From **Telemonitoring** to **Self-empowerment**

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North District Hospital
Our first telemonitored patient initially presented to the sleep lab...

Wife complained that her husband turned blue every night!
Prompt action by sleep lab nurse during second part of the night (the “empowered” healthcare professional)
Manual bilevel positive airway pressure titration in sleep lab
Non-Invasive Ventilation (NIV) Telemonitoring
172 patients received 244 episodes of telemonitoring.
Training carers on mask application
Other breathing disorders detected on telemonitoring
Concomitant sleep-disordered breathing

Saw tooth

Low TV

Concomitant sleep-disordered breathing
NIV telemonitoring outcomes

• **65 patients** (including 21 re-admitters) discharged with home NIV between May 2010 and May 2012 were telemonitored for $\geq$ 4 weeks over **99 episodes**

• 19 abnormal respiratory events despite mask leakage correction
  – 6 episodes of over-ventilation (excessive pressures)
  – 4 episodes of under-ventilation (tidal volume too low)
  – 4 episodes of suspected obstructive sleep apnoea
  – 3 episodes of desaturation
  – 2 episodes of inadequate respiratory rate

• BiPAP setting adjustment (IPAP, EPAP, respiratory rate, $O_2$ flow)

• *When patients & carers feel empowered to live with their illness, readmission could be avoided (67.6% episodes)*
Telemonitoring

Mild-Moderate Disease

Pulse oximetry - Severe Disease with Hypoxic Risk

Very Severe Disease with Resp Failure

Physical Activity - TeleRehabilitation
Pulse oximetry telemonitoring

SpO$_2$ finger probe

Transmitter

Password protected Website
**SpO₂ telemonitoring outcomes**

- New O₂ therapy users & long-term O₂ users with poor compliance
- Frequent admitters & community patients with symptoms of exacerbation

- 82 episodes of telemonitoring provided to 67 patients for 14 days between August 2010 and October 2011

- 63 (77%) episodes of **desaturation** among 50 patients
  - Acute COPD exacerbation in 27 (33%) episodes
    - Antibiotics and prednisolone were prescribed in 10 (37%) episodes
    - Outpatient appointment advanced in three (11%) episodes
  - **Hospitalization was avoided for 42 (84%) of the 50 hypoxic patients**

*Vong YP, HA Convention 2012*
Hypoxia despite oxygen therapy...

SaO₂ 80%

On oxygen at 3.5 L/min
Time with SpO₂ < 88%:
10h 28min

Clinical Admission with NIV initiation & decreased O₂ flow rate

Discharged with nocturnal NIV (IPAP 20, EPAP 12, RR 12, O₂ at 1 L/min)

SaO₂ 90%

Telemonitoring data:
Mean SpO₂ 92%
Time at SpO₂ < 88%:
19min
Walking with a near-empty oxygen cylinder...

I hadn’t realized that my oxygen saturation went down to 70%!

The oxygen company has been informed to refill my oxygen cylinder three times a week

