Telehealth and Diabetes Care Management

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Poll Question

What is your primary professional role?

- Clinician
- Non-clinician Investigator
- Healthcare administration
- Information technology support
- Other
Poll Question

What is your interest in telehealth?

• I’m using telehealth technologies in the care of patients.
• I’m not familiar with the topic and would like to learn more.
• I had nothing better to do today, so I decided to sign-up for this conference.
Telehealth

• *(Telemedicine)*
The use of information and communication technology to provide clinical care, patient education, provider education, and hospital administration in circumstances where distance separates those receiving services and those providing services.
Care management

• (Care coordination or case management)
  Facilitating delivery of the right care, in the right place at the right time.
  In most cases, the home is the preferred place of care
Interactive behavior change technology

• The use of hardware and software to promote and sustain behavior change (e.g. PDAs, websites, automated telephone calls)

• Assists patients and clinicians in monitoring patient’s health status, supports patients’ efforts to make changes, and enhances communication between patients and clinicians
Is Telehealth technology important?

- Generally accepted based on validation studies or anecdotal reports
- Few studies to assess cost-effectiveness
- FDA ranked home telehealth in top 5 of 36 new medical technologies in terms of impact on healthcare over the next 10 years
Telehealth applications

• Patient-to-provider – basic information
  – Ask basic questions, offer prompts, limited data

• Patient-to-provider – complex information
  – Internet-based portals

• Clinical peer-to-peer – basic information
  – Tele-radiology, dermatology, ophthalmology

• Clinical Peer-to-peer – complex information
  – Remote consultation
Patient-to-Provider Telehealth

Health Buddy

Viterion 100

Home PC
Can education and care management be delivered remotely?
Computer Use and Internet Access

- Survey of Ambulatory Care patients - VABHS
  894 respondents, age 62
  - 53% with computer access
  - 63% interested in receiving health information via the Internet
Internet-based applications

- **Weight management using e-counseling**
  - Greater weight loss with website access and e-counseling
- **Interactive asthma education website**
  - Access to a website was associated with:
    - *Increased asthma knowledge, reduced symptom days, fewer ER visits, lower steroid doses*

*Tate DF et al. JAMA 2003; 289: 1833-1836
Telephone-based management

- **Telephone calls with RN follow-up**
  - Biweekly automated telephone calls; most benefit when A1c >8% (net effect- 0.5 -1.1%)

- **Mobile phone and SMS messaging**
  - Patients send glucose results via phone, receive message from nurse
  - Decrease in A1c by 1.1% over 12 weeks

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Piette JD et al. Diabetes Care. 2001;24:202-208
Care management - caution

- **Nurse care management**
  - 246 patients, A1c 9.3%
  - Nurse care management using algorithms; follow-up over 18 months
  - No difference in A1c, BP, lipids
  - Intervention resulted in greater satisfaction with diabetes care

Web-based diabetes education and care management
Web-based care management

Recruitment and Screening

½ day Education

Usual Care

Web-based Care

HbA1c, BP, Quality of Life Questionnaires

Months

0  3  6  9  12
Methods

• **Web-based care management**
  – Provided with notebook computer, glucose and BP monitors and dial-up access to MyCareTeam™ website
  – Upload glucose and BP data
  – Interact with care manager via internal messaging system on website
  – Care manager uses algorithms to improve glucose and BP control

• **Usual care**- on-going care by their PCP
Clinical Characteristics

Baseline Characteristics (n = 104)

- HbA1c 10%
- Age (years) 64
- BMI (kg/m²) 33
- Sex (% male) 99
- Duration of diabetes (yrs) 12
- Prior Internet access (%) 29
HbA1c over 12 months

- Web-based care management
- Usual care

$P<0.05$ vs. Usual care
Persistence with web-site logins

- **Persistent users** ($n = 30$)
  - At least one website login every 3 months

- **Intermittent users** ($n = 22$)
  - $>3$ months during the study with no registered logins
HbA1c based on persistence

![Graph showing the change in HbA1c over time for Usual Care, Intermittent, and Persistent groups.]

