Poster: PRO17

# Economic Burden of X-Linked Myotubular Myopathy (XLMTM) by Ventilation Status

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## Introduction

### Background

- XLMTM is a rare, life threatening congenital myopathy caused by pathogenic mutations of a single gene, *MTM1*
  - These mutations lead to absence or dysfunction of myotubularin, a protein required for the normal development, maintenance, and function of skeletal muscle cells [1]
- XLMTM has an estimated incidence of 1 in 40,000-50,000 newborn males [1-3]
- ~80% of affected patients experience extreme muscle weakness leading to severe respiratory distress [4]
  - 50% of patients die by 18 months of age [4]
  - Most surviving patients require permanent invasive mechanical ventilation and gastrostomy tubes [2,3]
- There are currently no approved therapies for XLMTM
  - Management is generally supportive care with increasing levels of respiratory support, which doesn't address cause of disease

### Objective

- This goal of this study was to quantify XLMTM patient costs by ventilation status

## Methods

### Data Source

- IQVIA PharMetrics Plus commercial claims database, with enrollment, demographic, and claims data for over 140 million individuals in the U.S.

### Study Patients

- There is no diagnosis code, specific to XLMTM; consequently, patients were limited to males with 1+ reported diagnostic code(s) used for XLMTM within the first 18 months of life
  - ICD-9-CM: 359.0, Congenital hereditary muscular dystrophy or
  - ICD-10-CM: G71.2, Congenital myopathies
- Patients also met criteria identified in the RECENSUS study of confirmed XLMTM patients (NCT02231697)
- Patients with evidence of spinal muscular atrophy (SMA) or Duchenne muscular dystrophy (DMD) were excluded

### Study Design

- Longitudinal retrospective analysis
- Study window: 1/1/2006 to 9/30/2018

### Outcomes

- Healthcare resource utilization, including inpatient admissions, emergency department visits without inpatient admission, outpatient services (outpatient hospital visits, physician office visits, labs, imaging, home health), prescription drugs
- Mean annual per patient costs paid by commercial insurers
- All outcomes stratified by ventilation status (pre-ventilation, non-invasive, invasive) **(Figure 1)**

## Results

### Study patients

- 49 patients met inclusion criteria
- A variety of ventilation patterns were observed (**Figure 1**)
  - Most (n=40, 82%) were initially or eventually treated with invasive ventilation
  - Prior to invasive ventilation, 43% (n=21) received no ventilation and 27% (n=13) received non-invasive ventilation