As I no longer feel so breathless when I exercise
I can go out more often

I’ve not been admitted to hospital for the past 18 months!
Telemonitoring

COPD Assessment Test (CAT)
Mild-Moderate Disease

Severe Disease with Hypoxic Risk

Very Severe Disease with Resp Failure

Physical Activity - TeleRehabilitation
慢性阻塞性肺病 COPD 評估問卷

這問卷幫助你及醫療人員評估慢性阻塞性肺病(COPD)對你身心健康及日常生活的影響。測試結果及其分數可幫助你及肺病(COPD)的處理方法，及讓治療發揮最大的作用。

請就以下每題，選出一個最符合您現況的一格。請確保每題只選一個答案。

例子：我十分快樂 0 □ 2 □ 3 □ 4 □ 5 我十分傷心

<table>
<thead>
<tr>
<th>項目</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<tbody>
<tr>
<td>我沒有咳嗽</td>
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<tr>
<td>我肺內完全沒有痰液</td>
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<tr>
<td>我胸口完全沒有繃緊的感覺</td>
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<tr>
<td>當我行上斜路或上一層樓梯時，我沒有氣喘</td>
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<td>我在家中的活動不受限制</td>
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<tr>
<td>儘管我的肺部情況，我仍有信心離家外出</td>
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<tr>
<td>我睡得很好</td>
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<tr>
<td>我精力充沛</td>
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COPD 評估測試及 CAT 標誌屬 GlaxoSmithKline 集團之商標。
©2009 GlaxoSmithKline 版權所有。CAT – Hong Kong/Cantonese – Version of 09 Mar 10 – Mapi Research Institute. ID5536 / CAT_AU 1.0_nan-HK.doc
- Overall CAT score increase ≥ 5 suggests the onset of an exacerbation
- **Symptoms of exacerbation** scores > 3 highlighted in **red**

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<td>0-5</td>
<td>我不停咳嗽</td>
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<td>4</td>
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<td>2</td>
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<td>0-5</td>
<td>我肺內完全充滿痰液</td>
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<td>5</td>
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<td>3</td>
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<tr>
<td>3</td>
<td>我胸口完全沒有繃緊的感覺</td>
<td>0-5</td>
<td>我胸口感到十分繃緊</td>
<td>1</td>
<td>5</td>
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<td>當我行上斜路或上一層樓梯時,我沒有氣喘</td>
<td>0-5</td>
<td>當我行上斜路或上一層樓梯時,我感到十分氣喘</td>
<td>1</td>
<td>4</td>
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<tr>
<td>5</td>
<td>我在家中的活動不受限制</td>
<td>0-5</td>
<td>我在家中的活動十分受限制</td>
<td>1</td>
<td>4</td>
<td>3</td>
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<tr>
<td>6</td>
<td>儘管我的肺部情況,我仍有信心離家外出</td>
<td>0-5</td>
<td>因為我的肺部情況,我完全沒有信心離家外出</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>我睡得很好</td>
<td>0-5</td>
<td>我因肺部情況而睡得不好</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>3</td>
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<tr>
<td>8</td>
<td>我精力充沛</td>
<td>0-5</td>
<td>我完全沒有精力</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
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總分 8 31 27 27
Automated Instruction based on symptom scores
Non-pharmacological treatment

• Animated demonstrations of breathing and coughing techniques

• Tips on energy conservation
Patient feedback

- 95% felt that their self-management of cough, dyspnoea and sputum clearance had improved
- 95% felt that symptom control was enhanced and anxiety was reduced when their condition worsened
- 96% felt that overall understanding of disease and self-management were enhanced
Telemonitoring

Mild-Moderate Disease

Severe Disease with Hypoxic Risk

Very Severe Disease with Resp Failure

Physical Activity - TeleRehabilitation
Activity sensor worn on patient’s waist during daily activities

Home base station for patient data transmission

Immediate audio-visual feedback

Week 1: 25/9 - 1/10
Week 2: 2/10 - 6/10 (system upgrade)
Week 3: 14/10 - 20/10
Impact of telemonitoring on daily physical activity, self-awareness of physical activity and overall energy level

COPD Patients in 1st session of Pulmonary Rehabilitation Program (PRP)

Control group (n=6)  Study group (n=8)

Pedometer  Pedometer + PA Telemonitoring

After 6-week PRP
Results

1. **Daily Physical Activity (mean daily step count)**
   - Control 5207 → 8122 steps (↑103%)
   - Study 3971 → 8535 steps (↑232%)

2. **Self-awareness of Physical Activity (mean VAS 1-10)**
   - Control 6.50 → 8.33 (↑38%)
   - Study 5.13 → 7.63 (↑61%)

3. **Overall Energy Level (mean of CAT component)**
   - Control 1.60 → 0.40 (↓29%)
   - Study 1.75 → 0.38 (↓81%)
   (*p=0.037*
Telemonitoring

Crisis pack

Pulmonary Rehabilitation

Maintenance treatment
Thank you

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