- Usual Care
- Intermittent
- Persistent

Change in HbA1c (%) vs Months

0 3 6 9 12

0 0.0
-0.5
-1.0
-1.5
-2.0
-2.5
IDEATel – Methods

Informatics for Diabetes Education and Telemedicine

- **Telemedicine intervention**
  - Telemedicine in-home unit with nurse case management

- **Randomized trial**
  - Intervention vs. usual care

- **Medicare beneficiaries (n = 1665)**
  - Diabetes, >55 years, medically under-served areas in NY (upstate and NYC)
IDEATel – Change in A1c

Hemoglobin A1c (%)

Adjusted Mean

Usual Care

Telemedicine

Time (years)

Shea S et al. JAMIA 2009;16:446-456
IDEATel – Caveats

- **Modest clinical effects**
  - Small but significant changes – A1c (0.29%), SBP (4.3 mm Hg), lipids (3.8 mg/dl)

- **No mortality benefit**
  - Likely under-powered

- **Increased costs**
  - $8,000 per person per year for intervention
  - Total Medicare costs 71% higher in intervention group

Moreno L et al. Diabetes Care 2009; 32: 1202-4
Care management vs. Internet access?
Care management vs. Internet access

Recruitment and Screening

- Usual Care and Internet access
  - Telephone Care Management
  - Web-based Care Management

Questionnaires

Months

0  3  6  9  12
Methods

• **Web-based care management**
  – Notebook computer, glucose and BP monitors, access to website, care manager

• **Telephone-based care management**
  – Glucose and BP monitors, routine access to care manager via phone and office visits

• **Internet access**
  – Notebook computer and Internet access; home-page set to web-based diabetes care resources
### Baseline Characteristics ($n = 104$)

- **HbA1c** 9.9%
- **Age (years)** 60
- **Sex (% male)** 95
- **Duration of diabetes > 5 y** 78%
- **Some college education** 60%
HbA1c over 12 months

Change in HbA1c (%)

Internet access
Telephone
Web-based

Months

0 3 6 9 12
Clock-drawing test

- In the paper provided draw a clock face, with numbers, in the blue box.
- Show the hands of the clock pointing to 10 minutes after 11 o’clock.
Interactive Behavior Change Technology

Communication links that could be targeted by IBCT

Patients’ Care Team ➔ Informal Caregivers

Patients

Other Patients

Piette JD. Diabetes Care 2007; 30:2425-2432
Interactive behavior change technology

- Look before you leap
- One size does not fit all
- Beware of “cool” applications
- IBCT should support human contact
- Diabetes self-management is rarely patients’ primary life concern
- Not all patients need IBCT
- Innovations require multidisciplinary collaborations

Piette JD. Diabetes Care 2007; 30:2425-2432
Future Directions

• What component(s) are responsible for improved glucose control?
• Which patient characteristics identify those who will benefit from e-health applications?
• Fitting technology with patients
• Identifying cost-effective strategies
• How to sustain persistence
Summary

Telehealth-based diabetes management

• Clinical benefits demonstrated – but…
  – Key components are unclear
  – One size does not fit all
  – Patient persistence is likely required
  – Questionable cost-effectiveness
When you come to a fork in the road, take it.

*Lawrence “Yogi” Berra*
Tele-retinal Imaging

History of Teleretinal Imaging in VISN-1

- FY1998 – VA – Department of Defense – Joslin Diabetes Center collaboration established
- FY1999 – Teleretinal imaging begun at VA Boston and in VISN-20
- FY2000 – Image acquisition at Togus VAMC
- FY2001 – VHA convenes expert panel to review criteria
- FY2006 – VHA establishes national teleretinal imaging program
  National Training Center at VA Boston
- FY2007 – Image acquisition at multiple sites; image interpretation at VA Boston
- FY2008 >200,000 patients accessed
Tele-retinal Imaging

• Who?
  – Patients with diabetes mellitus
  – No recent eye examination or scheduled for eye exams with known low-risk characteristics
  – Not for those with known, advanced DR

• What?
  – Technology-assisted evaluation for diabetic retinopathy
  – NOT a substitute for a complete eye exam
Acquisition station

- Retinal camera
- Computer workstation
- No pupil dilation
- High-resolution digital stereo, color images
- Data transmission using standard network links
Diabetic Retinopathy