**Figure 1. Progression of Patients Across Ventilation States**

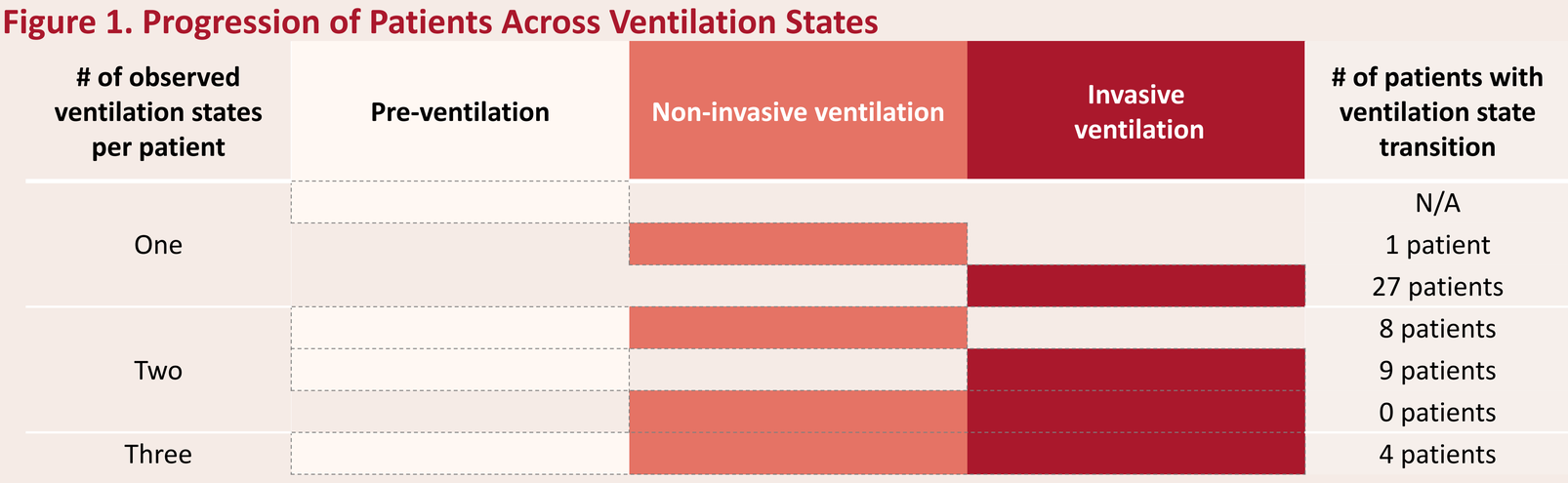



**Table 1. Mean per-patient healthcare costs by age and ventilation status, *USD* (n=49)**

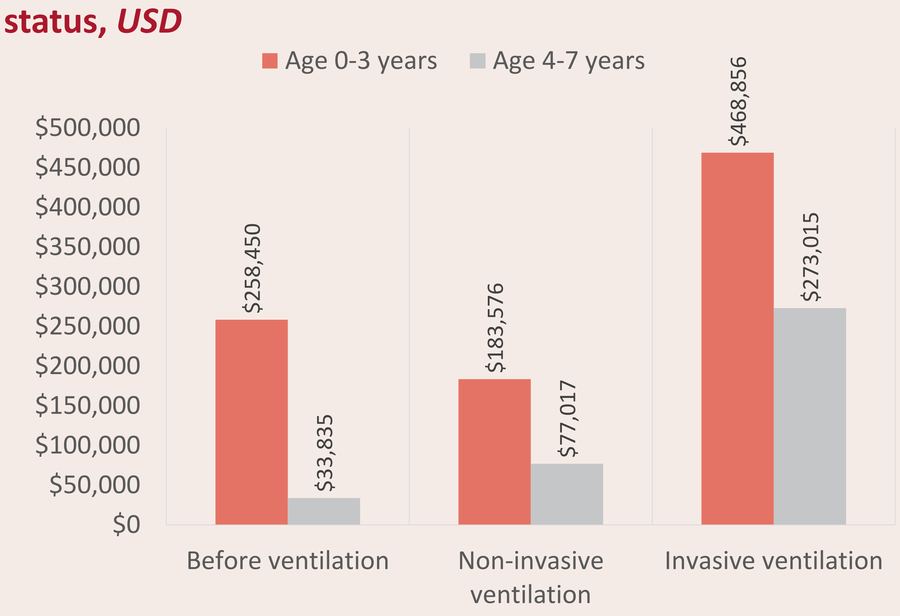
| Age (years) | *No Ventilation* | | | *Non-Invasive Ventilation* | | | *Invasive Ventilation* | | |
|---|---|---|---|---|---|---|---|---|---|
| | Observed patient months | Monthly all-cause healthcare costs | Annual all-cause healthcare costs* | Observed patient months | Monthly all-cause healthcare costs | Annual all-cause healthcare costs* | Observed patient months | Monthly all-cause healthcare costs | Annual all-cause healthcare costs* |
| 0 | 74 | $34,367 | $412,406 | 3 | $51,352 | $616,221 | 209 | $89,496 | $1,073,947 |
| 1 | 106 | $16,967 | $203,604 | 46 | $26,213 | $314,557 | 321 | $24,837 | $298,043 |
| 2 | 56 | $5,519 | $66,227 | 51 | $4,358 | $52,299 | 268 | $16,270 | $195,235 |
| 3 | 33 | $3,828 | $45,942 | 48 | $7,495 | $89,935 | 216 | $10,730 | $128,763 |
| 4 | 12 | $1,652 | $19,829 | 48 | $5,810 | $69,725 | 129 | $7,621 | $91,453 |
| 5 | 12 | $2,120 | $25,437 | 40 | $4,957 | $59,487 | 98 | $27,763 | $333,154 |
| 6 | 12 | $3,435 | $41,224 | | | | 83 | $14,629 | $175,545 |
| 7 | 9 | $4,071 | $48,852 | 1 | $14,692 | $176,307 | 48 | $67,297 | $807,567 |

*Estimated assuming average monthly costs per patient for 12 months

### Costs

- For patients receiving no ventilation support, mean monthly per-patient costs were highest in the first year of life: $34,367 (SD: $31,832) and declined over time (**Table 1**)
- Among those treated with invasive ventilation, mean monthly per-patient costs were also highest in the first year of life ($89,496, SD: $88,514), with lower costs in subsequent years
- The highest mean monthly costs observed were for an invasively ventilated patient in their first year of life: $1,144,580
  - Annualized, this patient would cost up to $13,734,580 in one year
- Costs were highest for all ventilation states in the youngest ages (**Figure 2**)
- Within each age bracket, costs were highest for invasive vent:
  - Annual cost of $486,856 for ages 0-3 years
  - Annual cost of $273,015 for ages 4-7 years
- Over the first 4 years of life (ages 0-3), mean annual costs for patients treated with invasive ventilation were $468,856, totaling nearly $2 million from birth through age 3 years
- Over the first 4 years of life, mean annual costs were lower if patients were treated only with no ventilation or non-invasive ventilation ($258,450, $183,756), totaling $1 million and $734k respectively

**Figure 2. Average annual cost per age group by ventilation status, *USD***




Younger patients have higher costs in all ventilation states, which is probably a reflection of more severe disease. Patients who survive past age 4 years are likely more stable and therefore require less intensive (and costly) medical intervention.

## Limitations

- Longitudinal data are sparse, limiting our ability to show long-term costs paid by commercial payers for XLMTM patients
- Annualized costs reported assume that monthly costs reflect costs throughout the year
- Home-health and durable medical equipment claims are paid first by Medicaid; therefore the direct economic burden of XLMTM may be greater, especially in stabilized patients
- These costs do not reflect indirect medical costs, including caregiver costs or lost wages

## Conclusions

Invasive ventilation is the most expensive health state for XLMTM patients, largely driven by the costs of inpatient care early in the course of the disease as captured by this claims database. Average annual costs are highest over the first 4 years of life, and can total $1.9 million on average. Over the first 8 years of life an average invasively ventilated patient could cost $3.1 million with outlier patients potentially costing many millions more.

### References

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### Disclosures

Mr. Slocomb is an employee of Audentes Therapeutics and Dr. James is a former employee of Audentes Therapeutics. Dr. Sacks, Mr. Cyr and Ms. Healey are employees of PRECISIONheor, a division of the Precision Medicine Group, which received funding from Audentes Therapeutics for this research. Dr. Graham and Dr. Beggs have previously received support from a sponsored research agreement with Audentes Therapeutics.