Remote Management & Rehabilitation of Individuals with COPD

Harnessing Technology for Aging-in-Place
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Chronic Diseases in Adults 65+ years, Canada, 2009 (Statistics Canada)

Majority of individuals with COPD are undiagnosed – true prevalence over 35% (Evans et al Health Reports 2014)
COPD – what is it?

- Chronic, progressive disease of both the airways and the lung tissue
- Long-term exposure to inhaled particles causes inflammatory process
- Destruction of lung tissue, and/or thickened, irritated airway walls
- 4th leading cause of death in North America
## Aging-in-place: a challenge for people with COPD

<table>
<thead>
<tr>
<th>SYMPTOM</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe shortness of breath</td>
<td>Stairs, walking</td>
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<tr>
<td></td>
<td>Talking, laughing</td>
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<tr>
<td></td>
<td>Sleep quality</td>
</tr>
<tr>
<td>Frequent respiratory infections</td>
<td>Regular ‘convalescence’</td>
</tr>
<tr>
<td></td>
<td>Hard to recover</td>
</tr>
<tr>
<td>Muscle weakness</td>
<td>ADL, including personal care, home care</td>
</tr>
<tr>
<td>Poor activity tolerance</td>
<td>ADLs</td>
</tr>
<tr>
<td>Variability of symptoms</td>
<td>Participation</td>
</tr>
<tr>
<td>Cough, wheeze</td>
<td>Stigma</td>
</tr>
</tbody>
</table>
Pulmonary Rehabilitation at St. Paul’s Hospital

**BENEFITS:**
- Improved activity tolerance
- Reduced breathlessness
- Increased quality of life
- Reduced risk of hospitalization for an exacerbation
- Cost-effective (4-8K per QUALY)
Prevalence of COPD in NHA is double that of VCH

Less than 1% of patients have access
What Technology Options May Be Useful in Pulmonary Telerehabilitation?
Home Monitoring

Blood pressure

ECG

oxygen, heart rate

Philips.com
Fraser Health BreatheWell at Home Project
September 2011 – March 2012

% decrease

- ER Visits: 30%
- Admits: 35%
- LOS: 15%
- Re-admit: 45%
A Nintendo Wii exercise program provides the same exercise demand as a traditional pulmonary rehabilitation program in adults with COPD: a randomized, within-subjects cross-over study

Camp PG et al, Clinical Respiratory Journal, 2014
<table>
<thead>
<tr>
<th></th>
<th>Wii Intervention</th>
<th>Treadmill</th>
<th>Paired t-test (p-value, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Energy</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure (J)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>353.5 (134.1)</td>
<td>317.1 (105.2)</td>
<td>0.256</td>
</tr>
<tr>
<td>Minimum</td>
<td>216.7</td>
<td>185.0</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>636.1</td>
<td>556.9</td>
<td></td>
</tr>
<tr>
<td><strong>Heart Rate (BPM)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>112.5 (13.2)</td>
<td>112.7 (10.2)</td>
<td>0.937</td>
</tr>
<tr>
<td>Minimum</td>
<td>93.3</td>
<td>94.0</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>134.3</td>
<td>128.7</td>
<td></td>
</tr>
<tr>
<td><strong>RPE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>3.2 (0.59)</td>
<td>3.1 (0.78)</td>
<td>0.671</td>
</tr>
<tr>
<td>Minimum</td>
<td>2.0</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>4.0</td>
<td>4.7</td>
<td></td>
</tr>
<tr>
<td><strong>Borg Dyspnea</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>3.4 (0.52)</td>
<td>3.1 (0.50)</td>
<td>0.0528</td>
</tr>
<tr>
<td>Minimum</td>
<td>2.7</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>4.3</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td><strong>SpO2 (%)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>94.7 (2.5)</td>
<td>92.3 (3.3)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Minimum</td>
<td>91.3</td>
<td>88.7</td>
<td></td>
</tr>
<tr>
<td>Maximum</td>
<td>98.3</td>
<td>98.0</td>
<td></td>
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</tbody>
</table>
Portable Monitoring

Nonin Wrist Oximeter

Lionsgate Technologies
Fitbit™ Fitness Devices

Image from Fitbit.com
Multiple technological options...

What has our research told us about what is important?
LungFIT – Identifying the Necessary Parameters of Pulmonary Telerehabilitation

To gain an in-depth understanding of patient and provider perspectives on telehealth for pulmonary rehabilitation

• Preferences and needs
• Insights into priority features and capabilities
• Recommendations for future applications
Preliminary Findings

1. Monitoring with biosensors can provide self-knowledge
2. The between-patient social aspect of any technology-enabled system is key
3. Important to connect with health care professional
4. Importance of rewards for motivation
5. Issues of safety & access
6. Importance of “eHealth literacy” and training
7. Importance of personalization
Key Policy Questions

- How much in-person contact?
- How to set boundaries on care?
- Who Pays?
- Who is Responsible?
- Patient & Provider IT supports?
Conclusion

• Many aspects of COPD raise barriers for healthy aging-in-place

• Technology enables us to deliver pulmonary rehabilitation

• Patients and providers want a system that
  ➢ offers reliable engagement
  ➢ is multi-faceted
  ➢ incorporates social contact, motivation, and feedback
  ➢ POLICY!!!
Funders

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Canadian Institutes of Health Research
Instituts de recherche en santé du Canada

The Lung Association
British Columbia

Canada Foundation for Innovation
Fondation canadienne pour l’innovation

Michael Smith Foundation for Health Research

PABC

Canadian Thoracic Society
Société canadienne de thoracologie