Abnormal Retinal Vessels

Pre-retinal hemorrhage
Non-diabetes eye findings

Glaucoma

Age-related macular degeneration
Tele-retinal Imaging

- When?
  - “Capture” patients when they present for primary care, subspecialty care, other visits

- Where?
  - NOT in the Ophthalmology or Optometry clinics
A Clinical Pathway for Tele-retinal Imaging

1. Patient Identified With Clinic Appointment
2. Review medical and eye care history
3. Candidate for tele-retinal imaging
4. Transmit images to Reading Center
5. Acquire images
6. Review images
7. Technician Triage/Appoint patients based on findings
8. Report in CPRS
Tele-retinal Imaging

• Why?
  – Frequency of annual eye exams are less than optimal
  – Eye clinic appointments require separate visit
  – Most patients have no retinopathy
  – Ability to triage patients
Tele-retinal imaging studies
## Agreement with clinical exam

268 patients examined by TRI and retina specialist

- Exact agreement 72%
- Within one DR level 89%
- Appropriate referral 92%
- Other referable eye findings 25%
- Patients with no DR or mild DR 67%

Other Ocular Conditions

1219 patients examined by TRI

- **Urgent ocular conditions** 1%
  - Retinal vein occlusion, vitreous hemorrhage
- **Urgent medical conditions** 4%
  - Retinal emboli, hypertensive retinopathy
- **Additional ocular diagnoses** 61%
  - Cataract, glaucoma suspect, choroidal nevus, macular degeneration

Tele-retinal imaging and glaucoma

Case-control study of patients examined by TRI

• 175 diagnosed as “glaucoma suspect”

• 175 without glaucomatous findings
  • Matched for age, sex and race

• Results from comprehensive eye exam
  – 103/175 (59%) “cases” met glaucoma criteria
  – 7/175 (4%) ”controls” met glaucoma criteria
  – Intra-ocular pressure was identical between groups

Adherence with eye care

Patients with diabetes randomly assigned to have tele-retinal imaging or not (n = 447)

- Tele-retinal imaging (n = 223)
  - Follow-up based on results of images

- Control group (n = 224)
  - Follow-up based on guidelines (e.g. annual eye exam)

- End points
  - Eye exam within 12 months, level of agreement between imaging and follow-up exam
## Eye care follow-up

<table>
<thead>
<tr>
<th></th>
<th>Follow-up Visit</th>
<th>No follow-up Visit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRI group</strong></td>
<td>194 (87%)*</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>(Documented eye care within 12 months)</td>
<td></td>
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<tr>
<td><strong>Control group</strong></td>
<td>172 (77%)</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>(No eye care in 12 months)</td>
<td></td>
</tr>
</tbody>
</table>

*P<0.01

Level of Satisfaction

How satisfied were you overall with this video examination?

A billion here and a billion there, and pretty soon you’re talking real money.

Everett Dirksen
Effectiveness of tele-retinal imaging

Whited J et al. Telemedicine and E-Health 2005
Total Costs of tele-retinal imaging

Digital retinal imaging  Ophthalmoscopy with dilation

$29.34
$20.26
$22.67
$27.07
$29.34

$9.12 $12.09

Proliferative Diabetic Retinopathy Detected
Panretinal Laser Photocoagulation
Severe Vision Loss

Whited J et al. Telemedicine and E-Health 2005
Future Research Directions

• Does tele-retinal imaging reliably identify ocular diseases other than DR?

• Can tele-retinal imaging substitute for an eye exam in low-risk patients?
Summary

Tele-retinal Imaging

• effective and cost-effective care coordination tool to improve eye care
• high level of agreement with follow-up eye exams
• often reveals other findings that warrant a referral for eye exam
• results are more than “screening” and less than “diagnostic” (i.e. evaluative)
Collaborators

**Care management**
- Helen Gomes
- George Alexis
- Betty A. Levine
- Graham McMahon
- Stephanie Fonda

**Tele-retinal imaging**
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- Sven E. Bursell
- Anthony Cavallerano
- Gerald Selvin
- Louis Pasquale
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