• 38 studies. Quality rather weak (median score 3, poor)

• all except one concluded positively in favour of telemedicine (97%)
  n.b. publication bias?

• weak evidence in favour of telemedicine

• great potential for telemedicine in the developing world

Common features of the 5 networks

• most rely on volunteer specialist expertise

• all seem to be operating at a few hundred cases per year

• their referral rates appear to be stable, i.e. they are not growing rapidly
A paradox

- it is often difficult to obtain a second opinion in developing countries
- telemedical networks offer a free and often rapid service
- why isn't demand growing rapidly?

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Email-based telemedicine

- email for messages and digital cameras for clinical pictures
- UK military (e.g. Falklands, Bosnia)
- charities
  - Kosovo
  - Cambodia
  - Swinfen Charitable Trust

Bosnia, January 1998

E-referral network

- low-cost telemedicine system – digital camera pictures and email
- spinal injuries hospital in Bangladesh, 1999
- referrals to international specialists coordinated by the charity, Swinfen Charitable Trust

Centre for the Rehabilitation of the Paralysed, Bangladesh
Email system

► specialists and staff work on a volunteer basis
► from July 1999 until 2002 emails handled manually
► AutoRouter developed by COH

Daily situation report

• contains details of:
  – number of messages during the last 24 h
  – list of any unanswered cases

Analysis of current caseload:
================================
38 unanswered queries
315 queries with dialogue in progress
3 unanswered cases*****

Summary of unanswered cases:
==============================
<table>
<thead>
<tr>
<th>Case No</th>
<th>Referrer</th>
<th>Specialist</th>
<th>Allocated</th>
</tr>
</thead>
<tbody>
<tr>
<td>1233c</td>
<td>112-Dr</td>
<td>300-Professor Mark Ludma</td>
<td>12/03/2004 8:25:23 AM</td>
</tr>
<tr>
<td>1273</td>
<td>139-Prof Bashar Fatoohi</td>
<td>297-Dr Nazar Anso</td>
<td>22/03/2004 10:55:00 AM</td>
</tr>
<tr>
<td>1275</td>
<td>139-Prof Bashar Fatoohi</td>
<td>250-Mr David Kingsbury</td>
<td>25/03/2004 9:56:00 AM</td>
</tr>
</tbody>
</table>

For more detailed information, send a 'LIST CASES' request.
System operators

- Australia
  - GMT+10
- UK
  - GMT

Web messaging system

- from August 2008
- email for notifications (non-confidential information)
- log in to secure server for patient data
Swinfen Charitable Trust (July 2007 data)

1479 cases

199 referrers from 119 hospitals in 33 countries

281 specialists

Outcomes - electronic messaging

• the Swinfen Charitable Trust has demonstrated that low-cost telemedicine is
  – feasible (median response time <2 d)
  – clinically useful
  – cost-effective

• it is surprising that email is not more widely used for clinical purposes (inc. assessment)

• automatic message-handling is a generic solution to a common problem in store-and-forward telemedicine
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Case from Afghanistan

"patient complains about ulcer (location face). Has got it for 14 years already, sometimes bleeding, no secretion, ulcer not painful but itchy ..."
Dermatologist's opinion
(New Zealand dermatologist)

► ... the most likely diagnosis is ulcerated nodulocystic basal cell carcinoma. The proximity to the eyelid is of concern (biopsy to confirm), and if possible, the patient should be treated by an experienced plastic, dermatologic or oculoplastic surgeon to reduce the likelihood of eyelid retraction post excision of the tumour

► (referrer subsequently put in touch with IK Foundation in Pakistan)

Case from PNG

Dr Michael Parsa, writing from a remote area in Papua New Guinea...

I was recently out at a remote village and saw a 4 month old girl who appears to have congenital glaucoma. She has bilateral cloudy, edematous corneas, this is really all I am basing my diagnosis on. She has a 4 year old sister who was also "born blind." This 4 year old has what appears to be a cataract on one side, but her eyes just rove around and she does not appear to be able to see anything from either eye.

