Patterns of Home Ventilation Usage in the Province of Alberta: A Retrospective Population-Based Cohort Study

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Objectives

1. Home Mechanical Ventilation and patient-centered outcomes. A systematic review

1. Temporal epidemiology of HMV prescribing trends in the province of Alberta. A retrospective cohort study

2. HMV user outcomes
Clinical Outcomes Associated with Home Mechanical Ventilation: A Systematic Review

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Background. The prevalence of patients supported with home mechanical ventilation (HMV) for chronic respiratory failure has increased. However, the clinical outcomes associated with HMV are largely unknown. Methods. We performed a systematic review of studies evaluating patients receiving HMV for indications other than obstructive lung disease, reporting at least one clinically relevant outcome including health-related quality of life (HRQL) measured by validated tools; hospitalization requirements; caregiver burden; and health service utilization. We searched MEDLINE, EMBASE, CINAHL, the Cochrane library, clinical trial registries, proceedings from selected scientific meetings, and bibliographies of retrieved citations. Results. We included 1 randomized control trial (RCT) and 25 observational studies of mixed methodological quality involving 4425 patients; neuromuscular disorders (NMD) (n = 1687); restrictive thoracic diseases (RTD) (n = 481); obesity hypoventilation syndrome (OHS) (n = 293); and others (n = 748). HRQL was generally described as good for HMV users. Mental rather than physical HRQL domains were rated higher, particularly where physical assessment was limited. Hospitalization rates and days in hospital appear to decrease with implementation of HMV. Caregiver burden associated with HMV was generally high; however, it is poorly described. Conclusion. HRQL and need for hospitalization may improve after establishment of HMV. These inferences are based on relatively few studies of marked heterogeneity and variable quality.
Disclosures

- Covenant Health Research Grant
- Genzyme

Conflicts of Interest

- None
Rationale

• Home mechanical ventilation (HMV) usage has increased dramatically since the 1980s
  – Non-invasive ventilation
  – Morbidity and mortality benefit
  – Expansion to a range of disease states
  – Establishment of community based programs
  • ROP established in 1972
Rationale

- The CTS published HMV guidelines in 2011

- Canadian prevalence estimated at 12.9/100,000 population
  - 73% NIV, 18% TV, 9%NR
Objective

- To identify and summarize all literature examining patient-centered outcomes, other than survival, in HMV users
Methods

- A scoping review of the literature of studies evaluating patients receiving HMV reporting at least one clinically relevant outcome:
  - health-related quality of life (HRQL)
  - hospital admission rates
  - health service utilization
  - sleep quality
  - care giver burden
Study identification process

- Citations identified through database search (duplicates removed) (n = 1371)
- Additional articles identified through other sources (n = 6)
- Potentially relevant articles identified for further review* (n = 40)
- Studies included in final analysis (n = 24)

* 4 German language articles included

- Citations did not meet criteria for primary survey (n = 1337)
  - Full text articles excluded (n = 16)
    - Did not meet inclusion (n = 5)
    - Review articles (n = 3)
    - Duplicate cohorts (n = 3)
    - Guideline (n = 1)
    - European HMV demographic survey (n = 1)
    - HRQOL questionnaires (n = 3)
## Study and Patient characteristics

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<th>Study</th>
<th>Year</th>
<th>Study design</th>
<th>Location</th>
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<th>Age (mean)</th>
<th>M (%)</th>
<th>COPD(n)</th>
<th>NMD(n)</th>
<th>RTD(n)</th>
<th>OHS(n)</th>
<th>NIV (%)</th>
<th>f/u (mo)</th>
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<td>532</td>
<td>478</td>
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## Health Related Quality of Life

Mean change in SF-36 QOL domains at 12mo HMV compared to baseline across studies and disease states

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<th>Disease state</th>
<th>Study</th>
<th>n</th>
<th>Physical capacity</th>
<th>Mental capacity</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>PF</td>
<td>RP</td>
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<td>RTD</td>
<td>Windish et al</td>
<td>29</td>
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<td>NC</td>
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<td></td>
<td>Hein et al</td>
<td>8</td>
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<td>NC</td>
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<tr>
<td></td>
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<td>35</td>
<td>NC</td>
<td>+</td>
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<td>NR</td>
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<td>17</td>
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<td>8</td>
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<td>NC</td>
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<td></td>
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<td>27</td>
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<td>NC</td>
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<tr>
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<td>41</td>
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<td>NC</td>
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<td></td>
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<td>NR</td>
<td>NR</td>
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<td>OHS</td>
<td>Windish et al</td>
<td>9</td>
<td>+</td>
<td>+</td>
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<td></td>
<td>Tsolaki et al</td>
<td>28</td>
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# Hospitalization Rates