Will medicine alone be curative for this patient or will she need surgery? How soon must the surgery be done?
Ophthalmologist's opinion

► If the eyes are also larger than normal, that is the so called 'ox eye' or buphthalmos, then the diagnosis is confirmed. For congenital glaucoma, they are photophobic, very watery, with cloudy corneas, and large eyes. The treatment is 100% surgical. Before surgery can be organised, I would suggest using betaxalol 0.5% once a day (twice if no complications). She should be seen as soon as possible in a paediatric eye facility, such as Princess Margaret Hospital for Children in Perth, with a view to surgery as soon as possible.

► Let me know if I can help. I am happy to manage her at the above hospital in Perth.

Case from Tristan da Cunha in the South Atlantic

Dear Consultant
This 4-year-9-month female patient presented to me at 08h15 on the 26th of March 2003 with acute abdominal pain in the right iliac fossa.

Her temperature was 38.5 ºC, she could not straighten her legs and I found guarding and peritonitis … I was clinically convinced that this was acute appendicitis. I am responsible for both the anaesthetic and surgical procedure ... Rapid sequence induction and assisted ventilation … No anaesthetic complications … The appendix was ruptured. I removed the omentum that was part of the abscess …
As there is no drainage and bowel sounds are present, when would you recommend that I remove the drain? Furthermore, shall I just pull it out in one swoop? The drain is easily mobile but also quite snug and I hope not to have to put in more stitches after removal.

Could you please advise on further monitoring and possible complications. Thanking you for your support and awaiting your advice.

Locum Medical Officer

---

Dear Doctor,
Greetings from Brisbane, Australia.

Sounds like you have done rather well, being both Surgeon and Anaesthetist.

We would not normally use a drain in this situation, just keep on IV antibiotics until the temperature settles which might be as long as 3-5 days. If it is only serous fluid coming from the drain, I would pull it out in 2 stages over 2 days ... and best to use saline rather than water for the washout. Let me know how she does over the next few days.

Yours sincerely
(Consultant, Paediatric Surgeon, Australia)
Dear Sir,
This unlucky and lucky at same time, child exposed to bullet from above of unknown origin to the left upper part of the frontal bone pass through the frontal lobe as we see in the CT scan to the left orbit behind the globe Conscious, oriented and fully active only complain from heaviness in the left orbit

Examination
VA: 6/6 x 6/6 Mild proptosis not bru; neither thrill
Mild limitation of ocular motility in lateral gaze
Good alignment in primary position and there is no diplopia
Pupil: round regular react to light
Normal fundi and optic disc

Your opinion
With best regard
Dr. SAGED AL-ASSADY
Telemedicine in the developing world – 2

Outline

1. SCT experience
2. digital images
3. why isn't demand escalating?
4. where to from here?
SCT characteristics

- free service to users
- unlimited range of expertise available
- S&F operation, so not for emergencies
- provides audit trail in case of medicolegal problems
- use at own risk
- specialists advise the treating doctor, not the patient, i.e. "good samaritan" insurance cover
- user surveys are very positive
- patient follow-up good where available

Type of cases 1999-2007 (no of queries=2010)
Summary: electronic messaging

• the Swinfen Charitable Trust has demonstrated that low-cost telemedicine is
  – feasible (median response time <2 d)
  – clinically useful
  – cost-effective

• it is surprising that email is not more widely used for clinical purposes

• automatic message-handling is a generic solution to a common problem in store-and-forward telemedicine

SCT experience

• useful in a very wide range of cases, e.g. neurology

• not suitable for emergencies

• web-messaging is superior to plain email

• doctors are poor at taking clinical photos
"Satellite" systems

- copy SCT systems are being operated by other organisations

Outline

1. SCT experience
2. digital images
3. why isn't demand escalating?
4. where to from here?
Digital images

- doctors are very bad at taking clinical photographs!

- good results require more than point-and-shoot (n.b. the PHD camera doesn’t help)

Image quality survey

- images submitted during two 3-month study periods were compared

- quality of the images assessed by scoring in four categories:
  - focus
  - anatomical perspective
  - composition
  - lighting

Jakowenko J, Wootton R. An analysis of the images attached to referral messages in an email-based telemedicine system for developing countries. *J Telemed Telecare* 2006; 12 (suppl. 3): 49-53
Attached images became more common

Period 2 – 54%, compared with 38% before

Period 2 – more microscope images, more X-rays

Image quality

- for the images in the referral messages, the median score in 2002 was 16
  ... and the median score in 2006 was 15

- significant difference (P<0.001)
Education in the field

• during the period covered by the study a printed photography guide was produced and sent to all referring doctors

• despite this, image quality declined

• web-based education may be more effective

Tutorial

before

after
Outline

1. SCT experience
2. digital images
3. why isn't demand escalating?
4. where to from here?

A paradox of altruism

• it is often difficult to obtain a second opinion in developing countries

• telemedical networks offer a free and often rapid service

• why isn't demand growing rapidly?
Why isn't demand escalating?

1. "Thatcherism"
2. referrers too busy
3. cultural problem of asking for help
4. knowledge at referring sites of some diseases may be greater than that of the 'experts'
5. perceived loss of control by national health care system

1. Thatcherism

i.e. an item or service is not valued if it is free

• probably not relevant in the context of the developing world where donor support is the norm
2. Referrers too busy

• much helped by availability of appropriate assistants, e.g. medical students


3. Cultural problem of asking for help

• a doctor is by definition the expert

• it may be viewed as failure to ask for assistance
4. Local knowledge may be more than that of 'experts'

- crucial that 'experts' are selected appropriately, e.g. in-country expertise may be superior in some conditions

- specialists may sometimes request inappropriate tests
5. Perceived loss of control

- most networks provide expertise from out of country

The case of the Solomon Islands

- steady referral rates for first five years
- abrupt cessation in 2005
Coincidence?

• the cessation of referrals coincided with a new top appointment in the MoH

• the individual concerned was known to have strong nationalistic tendencies

• n.b. correlation does not prove cause and effect

The perception of influence

• is telemedicine perceived as
  – neocolonialism?
    i.e. the maintenance of control by former colonial powers using indirect (economic) controls
  – cultural imperialism?
    i.e. promoting, distinguishing, separating, or artificially injecting the culture or language of one nation into another
Outline

1. SCT experience
2. digital images
3. why isn't demand escalating?

What is the right strategy?

• build intra-country telemedicine networks as soon as practicable

... exactly what was being proposed in the Solomons
Solomon Islands e-Health project
(Aug 2004)

1. all hospitals in the Solomons to be connected by a managed telemedicine network
2. network management from the NRH

Solomon Islands e-Health project

3. super-specialist referrals sent out to the Swinfen network for reply
Telemedicine in the developing world

The work of the Swinfen Charitable Trust (and others) demonstrates that low-cost telemedicine is

- feasible
- clinically useful
- sustainable
- scaleable

... but it isn't yet happening on a significant scale


Questions

1. what is the value of telemedicine in the developing world? **great potential**
2. what is the experience so far? **limited**
3. what could be done in the future? **we need a demonstrator**
An exemplar

• an obviously successful telemedicine project could be replicated widely

• but what does "obviously successful" mean?

Peruvian network

• email by VHF radio link

• fewer urgent patient transfers from health posts and health centres

• emerging evidence for cost-effectiveness

The way forward

We need within-country telemedicine networks that

– focus on areas identified by WHO to affect the disease burden
– demonstrably alter health outcomes
– can be shown to be cost-effective and sustainable
– provide a model for other countries to copy

*treatment of TB
maternal health
family planning
school health
childhood illness
HIV/AIDS prevention
treatment of STIs
immunization
malaria
tobacco control
other disease and injuries

*supported internationally, e.g. for super-specialist referrals