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<th>Study</th>
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<th>n</th>
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<th>After $^\text{b}$</th>
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</thead>
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<td>NR</td>
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<td>27</td>
<td>1.1 (1.2)</td>
<td>0.3 (1.2)</td>
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<td></td>
<td>RTD</td>
<td>35</td>
<td>1.2 (1.8)</td>
<td>0.8 (1.2)</td>
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<td>Farrero et al</td>
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<td>43</td>
<td>2.2 (2.4)</td>
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<td>654</td>
<td>1.5 (2.5) $^\ddagger$</td>
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<td>Vitacca et al</td>
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<td>375</td>
<td>NR</td>
<td>0.5 (0.4) $^|$</td>
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<td></td>
<td>RTD</td>
<td>128</td>
<td>NR</td>
<td>0.8 (0.5) $^|$</td>
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<td></td>
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<td>d in hospital/pt/y</td>
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<td>3.8 (5.7)</td>
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<td>10.9 (13.3)</td>
<td>0</td>
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</table>
Family Caregivers

• Younger than HMV users
• Predominantly female (76%)
• Spousal (54%) or parental (31%) relation.
• <50% were actively employed
  – Many quit work or reduce work hours
• 80% of FCG would choose HMV again
Conclusions

• There is a paucity of literature on patient-centered outcomes of HMV users.

• QOL and hospitalization rates improve with the establishment of HMV

• Caregiver burden is high. Particularly financial.

• Further high quality studies are needed
Unanswered questions in Alberta and Canada

• Prevalence of HMV users?
  – Incidence
• Demographics?
• Temporal trends in prescribing patterns?
• Health service utilization?
• Guideline adherence?
The team

• Sean Bagshaw – Supervisor
• Karen Rimmer and Andrea Loewen – Calgary
• Doug Mckim – Ottawa
• Louise Rose – Toronto
• Joanna MacLean – University of Alberta
• Jeff Bakal – Analyst Alberta Health Services
• RESP/ROP
• AADL
Methods

• Retrospective chart review
  – AADL funding approvals for bi-level positive airway pressure ventilation machines since 2009
  – All persons followed by the Respiratory Outreach Program for invasive tracheostomy ventilation and mouth piece ventilation since 2003
Home Ventilation Users Alberta

• 2,489 patients were prescribed BPAP during the 6 year study period
  – (Jan 1, 2009 and Dec 31, 2014)

• 209 portable ventilator users were identified
  – (Jan 1, 2003 and Sept 1, 2015)
  – 122 of these were initiated on HMV during the 13 year study period
BPAP

- Average annual incidence 107.7 per million population (pmp)
  - Estimated annual increase 5.7% [95% CI, 1.4-10.1], $p=0.02$
• 6.4% were pediatric (age <18y/o) (6.7 pmp)
  – Estimated annual increase 7.8% (95% CI, 2.2-13.5, p=0.02).
Portable Ventilator users

Tracheostomy

Mouth-Piece
• Average annual prevalence 19.0 pmp
  • **19.4% increase/year** [95% CI, 3.1-35.7], p=0.02).
Prevalence

- **TV**: 67.9% of users (14.3 pmp; p=0.14 for trend)
- **MP**: 14.8% (2.7 pmp).
  - Increase 5.5%/y (95% CI, 0.7-10.4%, p=0.03).
Portable Vent user prescribing trends by case mix
• 38% of the total cohort (7.3 pmp)
  • 11.5% increase/y (95% CI, 4.8-18.1, p=0.003).
Conclusions

• NIV BPAP prescribing incidence has increased significantly in Alberta

• “Children” and SDB
  – obesity
  – advances in medicine with prolonged survival;
  – improved disease recognition
  – better implementation of therapy according to guidelines

• VAI prevalence in Canada likely underestimated.
Now we have a better sense of “WHO”

• Prevalence of HMV users?
• Demographics?
• Temporal trends in prescribing patterns?
• **Health service utilization?**
• **Guideline adherence?**
List persons approved for AADL HMV funding

The list with PHN, name, sex, DOB

SPOR (Support Patient Oriented Research) analytics

New list with attached datasets (de-identified)

AH datasets
Practitioner Claims
Health Resource Utilization

The data

- Ambulatory access
  - Pulmonologist?
  - Sleep studies, PFTs
- Hospitalizations
  - ER visits
  - ICU vs pulmonary vs ward
  - Admitting diagnoses
  - Procedures
- Mortality

The populations

- Neuromuscular
- Pediatric to Adult Transition
  - (age 16 to first adult physician encounter)
- Invasively ventilated
References


Any “Crushing” Questions

erika.macintyre@covenanthealth.ca